

Question: What is the significance of the resultant force in practical applications?

Answer: The resultant force allows the effective use of multiple small forces to achieve the effect of a single large force.

Question: How are millions of chemical compounds formed despite the limited number of elements?

Answer: Millions of chemical compounds are formed through the chemical combination of the limited number of elements.

Question: How does the weight of an object in water compare to its weight in air?

Answer: The weight of an object in water is less than its weight in air because the upthrust exerted by the water reduces the apparent weight of the object.

Question: How do you calculate the displacement of an object moving at 10 m/s for 6 seconds?

Answer: Displacement =  $10 \text{ m/s} \times 6 \text{ s} = 60 \text{ meters}$ .

Question: What is the role of recycling in reducing electronic waste?

Answer: Recycling reduces electronic waste by recovering valuable materials, reducing the need for raw material extraction, and preventing harmful substances from entering the environment.

Question: How does increasing the mass of an object affect its potential energy?

Answer: Increasing the mass of an object increases its potential energy, as potential energy is directly proportional to mass.

Question: Calculate the power of a 12V electric bulb drawing a current of 1.5A.

Answer: The power (P) of the bulb is  $P = VI = 12\text{V} \times 1.5\text{A} = 18\text{W}$ .

Question: What are the features of vertebrates in the class Pisces?

Answer: Vertebrates in the class Pisces have a bony or cartilaginous endoskeleton, streamlined bodies, scales, fins for swimming, a lateral line system for detecting vibrations, a two-chambered heart, gills for respiration, and are cold-blooded.

Question: What are the consequences of ozone layer depletion?

Answer: Consequences of ozone layer depletion include increased UV radiation reaching the Earth's surface, which can lead to higher rates of skin cancer, cataracts, and damage to ecosystems.

Question: What is the primary function of the large intestine?

Answer: The primary function of the large intestine is to absorb water from the remaining indigestible food matter, forming semi-solid fecal matter.

Question: How does the concept of buoyancy explain why ice floats on water?

Answer: Ice floats on water because it is less dense than liquid water, causing the buoyant force to be greater than the weight of the ice.

Question: What is the trend in electronegativity within Group VII elements?

Answer: The trend in electronegativity within Group VII elements is a decrease from top to bottom.

Question: How do sound waves create the sensation of hearing?

Answer: Sound waves cause the eardrum and inner ear structures to vibrate, converting mechanical energy into electrical signals perceived as sound.

Question: What is the significance of the focal point in lenses?

Answer: The focal point is where light rays converge (convex) or appear to diverge (concave), determining the lens's magnifying power.

Question: What is the role of a current transformer in power measurement?

Answer: A current transformer measures high currents by producing a lower, proportional current that can be safely monitored and used for power measurement and protection.

Question: What is the potential energy of a 5 kg object at a height of 8 m?

Answer: The potential energy is 400 Joules (J).

Question: How does the thermal conductivity of a material affect its heat transfer properties?

Answer: The thermal conductivity of a material determines its ability to transfer heat. High thermal conductivity materials transfer heat efficiently, while low thermal conductivity materials act as insulators.

Question: What is the significance of the electronic configuration in predicting the chemical properties of elements?

Answer: The electronic configuration helps predict the chemical properties of elements by indicating the number and arrangement of valence electrons, which determine how an element will react.

Question: What is the formula for speed?

Answer:  $\text{Speed} = \text{Distance} / \text{Time}$

Question: What is the role of the retina in the human eye?

Answer: The retina detects light and converts it into electrical signals sent to the brain for visual perception.

Question: What is the purpose of the axle in an alternating current dynamo?

Answer: The axle rotates the coil within the magnetic field, enabling continuous induction of electromotive force and generation of alternating current.

Question: How does the body respond to high altitude?

Answer: At high altitude, the body increases breathing rate and red blood cell production to compensate for lower oxygen levels, and may experience altitude sickness.

Question: What is the principle behind the use of lenses in microscopes?

Answer: Microscopes use lenses to achieve high magnification of small objects by converging light rays through several focal points.

Question: What is the function of ribosomes?

Answer: Ribosomes are small organelles without a membrane, providing a place for protein synthesis and can be found freely in the cytoplasm or attached to the endoplasmic reticulum.

Question: What are the principle changes in fetal development during the sixth month?

Answer: During the sixth month, the fetus develops eyebrows and eyelashes.

Question: What hormones regulate the human reproductive process?

Answer: Hormones such as Follicle Stimulating Hormone (FSH), Luteinizing Hormone (LH), testosterone, estrogen, and progesterone regulate the human reproductive process.

Question: Why is it important to disconnect appliances during lightning strikes?

Answer: Disconnecting appliances during lightning strikes prevents potential damage from power surges and reduces the risk of electrical fires.

Question: What is the function of a depletion layer in a p-n junction?

Answer: The depletion layer in a p-n junction is the region where free electrons and holes have recombined, leaving behind immobile charged ions and creating an electric field.

Question: How does the electrolysis of water produce oxygen gas?

Answer: Oxygen gas is produced at the anode by the oxidation of OH<sup>-</sup> ions:  
 $4\text{OH}^- (\text{aq}) \rightarrow \text{O}_2 (\text{g}) + 2\text{H}_2\text{O} (\text{l}) + 4\text{e}^-$ .

Question: How does the electrolysis of brine produce chlorine and sodium hydroxide?

Answer: The electrolysis of brine (aqueous sodium chloride) produces chlorine gas at the anode and hydrogen gas at the cathode. The remaining solution contains sodium hydroxide.

Question: What is parthenocarpy?

Answer: Parthenocarpy is the development of fruits without fertilization, resulting in seedless fruits. Artificial growth substances can induce parthenocarpy.

Question: What are the advantages of layering?

Answer: Layering allows the propagation of plants that do not produce seeds and enables the production of several plants easily.

Question: How does the electronic configuration of chlorine influence its reactivity?

Answer: The electronic configuration of chlorine (2, 8, 7) makes it highly reactive, as it needs to gain one electron to achieve a stable configuration, readily forming bonds with other elements.

Question: How does a supercapacitor differ from a traditional capacitor?

Answer: A supercapacitor differs from a traditional capacitor by offering much higher capacitance and energy storage capability, achieved through electrostatic charge separation at the electrode-electrolyte interface, allowing rapid charging and discharging.

Question: Explain the significance of a printed circuit board (PCB) in electronic devices.

Answer: A printed circuit board (PCB) provides a platform for mounting electronic components and interconnecting them with conductive tracks, ensuring reliable and compact circuit assembly.

Question: What is the valency of chlorine?

Answer: The valency of chlorine is 7 and 1.

Question: How is a chemical equation written and balanced?

Answer: A chemical equation is written using chemical symbols and formulae for the reactants and products. It is balanced by ensuring the number of atoms of each element on the reactant side equals the number on the product side. For example, balancing magnesium and oxygen to form magnesium oxide:  $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$ .

Question: How does concentration affect the number of collisions in a reaction?

Answer: Higher concentration increases the number of reactant particles in a given volume, leading to more collisions and a faster reaction rate.

Question: What is the molar mass of calcium carbonate ( $\text{CaCO}_3$ )?

Answer: The molar mass of calcium carbonate is 100 grams per mole, calculated as 40 for calcium, 12 for carbon, and  $3 \times 16$  for oxygen.

Question: How is the resultant of two parallel forces experimentally checked?

Answer: It is checked by using Newton balances and a strip of wood to demonstrate that the sum of the forces is equal to the resultant force.

Question: How can the heat change in the reaction of vinegar and lime water be calculated?

Answer: Using the formula  $Q = mc\theta$  with the given temperature change, density of water, and specific heat capacity of water.

Question: What is the significance of the principal axis in lenses?

Answer: The principal axis is the reference line for measuring angles and distances in ray diagrams, crucial for analyzing lens behavior.

Question: How does the strength of the magnetic field affect the performance of a dynamo?

Answer: A stronger magnetic field increases the induced electromotive force, improving the dynamo's performance and electricity generation.

Question: How is carbon dioxide collected by upward displacement of air?

Answer: Carbon dioxide, denser than air, is collected by allowing it to displace air upwards in an inverted gas jar, a method known as upward

displacement of air.

Question: How do you convert a temperature from Celsius to Kelvin?

Answer: To convert a temperature from Celsius to Kelvin, add 273 to the Celsius temperature.

Question: What is the role of lysosomes in autophagy?

Answer: Lysosomes degrade damaged or unnecessary cellular components through autophagy, recycling their building blocks for new cellular structures and functions.

Question: What are the effects of air pollution on human health?

Answer: The effects of air pollution on human health include respiratory problems, cardiovascular diseases, lung cancer, and increased mortality rates.

Question: What is the role of lenses in optical instruments?

Answer: Lenses in optical instruments like microscopes and telescopes magnify and focus light, enabling detailed observation of small or distant objects.

Question: Describe the role of an electricity meter in monitoring energy consumption.

Answer: An electricity meter monitors energy consumption by recording the total kilowatt hours (kWh) of electricity used by the household, providing data for billing and energy management.

Question: What is the charge of a neutron?

Answer: A neutron has no charge; it is neutral.

Question: How is the chemical equation for the reaction between sodium and chlorine written and balanced?

Answer: The chemical equation for sodium reacting with chlorine is:  $2\text{Na} + \text{Cl}_2 \rightarrow 2\text{NaCl}$ , ensuring equal numbers of sodium and chlorine atoms on both sides.

Question: How does a magnetic field affect a moving charge?

Answer: A magnetic field exerts a force on a moving charge, altering its trajectory according to the right-hand rule for positive charges or the left-hand rule for negative charges.

Question: What is the role of indigenous knowledge in environmental conservation?

Answer: Indigenous knowledge plays a role in environmental conservation by providing traditional practices and insights that contribute to sustainable resource management and biodiversity protection.

Question: Describe the function of a low-dropout regulator (LDO) in voltage regulation.

Answer: A low-dropout regulator (LDO) provides efficient and stable voltage regulation with a small difference between the input and output voltages, making it suitable for sensitive electronic circuits.

Question: What are the three terminals of a transistor called?

Answer: The three terminals of a transistor are called the emitter, collector, and base.

Question: How are the properties of metalloids different from those of metals and non-metals?

Answer: Metalloids have properties intermediate between those of metals and non-metals, exhibiting a mix of metallic and non-metallic characteristics.

Question: Explain the principle of a fuel cell.

Answer: A fuel cell generates electrical energy by converting chemical energy from a fuel (e.g., hydrogen) and an oxidant (e.g., oxygen) into electricity through electrochemical reactions, producing water as a byproduct.

Question: How do ultraviolet rays impact human health?

Answer: Ultraviolet rays can cause skin tanning and burning, and prolonged exposure increases the risk of skin cancer and other health issues.

Question: How does the use of pesticides affect non-target species?

Answer: Pesticides harm non-target species by causing toxicity, disrupting reproductive processes, and reducing biodiversity. They pose risks to beneficial insects, birds, and aquatic organisms.

Question: What are the sources of radiation that increase environmental radiation levels?

Answer: Sources of increased environmental radiation levels include natural sources and human activities, such as nuclear power station accidents and the destruction of the ozone layer.

Question: What is the unit used to measure the mass of a motor car?

Answer: The mass of a motor car is measured in kilograms (kg).

Question: What is the pressure exerted by a 1-meter-high column of mercury with a density of  $13,600 \text{ kg/m}^3$ ?

Answer: The pressure exerted is calculated using  $P = h\rho g$ . For a height of 1 m, the pressure is  $P = 1 \text{ m} * 13,600 \text{ kg/m}^3 * 10 \text{ m/s}^2 = 136,000 \text{ Pa}$ .

Question: What is the function of the gynoecium?

Answer: The gynoecium, the female reproductive structure, contains ovules in the ovary, which are the female gamete cells of the flower.

Question: What is the unit of mean speed?

Answer: The unit of mean speed is meters per second (m/s).

Question: How do you apply a couple of forces to open or close a tap?

Answer: To open or close a tap, apply a couple of forces on the tap head by using both hands to exert equal and opposite forces, causing the tap to rotate.

Question: What is the role of ATP in cellular metabolism?

Answer: ATP provides energy for various cellular processes, including muscle contraction, active transport, biosynthesis of macromolecules, and signal transduction.

Question: What factors affect the pitch of sound in wind instruments?

Answer: The pitch depends on the length of the air column within the instrument.

Question: How can the knowledge of exothermic and endothermic reactions be used in everyday life?

Answer: It can be applied in activities like cooking, heating, cooling, and understanding natural processes like respiration and photosynthesis.

Question: How do sound waves interact with different materials?

Answer: Sound waves can be absorbed, reflected, or transmitted depending on the material's properties and the frequency of the waves.

Question: How does the Golgi apparatus modify proteins?

Answer: The Golgi apparatus adds carbohydrates and lipids to proteins, sorts them, and packages them into vesicles for delivery to their final destinations.

Question: Give an example of a common separation process used in daily life.

Answer: Removing stones and sand from rice.

Question: What happens to the energy consumed in the heating coils of electric ovens?

Answer: In the heating coils of electric ovens, the consumed energy is converted entirely into heat.

Question: What is the significance of the mole concept in chemistry?

Answer: The mole concept is significant because it allows chemists to count atoms, molecules, and ions by weighing them, making it possible to relate quantities of substances in chemical reactions.

Question: What properties of water are influenced by hydrogen bonds?

Answer: Hydrogen bonds influence water's high boiling point, high specific heat capacity, and its ability to exist as a liquid at room temperature.

Question: Where is the focal point of a convex mirror located?

Answer: The focal point is situated on the principal axis, behind the mirror, at the midpoint between the pole and the center of curvature.

Question: What is the speed of electromagnetic waves in a vacuum?

Answer: The speed of electromagnetic waves in a vacuum is approximately  $3 \times 10^8$  m/s.

Question: What systems are involved in maintaining coordination in the body?

Answer: The nervous system and the endocrine system.

Question: How does the addition of sulfuric acid to water affect the electrolysis process?

Answer: Adding sulfuric acid increases the concentration of  $H^+$  ions, enhancing the conductivity of the solution and improving the efficiency and speed of the electrolysis process.

Question: How are disaccharides formed?

Answer: Disaccharides are formed when two monosaccharides join together, releasing a water molecule.

Question: Design a circuit to automatically light a bulb in the dark using a transistor and a Light Dependent Resistor (LDR), including the experimental setup and working principle.

Answer: An automatic light control circuit uses a transistor and an LDR to switch on a bulb when it gets dark. Materials Required: A D400 transistor, an LDR, a 10 k $\Omega$  volume controller (VR), a 2.5 V bulb, a 3 V battery cover, a circuit board, and connecting wires. Setup: Circuit Assembly: Connect the transistor, LDR, VR, and bulb as shown in the circuit diagram. Power Supply: Use the 3 V battery to power the circuit. Procedure: Initial Setup: Cover the LDR with your fingertip to simulate darkness. Adjust VR: Adjust the VR until the bulb just lights up. Light Exposure: Remove your fingertip to expose the LDR to light. The bulb should go out as the resistance of the LDR decreases. Working Principle: LDR Function: The resistance of the LDR varies with light intensity. It has a high resistance in the dark and a low resistance in the light. Voltage Divider: The LDR and VR form a voltage divider, providing a variable voltage to the base of the transistor. Transistor Switching: When the LDR is in the dark, its high resistance increases the base-emitter voltage of the transistor, turning it on and lighting the bulb. In the light, the low resistance of the LDR decreases the base-emitter voltage, turning the transistor off and extinguishing the bulb. Conclusion: The automatic light control circuit effectively uses the LDR's variable resistance to control the transistor, enabling the bulb to light up in the dark and turn off in the light, demonstrating the transistor's switching capability.

Question: What is the direction of the resultant force when two forces act in opposite directions?

Answer: The direction of the resultant force is in the direction of the larger force.

Question: Why is it important to measure the initial and final temperatures accurately in heat change experiments?

Answer: Accurate temperature measurements are crucial for calculating the correct amount of heat change in the reaction.

Question: Describe the equilibrium of a child sitting on a swing in terms of forces.

Answer: The child remains in equilibrium because the forces exerted by the two ropes balance the weight of the child. These forces are coplanar and parallel, and their magnitudes add up to equal the weight of the child.

Question: What is the wavelength of a wave with a frequency of  $5 \times 10^{14}$  Hz in a vacuum?



Answer: The wavelength is 600 nanometers (nm), calculated using the formula  $\lambda = c/f$ .

Question: What is the electromagnetic spectrum?

Answer: The electromagnetic spectrum is the range of all types of electromagnetic radiation, classified by their frequency or wavelength.

Question: How is the frequency of sound waves related to their pitch?

Answer: Higher frequency sound waves produce higher-pitched sounds, while lower frequency waves produce lower-pitched sounds.

Question: What is cross-pollination?

Answer: Cross-pollination occurs when pollen from a flower is deposited on the stigma of a flower on a different plant of the same species, promoting genetic diversity.

Question: What is the purpose of the galvanometer in demonstrating electromagnetic induction?

Answer: The galvanometer measures the induced current, indicating the presence and magnitude of electromagnetic induction in a circuit.

Question: What is the purpose of a pressure cooker in cooking?

Answer: A pressure cooker increases the pressure inside, raising the boiling point of water and allowing food to cook faster at higher temperatures, reducing cooking time and energy consumption.

Question: What is the role of parenchyma tissue in water storage?

Answer: Parenchyma tissue in xerophytic plants like Aloe and Bryophyllum stores water, helping the plant survive in arid conditions.

Question: Explain the operation of a digital multimeter.

Answer: A digital multimeter measures electrical quantities such as voltage, current, and resistance by converting analog signals to digital data and displaying the values on a digital screen.

Question: What is the gynoecium?

Answer: The gynoecium is the female reproductive structure of a flower, comprised of the stigma, style, and ovary. Ovules, the female gamete cells, are located in the ovary.

Question: What is thermal equilibrium?

Answer: Thermal equilibrium is the state when two objects in contact no longer transfer heat between them, having reached the same temperature.

Question: What is the role of fruits and seeds in plant reproduction?

Answer: Fruits and seeds play a crucial role in plant reproduction by facilitating the dispersal and germination of new plants.

Question: How does the amplitude of a sound wave relate to its loudness?

Answer: Larger amplitude waves carry more energy, resulting in louder sounds, while smaller amplitude waves produce softer sounds.

Question: What is the relationship between the potential difference and current in a nichrome wire coil?

Answer: The potential difference and current in a nichrome wire coil are directly proportional, as described by Ohm's Law, provided the temperature remains constant.

Question: What is Archimedes' principle?

Answer: Archimedes' principle states that when an object is partially or completely submerged in a fluid, the upthrust acting on it is equal to the weight of the fluid displaced by the object.

Question: What is the reaction between sodium and water?

Answer: Sodium reacts vigorously with water to form sodium hydroxide and hydrogen gas:  $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$ .

Question: What is the function of red blood cells in blood tissue?

Answer: Red blood cells transport oxygen from the lungs to tissues and carry carbon dioxide back to the lungs for exhalation.

Question: How does the body's response to dehydration affect kidney function?

Answer: During dehydration, the kidneys increase water reabsorption and reduce urine output to conserve water, maintaining hydration and electrolyte balance.

Question: What is the potential difference between the terminals of a power supply connected to a nichrome wire coil with a resistance of  $10\ \Omega$  and a current of  $0.6\ \text{A}$ ?

Answer: Using Ohm's Law,  $V = IR$ , the potential difference is  $V = 0.6\ \text{A} \times 10\ \Omega = 6\ \text{V}$ .

Question: What is food mile, and how does it impact sustainability?

Answer: Food mile is the distance a food item travels from producer to consumer. Shorter food miles are more sustainable and environmentally friendly as they reduce transportation emissions and support local economies.

Question: How does reducing the mass of a vehicle affect its acceleration for a given force?

Answer: Reducing the mass of a vehicle increases its acceleration for a given force, as acceleration is inversely proportional to mass.

Question: How does the mass per unit length of a string affect the sound produced by string instruments?

Answer: A string with a lower mass per unit length vibrates faster, producing higher frequency sounds, while a heavier string produces lower frequency sounds.

Question: What is the molar mass of glucose ( $\text{C}_6\text{H}_{12}\text{O}_6$ )?

Answer: The molar mass of glucose is  $180\ \text{g/mol}$ .

Question: What changes occur in the fetus during the sixth month of development?

Answer: During the sixth month, the fetus develops eyebrows and eyelashes.

Question: How is the molar mass of carbon dioxide (CO<sub>2</sub>) calculated?

Answer: The molar mass of carbon dioxide (CO<sub>2</sub>) is calculated by summing the relative atomic masses of its constituent atoms, resulting in 44 grams per mole.

Question: What is the weight of a 5 kg object on Earth?

Answer: The weight of a 5 kg object on Earth is  $5 \times 9.8 = 49$  N.

Question: How is the Celsius scale defined?

Answer: The Celsius scale is defined by taking the temperature at which pure ice melts into liquid water under one atmosphere as 0°C and the temperature at which water vaporizes into steam as 100°C.

Question: How do animals use the earth's magnetic field?

Answer: Some animals, such as birds, use the earth's magnetic field for navigation during migration.

Question: How do chloroplasts contribute to the carbon cycle?

Answer: Chloroplasts convert carbon dioxide into organic compounds through photosynthesis, contributing to the carbon cycle by producing oxygen and glucose.

Question: How is the chemical formula of magnesium nitride represented?

Answer: The chemical formula of magnesium nitride is Mg<sub>3</sub>N<sub>2</sub>, indicating three magnesium ions and two nitride ions.

Question: What is the significance of the renal pelvis in the urinary system?

Answer: The renal pelvis collects urine from the nephrons and funnels it into the ureters for transport to the bladder.

Question: Materials required : - A small beaker, a solution of citric acid, a solution of sodium bicarbonate  
Method : - Add about 10 cm<sup>3</sup> of the citric acid solution to a small beaker and record its temperature. Record the temperature of the sodium bicarbonate solution also. Add about 10 cm<sup>3</sup> of the sodium bicarbonate solution to the beaker containing citric acid, stir and note the temperature. State your observations. What is observed when citric acid reacts with sodium bicarbonate in this Activity ?

Answer: The temperature decreases, indicating an endothermic reaction.

Question: How do geneticists use twin studies to understand the heritability of traits?

Answer: Geneticists use twin studies to compare the similarities and differences between monozygotic (identical) and dizygotic (fraternal) twins, helping to estimate the genetic and environmental contributions to the heritability of traits.

Question: What is the function of brushing rings in an alternating current dynamo?

Answer: Brushing rings connect the rotating coil to the external circuit, allowing current to flow continuously despite the coil's rotation.

Question: What are the advantages of using polythene?

Answer: Polythene is durable, lightweight, and resistant to water and chemicals, making it useful for various applications.

Question: What is the importance of the light-dependent reactions in photosynthesis?

Answer: Light-dependent reactions convert light energy into chemical energy in the form of ATP and NADPH, which are used in the light-independent reactions to produce glucose.

Question: How is the resultant force of two collinear forces acting in opposite directions calculated?

Answer: The resultant force is calculated by subtracting the smaller force from the larger force, in the direction of the larger force.

Question: What are the features of invertebrates in the phylum Arthropoda?

Answer: Invertebrates in the phylum Arthropoda are triploblastic, coelomic, have jointed limbs, segmented bodies forming functional segments called Tagma, a chitinous cuticle acting as an exoskeleton, bilateral symmetry, and show sexual dimorphism.

Question: How do you determine the number of moles in a given mass of a compound?

Answer: The number of moles in a given mass of a compound is determined by dividing the mass by the molar mass of the compound,  $n = m/M$ .

Question: What is the significance of phloem loading and unloading in nutrient transport?

Answer: Phloem loading and unloading regulate the movement of sucrose and other nutrients from source tissues (leaves) to sink tissues (roots, fruits), ensuring proper distribution.

Question: Describe the reactivity of magnesium with steam.

Answer: Magnesium reacts with steam to form magnesium oxide and hydrogen gas:  $\text{Mg} + \text{H}_2\text{O} \rightarrow \text{MgO} + \text{H}_2$ .

Question: What happens when the coil in an alternating current dynamo is parallel to the magnetic field?

Answer: When the coil is parallel to the magnetic field, the induced electromotive force becomes zero as the conductors do not intersect the field lines.

Question: How much kinetic energy does a 3 kg object have when moving at 4 m/s?

Answer: The kinetic energy is 24 Joules (J).

Question: How does a voltage divider circuit work?

Answer: A voltage divider circuit divides the input voltage into smaller fractions using two resistors connected in series, providing a desired output voltage.

Question: What is the function of the corpus luteum in the menstrual cycle?  
Answer: The corpus luteum forms from the remains of the graafian follicle after ovulation and secretes progesterone to maintain the uterine lining for potential pregnancy.

Question: What are the environmental impacts of deforestation?  
Answer: The environmental impacts of deforestation include loss of biodiversity, disruption of water cycles, increased greenhouse gas emissions, and soil erosion.

Question: What is the relationship between potential energy and the position of an object?  
Answer: Potential energy is directly related to the position of an object, with higher positions corresponding to greater potential energy.

Question: What is the chemical formula for lithium oxide?  
Answer: The chemical formula for lithium oxide is  $\text{Li}_2\text{O}$ .

Question: How is the period of an element determined?  
Answer: The period of an element is determined by the number of energy levels (shells) carrying electrons in an atom of that element.

Question: What are the harmful effects of protozoans to humans?  
Answer: Protozoans can cause diseases like Amoebiasis, Malaria, and Sleeping sickness.

Question: What are heterotrophs?  
Answer: Heterotrophs are animals that cannot produce their own food and depend on other organisms for nutrition, also known as consumers.

Question: What are the components of a simple transformer?  
Answer: A simple transformer consists of two insulated copper coils (primary and secondary) wrapped around a soft iron core.

Question: How does a loudspeaker convert electrical signals into sound waves?  
Answer: A loudspeaker converts signals into sound by vibrating a coil and cone, generating sound waves that correspond to the electrical signal.

Question: Why are PVC pipes preferred over iron pipes for water distribution?  
Answer: PVC pipes are resistant to corrosion, lighter, easier to install, and have a longer lifespan compared to iron pipes.

Question: What are radio waves, and how are they used in communication?  
Answer: Radio waves have the longest wavelengths and lowest frequencies in the electromagnetic spectrum, used for long-distance communication by modulating their amplitude or frequency.

Question: How are infrared rays used in everyday life?  
Answer: Infrared rays are used in thermal imaging, remote controls, and communication technologies like infrared data transmission.

Question: How do ultrasound waves help in the examination of internal organs?

Answer: Ultrasound waves are emitted and reflected back from internal structures, creating images used for diagnostic purposes.

Question: How is the chemical formula of hydrogen chloride written?

Answer: The chemical formula of hydrogen chloride is HCl, indicating one hydrogen atom and one chlorine atom.

Question: Differentiate between intrinsic and extrinsic semiconductors, including the effects of doping with group III and group V elements.

Answer: Intrinsic and extrinsic semiconductors differ based on their purity and the presence of additional elements to enhance conductivity. Intrinsic Semiconductors: Definition: Pure semiconductors without any significant impurities. Examples: Pure silicon (Si) and germanium (Ge). Conductivity: Conductivity is relatively low at room temperature because the number of charge carriers (electrons and holes) is limited to those generated by thermal energy. Extrinsic Semiconductors: Definition: Semiconductors that have been doped with small amounts of impurity elements to increase their conductivity. Types of Doping: n-type Semiconductors: Doped with group V elements (e.g., phosphorus (P), arsenic (As), antimony (Sb)). Mechanism: Group V elements have five valence electrons. When doped into silicon, four of these electrons form covalent bonds with neighboring silicon atoms, leaving the fifth electron free to move. Charge Carriers: The additional free electrons increase the number of negative charge carriers, making electrons the majority carriers. Example: Doping silicon with phosphorus increases the electron concentration, forming an n-type semiconductor. p-type Semiconductors: Doped with group III elements (e.g., boron (B), aluminum (Al), gallium (Ga), indium (In)). Mechanism: Group III elements have three valence electrons. When doped into silicon, these atoms form three covalent bonds, leaving one bond incomplete, creating a hole. Charge Carriers: The holes increase the number of positive charge carriers, making holes the majority carriers. Example: Doping silicon with boron increases the hole concentration, forming a p-type semiconductor. Summary: Intrinsic Semiconductors: Pure, with conductivity determined by temperature and intrinsic properties. Extrinsic Semiconductors: Doped to enhance conductivity, with n-type and p-type variations based on the type of doping element used.

Question: What is a frictional force?

Answer: A frictional force is an opposing force exerted by a surface on an object that opposes its motion. Friction always opposes the motion of an object.

Question: How does genetic engineering improve the nutritional content of crops?

Answer: Genetic engineering improves the nutritional content of crops by introducing genes that enhance the production of vitamins, minerals, and other essential nutrients, creating biofortified crops that address nutrient deficiencies in populations.

Question: What role do hydrogen bonds play in solubility?

Answer: Hydrogen bonds between solute and solvent molecules increase solubility for compounds capable of forming such bonds, like alcohols in water.

Question: How does the release of sulfur dioxide (SO<sub>2</sub>) affect the environment?

Answer: The release of sulfur dioxide (SO<sub>2</sub>) affects the environment by contributing to acid rain, which can harm aquatic ecosystems, damage crops, and degrade buildings and infrastructure.

Question: What is the acceleration of a 6 kg object when a force of 24 N is applied?

Answer: The acceleration is  $a = F/m = 24/6 = 4 \text{ m/s}^2$ .

Question: Explain a double displacement reaction with an example.

Answer: A double displacement reaction involves the exchange of elements or radicals between two compounds to form new compounds. An example is the reaction between barium chloride and sodium sulfate, forming barium sulfate and sodium chloride:  $\text{BaCl}_2 + \text{Na}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + 2\text{NaCl}$ .

Question: What is the concentration of a solution containing 0.1 mol of acetic acid in 250 cm<sup>3</sup> of water?

Answer: The concentration is 0.4 mol/dm<sup>3</sup>.

Question: What are photoautotrophic organisms?

Answer: Photoautotrophic organisms are those that produce their own food using light energy. Most plants are photoautotrophic.

Question: What is the relationship between the speed of a wave, its frequency, and its wavelength?

Answer: The speed of a wave ( $v$ ) is equal to the product of its frequency ( $f$ ) and wavelength ( $\lambda$ ), expressed as  $v = f\lambda$ .

Question: What occurs when an object is placed at the focal point of a convex lens?

Answer: The image is formed at infinity and is larger than the object.

Question: What is the relative atomic mass of oxygen?

Answer: The relative atomic mass of oxygen is 16.

Question: How does the electrolysis of water demonstrate the decomposition of water molecules?

Answer: The electrolysis of water decomposes water molecules into hydrogen and oxygen gases, illustrating the breakdown of water into its constituent elements.

Question: What is the principle behind the expansion of liquids demonstrated in a test tube experiment?

Answer: When a test tube filled with colored water is placed in warm water, the test tube expands first, causing the liquid level to drop. As the liquid heats up and expands more than the glass, the liquid level rises, demonstrating thermal expansion.

Question: Explain the function of a residual current circuit breaker (RCCB).  
Answer: An RCCB protects residents from electric shocks by automatically disconnecting the power supply when it detects a current leak to the ground or the metal casing of an appliance.

Question: What is the boiling point of water under one atmosphere of pressure?

Answer: The boiling point of water under one atmosphere of pressure is 100°C.

Question: Why is friction necessary for walking?

Answer: Friction is necessary for walking because it provides the grip needed to push off the ground and move forward without slipping.

Question: What is the effect of thermal expansion on the design of railway tracks?

Answer: Thermal expansion affects the design of railway tracks by requiring expansion gaps to accommodate the tracks' length changes due to temperature variations, preventing deformation and ensuring safe operation.

Question: How is the resultant force of two parallel forces acting along the same direction demonstrated?

Answer: It is demonstrated by using Newton balances and a strip of wood to show that the sum of the forces from two balances is equal to the force measured by a third balance.

Question: How is equilibrium maintained in an object under three parallel forces?

Answer: Equilibrium is maintained when one of the forces is equal in magnitude to the resultant of the other two forces and acts in the opposite direction.

Question: What is upthrust and how is it experienced by objects in a liquid?

Answer: Upthrust is the upward force exerted by a liquid on an object immersed in it. It is experienced as a reduction in the apparent weight of the object due to the liquid's buoyant force.

Question: What is the chemical formula for magnesium sulfide?

Answer: The chemical formula for magnesium sulfide is  $\text{MgS}$ .

Question: What is an example of a heterogeneous mixture?

Answer: An example of a heterogeneous mixture is muddy water, where clay particles are not uniformly distributed.

Question: How does the removal of stored starch from leaves before experiments affect the results?

Answer: Removing stored starch ensures that any detected starch is newly produced, confirming the occurrence of photosynthesis during the experiment.

Question: How is oxygen gas prepared by heating potassium nitrate?



Answer: Heating potassium nitrate decomposes it into potassium nitrite and oxygen gas:  $2\text{KNO}_3 \rightarrow 2\text{KNO}_2 + \text{O}_2$ .

Question: What is the role of chlorophyll in photosynthesis?

Answer: Chlorophyll is a specific organic compound in plant cells that captures light energy, which is then used to convert carbon dioxide and water into glucose and oxygen during photosynthesis.

Question: What is the resultant force if two forces of 10 N and 6 N act in the same direction?

Answer: The resultant force is 16 N in the same direction.

Question: How does a capacitor help in smoothing the rectified output?

Answer: A capacitor stores charge during the peak of the rectified voltage and releases it when the voltage drops, reducing the fluctuations and producing a smoother DC output.

Question: What is the specific heat capacity of ethanol?

Answer: The specific heat capacity of ethanol is  $2500 \text{ J kg}^{-1} \text{ K}^{-1}$ .

Question: What is the relationship between magnetic field strength and induced voltage?

Answer: The induced voltage is directly proportional to the magnetic field strength, with stronger fields generating higher voltage.

Question: What is the relationship between the height of a liquid column and the pressure it exerts?

Answer: The pressure exerted by a liquid column increases with the height of the column.

Question: How does the specific latent heat of fusion relate to the melting process of a substance?

Answer: The specific latent heat of fusion quantifies the energy required to convert a solid into a liquid at its melting point, providing insight into the energy dynamics of the melting process.

Question: What are the main types of waste that contribute to environmental pollution, and how can they be managed?

Answer: Environmental pollution is caused by various types of waste, including industrial, domestic, electronic, and nuclear waste. Each type has specific sources and management strategies. Industrial Waste: This includes chemicals, heavy metals, hydrocarbons, and particulate matter from manufacturing processes. Effective management involves treating effluents before discharge, recycling waste materials, and implementing cleaner production technologies. Domestic Waste: Household waste consists of food scraps, plastics, paper, glass, and garden waste. Proper management includes waste segregation, composting organic waste, recycling materials like paper and glass, and reducing the use of non-biodegradable plastics. Electronic Waste (E-Waste): E-waste includes discarded electronic devices like computers, phones, and batteries. Management strategies involve recycling valuable components, proper disposal of hazardous materials, and promoting the repair and reuse of electronic devices to extend their lifecycle. Nuclear Waste: This highly toxic

and radioactive waste is produced from nuclear power plants and medical applications. Safe management requires secure containment, deep geological storage, and reducing waste production through efficient use of nuclear materials. Effective waste management is crucial to minimizing the environmental impact of these pollutants. It involves a combination of regulatory measures, technological innovations, and public awareness to ensure waste is reduced, reused, and recycled wherever possible.

Question: At what object distance is the largest image formed by a concave mirror?

Answer: The largest image is formed when the object is placed at the focal point, and the image is inverted.

Question: What is the equivalent resistance of a  $12\ \Omega$  resistor and a  $6\ \Omega$  resistor connected in parallel?

Answer: The equivalent resistance is  $1/R = 1/12\Omega + 1/6\Omega = 1/4\Omega$ , so  $R = 4\Omega$ .

Question: How can the effect of a catalyst on a reaction be demonstrated experimentally?

Answer: By comparing the rate of gas evolution in reactions with and without the catalyst, the effect of the catalyst can be observed.

Question: What is the significance of the cell cycle in maintaining genetic stability?

Answer: The cell cycle ensures accurate DNA replication and distribution to daughter cells, maintaining genetic stability and preventing mutations or chromosomal abnormalities.

Question: What is the activity series useful for?

Answer: The activity series is useful for finding methods to prevent corrosion of metals, selecting metals to make electrochemical cells, and deciding on suitable methods for extracting metals based on their reactivity.

Question: How is the chemical formula of ammonium phosphate represented?

Answer: The chemical formula of ammonium phosphate is  $(\text{NH}_4)_3\text{PO}_4$ , indicating three ammonium ions and one phosphate ion.

Question: How does the surface area of electrodes influence the performance of an electrochemical cell?

Answer: The surface area of electrodes influences the performance of an electrochemical cell by affecting the reaction rate and current density. Larger surface areas provide more active sites for reactions, improving cell efficiency and capacity.

Question: What is the result when solid sodium hydroxide dissolves in water?

Answer: The temperature rises due to the loss of heat, indicating an exothermic reaction.

Question: Describe the reaction of zinc with dilute sulfuric acid.

Answer: Zinc reacts with dilute sulfuric acid to form zinc sulfate and hydrogen gas:  $\text{Zn} + \text{H}_2\text{SO}_4 \rightarrow \text{ZnSO}_4 + \text{H}_2$ .

Question: How do microwaves heat food in a microwave oven?

Answer: Microwaves cause water molecules in food to vibrate, generating heat through molecular friction and cooking the food.

Question: How does a transformer transfer electrical energy between circuits?

Answer: A transformer uses electromagnetic induction to transfer electrical energy between its primary and secondary windings, allowing voltage step-up or step-down in power distribution.

Question: What is the primary function of xylem tissue?

Answer: Xylem tissue transports water and minerals absorbed by plant roots throughout the plant body and provides mechanical support.

Question: What are the features of invertebrates in the phylum Echinodermata?

Answer: Invertebrates in the phylum Echinodermata are marine, triploblastic, coelomic organisms with bodies separated into 5 radial arms, a sharp spiny body covering, a water vascular system, tube feet for locomotion and respiration, and penta-radial symmetry.

Question: How do animals obtain energy?

Answer: Animals obtain energy by consuming organic matter, including plants and other animals, and breaking down the nutrients through digestion and cellular respiration.

Question: What is the relationship between the force required to initiate rotation and the perpendicular distance from the axis of rotation?

Answer: The force required to initiate rotation decreases as the perpendicular distance from the axis of rotation increases, making it easier to rotate the object.

Question: How does the body's endocrine system interact with kidney function?

Answer: The endocrine system regulates kidney function through hormones like ADH, aldosterone, and PTH, affecting fluid balance, electrolyte levels, and blood pressure.

Question: How do catalysts affect the activation energy of a reaction?

Answer: Catalysts lower the activation energy, making it easier for reactants to collide and form products, thus increasing the reaction rate.

Question: Why does rusting occur faster on the part of a knife smeared with lime juice?

Answer: Lime juice is acidic, and acids accelerate the rusting process.

Question: What are the signs and symptoms of acute kidney injury (AKI)?

Answer: Symptoms of AKI include reduced urine output, swelling in legs and ankles, fatigue, shortness of breath, and confusion.

Question: What is cross-pollination?

Answer: Cross-pollination occurs when pollen from a flower is deposited on the stigma of a flower on a different plant of the same species, promoting genetic diversity.

Question: How much work is done in lifting a 40 N object by a vertical distance of 2 m?

Answer: The work done is 80 Joules (J).

Question: What is the role of the renal vein in the urinary system?

Answer: The renal vein carries filtered blood away from the kidneys back to the heart.

Question: How do geneticists use symbols to represent different traits?

Answer: Geneticists use symbols (capital and lowercase letters) to represent alleles for different traits, simplifying the notation of genotypes and inheritance patterns.

Question: What is the reaction between magnesium and hydrochloric acid?

Answer: Magnesium reacts with hydrochloric acid to form magnesium chloride and hydrogen gas ( $\text{Mg} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$ ).

Question: How does the brake system in vehicles utilize the principle of pressure transmission?

Answer: The brake system uses the pressure generated by the driver's force on the brake pedal, which is transmitted through the brake fluid to the brake pads, applying pressure on the brake discs or drums.

Question: How does blood flow through the kidneys and support filtration?

Answer: Blood flows into the kidneys through the renal arteries, is filtered in the glomeruli, and exits via the renal veins, ensuring waste removal and homeostasis.

Question: What is the absolute zero temperature in the Kelvin scale?

Answer: Absolute zero temperature in the Kelvin scale is 0 K, corresponding to  $-273.15^\circ\text{C}$ , where the kinetic energy of particles is zero.

Question: What are lymph nodes, and what is their function?

Answer: Lymph nodes are places where lymphatic vessels aggregate, and they destroy germs that enter the body.

Question: How does gravitational potential energy change with mass?

Answer: Gravitational potential energy increases with mass, as it is directly proportional to the object's mass.

Question: What are the deficiency symptoms of vitamin A?

Answer: Deficiency symptoms of vitamin A include night blindness, Bitot's patches in the eye, dryness of the skin, and blisters on knees and elbows.

Question: How does increasing mass affect gravitational potential energy?

Answer: Increasing mass increases gravitational potential energy proportionally, as potential energy is directly related to mass.

Question: What are some common uses of hydrochloric acid in industries?  
Answer: Hydrochloric acid is used to remove rust from steel objects, make gelatin, and produce aqua regia.

Question: What is the specific heat capacity of lead?  
Answer: The specific heat capacity of lead is  $130 \text{ J kg}^{-1} \text{ K}^{-1}$ .

Question: Why is the unit mole practically used in chemistry?  
Answer: The unit mole is used to measure the amounts of substances that exist in very large numbers, making it practical for chemical calculations.

Question: How does the presence of chloroplasts in collenchyma cells enhance their function?  
Answer: Chloroplasts in collenchyma cells enable these cells to carry out photosynthesis, contributing to the plant's energy production while providing structural support.

Question: Describe the image formed when an object is placed between the focal length and twice the focal length of a convex lens.  
Answer: A magnified, inverted, and real image is formed on the opposite side of the lens.

Question: What is the specific heat capacity of lead?  
Answer: The specific heat capacity of lead is  $130 \text{ J kg}^{-1} \text{ K}^{-1}$ .

Question: Describe the operation of a light-emitting diode (LED).  
Answer: A light-emitting diode (LED) produces light through electroluminescence, where electrons recombine with holes in the semiconductor material, releasing energy as photons.

Question: What is a cation?  
Answer: A cation is a positively charged ion formed by the loss of electrons.

Question: What is the potential difference between two points in a circuit with a 12 V power supply and three resistors connected in series?  
Answer: The potential difference is the sum of the voltage drops across each resistor, which is equal to the total supply voltage of 12 V.

Question: How is the chemical formula of hydrogen sulphide written?  
Answer: The chemical formula of hydrogen sulphide is  $\text{H}_2\text{S}$ , indicating two hydrogen atoms and one sulphur atom.

Question: What are the features of invertebrates in the phylum Cnidaria?  
Answer: Invertebrates in the phylum Cnidaria are aquatic, mostly marine, diploblastic with a coelenteron, have radial symmetry, and are predators with nematocysts.

Question: Calculate the power required to lift a 5 kg object to a height of 8 m in 10 seconds.  
Answer: The power required is 40 Watts (W).

Question: How does the release of nitrogen oxides ( $\text{NO}_x$ ) contribute to the formation of ground-level ozone?

Answer: The release of nitrogen oxides (NO<sub>x</sub>) contributes to the formation of ground-level ozone by reacting with volatile organic compounds (VOCs) in the presence of sunlight, forming ozone and other pollutants.

Question: What are the sources of greenhouse gas emissions in agriculture?

Answer: Sources of greenhouse gas emissions in agriculture include enteric fermentation in livestock, rice paddies, the use of synthetic fertilizers, and the burning of agricultural residues.

Question: What is the formula for Ohm's Law?

Answer: Ohm's Law is expressed as  $V = IR$ , where  $V$  is the potential difference,  $I$  is the current, and  $R$  is the resistance.

Question: What is the atomic number of an element?

Answer: The atomic number is the number of protons in an atom of the element.

Question: What is the relationship between current and potential difference in a conductor according to Ohm's Law?

Answer: According to Ohm's Law, the current passing through a conductor is directly proportional to the potential difference across it, provided the temperature remains constant.

Question: What are some common household acids and their uses?

Answer: Common household acids include vinegar (acetic acid) for cooking and cleaning, and citric acid for flavoring and preserving food.

Question: Can you give examples of strong bases and their ionization in water?

Answer: Examples include Sodium hydroxide (NaOH), which ionizes into Na<sup>+</sup> and OH<sup>-</sup>, and Potassium hydroxide (KOH), which ionizes into K<sup>+</sup> and OH<sup>-</sup>.

Question: Explain the process of cell division in mitosis.

Answer: Mitosis involves the division of a parent cell into two identical daughter cells, maintaining the chromosome number, and consists of stages like prophase, metaphase, anaphase, and telophase.

Question: Calculate the amount of sulfuric acid (H<sub>2</sub>SO<sub>4</sub>) in moles in 49 grams.

Answer: The amount of sulfuric acid in 49 grams is 0.5 moles, calculated as  $49/98 = 0.5$  moles.

Question: What is the position of sodium in the Periodic Table?

Answer: Sodium is in Group I and Period 3 of the Periodic Table.

Question: How is atmospheric pressure measured using a mercury barometer?

Answer: Atmospheric pressure is measured using a mercury barometer by the height of the mercury column in a glass tube. The height of the column represents the atmospheric pressure exerted on the mercury in the container.

Question: How do you maintain equilibrium in an object under the action of more than three forces?

Answer: Maintain equilibrium by applying the forces in such a way that their resultant is zero, meaning the sum of the forces and moments balance out, resulting in no net force or moment acting on the object.

Question: How is the chemical formula of hydrogen chloride written?

Answer: The chemical formula of hydrogen chloride is HCl, indicating one hydrogen atom and one chlorine atom.

Question: What are the characteristics of organisms in the Domain Bacteria?

Answer: Organisms in the Domain Bacteria are prokaryotes, sensitive to antibiotics, can be pathogenic, and are found everywhere in the environment.

Question: Give an example of a function performed by specific cells in the body.

Answer: Red blood cells transport oxygen, and neurons transmit impulses.

Question: What is the maximum height reached by an 800 g object projected upwards at 20 m/s?

Answer: The maximum height is 20 meters.

Question: How does the electrolyte temperature affect the rate of electrochemical reactions?

Answer: The electrolyte temperature affects the rate of electrochemical reactions by influencing ion mobility and reaction kinetics. Higher temperatures generally increase reaction rates but may also accelerate side reactions and reduce electrolyte stability.

Question: What are the features of invertebrates in the phylum Annelida?

Answer: Invertebrates in the phylum Annelida are triploblastic, have segmented bodies, bilateral symmetry, a coelom, and reproduce both asexually and sexually.

Question: What is the relationship between altitude and atmospheric pressure?

Answer: Atmospheric pressure decreases with increasing altitude because there is less air above the measurement point, resulting in lower weight and pressure.

Question: How do you calculate the power dissipated by a resistor in a circuit?

Answer: The power dissipated by a resistor is calculated using  $P = IV$ ,  $P = I^2 R$ , or  $P = V^2 / R$ , depending on the available information.

Question: What is the role of mass in Newton's second law?

Answer: In Newton's second law, mass is inversely proportional to acceleration. For a constant force, increasing mass decreases acceleration and vice versa.

Question: What is the importance of understanding periodic trends in chemistry?

Answer: Understanding periodic trends is important in chemistry as it helps in predicting the properties and behaviors of elements, aiding in the study of chemical reactions and the development of new materials.

Question: What are the environmental impacts of plastic waste?

Answer: Plastic waste pollutes land and water, harms wildlife through ingestion and entanglement, and introduces toxic substances into the food web. It contributes to long-term environmental degradation and health risks.

Question: How do variations in chlorophyll concentration affect photosynthesis?

Answer: Higher chlorophyll concentration increases the plant's ability to capture light energy, enhancing photosynthesis efficiency and glucose production.

Question: How does the reduction of  $\text{Cu}^{2+}$  ions at the cathode affect the copper sulfate solution?

Answer: The reduction of  $\text{Cu}^{2+}$  ions at the cathode removes these ions from the solution, decreasing the intensity of the blue color and resulting in the deposition of copper metal on the cathode.

Question: Describe an experiment to confirm the presence of carbon and hydrogen in candle wax, including the procedure and observations.

Answer: To confirm the presence of carbon and hydrogen in candle wax, an experiment involving the combustion of wax can be conducted. The setup requires materials such as connecting tubes, a beaker, an aspirator, lime water, copper sulfate, a U-tube, and test tubes. Procedure: Assemble the apparatus with the candle connected to an aspirator, allowing air to pass through the system. Light the candle to initiate the combustion of wax. The air passing through the system will carry the combustion products through the U-tube containing anhydrous copper sulfate and a test tube containing lime water. Observe the changes in the U-tube and the test tube.

Observations: The anhydrous copper sulfate in the U-tube turns from white to blue, indicating the presence of water vapor produced during the combustion. This confirms that hydrogen is a component of the candle wax, as hydrogen combustion forms water. The lime water in the test tube turns milky, indicating the formation of carbon dioxide. This confirms the presence of carbon in the wax, as carbon combustion produces carbon dioxide. Through this experiment, the presence of both carbon and hydrogen in candle wax is verified.

Question: What is the role of phosphorous in plants?

Answer: Phosphorous is a constituent of nucleic acids and ATP (Adenosine Triphosphate), and is important for protein synthesis.

Question: What are the conventions adopted in electrolysis regarding the electrodes?

Answer: In electrolysis, the electrode connected to the positive terminal of the power supply is the anode (positive electrode), and the electrode connected to the negative terminal is the cathode (negative electrode).



Positive ions migrate towards the cathode and undergo reduction, while negative ions migrate towards the anode and undergo oxidation.

Question: What are the major parts of a tank in the Sri Lankan irrigation system?

Answer: Major parts of a tank include the tank bund, sluice, Bisokotuwa (sluice gate), Ralapanawa, and canals. These components work together to manage water pressure and distribution effectively.

Question: What is the significance of a double bond in an oxygen ( $O_2$ ) molecule?

Answer: A double bond in an oxygen ( $O_2$ ) molecule involves the sharing of two pairs of electrons between two oxygen atoms, resulting in a strong and stable bond.

Question: What is the potential energy of a 4 kg object lifted to a height of 2.5 m?

Answer: The potential energy is 100 Joules (J).

Question: What is the concentration of a solution containing 1 mol of acetic acid in  $1\text{ dm}^3$  of water?

Answer: The concentration is  $1\text{ mol/dm}^3$ .

Question: What is the function of the plasma membrane in maintaining cellular homeostasis?

Answer: The plasma membrane regulates the movement of substances in and out of the cell, maintaining cellular homeostasis by controlling the internal environment.

Question: How do dentists use concave mirrors?

Answer: Dentists use concave mirrors to view inside the mouth of patients, as these mirrors provide enlarged images of the teeth.

Question: What is the significance of the perpendicular distance in the moment of a couple of forces?

Answer: The perpendicular distance in the moment of a couple of forces determines the magnitude of the moment. A greater distance results in a larger moment for the same force, enhancing the rotational effect.

Question: What is the specific heat capacity of concrete?

Answer: The specific heat capacity of concrete is  $3000\text{ J kg}^{-1}\text{ K}^{-1}$ .

Question: What is the purpose of a light-dependent resistor (LDR) in automatic lighting systems?

Answer: An LDR changes its resistance based on the intensity of light it is exposed to, making it useful in automatic lighting systems that turn lights on or off based on ambient light levels.

Question: What are some examples of organisms in the phylum Mollusca?

Answer: Examples of organisms in the phylum Mollusca include Snail, Cuttlefish, and Octopus.

Question: What is the kinetic energy of a 1.5 kg object moving at 8 m/s?

Answer: The kinetic energy is 48 Joules (J).

Question: How is the atomic number represented?

Answer: The atomic number is symbolized by 'Z'.

Question: How do you determine the direction of the moment of force in a given scenario?

Answer: Determine the direction of the moment of force by observing whether the applied force causes clockwise or anti-clockwise rotation and classifying the moment accordingly.

Question: How do plants store energy?

Answer: Plants store energy in the form of starch, which is synthesized from glucose produced during photosynthesis and stored in various parts of the plant, such as roots and seeds.

Question: How are lipids formed?

Answer: Lipids are formed by the reaction of fatty acids and glycerol.

Question: What are the advantages of using solid-state electrolytes in batteries?

Answer: Solid-state electrolytes in batteries offer advantages like improved safety, higher energy density, longer cycle life, and the potential for flexible and lightweight designs, making them suitable for advanced energy storage applications.

Question: What is the significance of sound waves being mechanical waves?

Answer: As mechanical waves, sound waves require a medium to travel, unlike electromagnetic waves that can propagate through a vacuum.

Question: What is parturition?

Answer: Parturition, or childbirth, is the process of delivering the fetus from the uterus through the vagina, facilitated by the contraction of uterine muscles.

Question: How does the rate of change of the magnetic field affect the induced voltage?

Answer: A faster rate of change of the magnetic field induces a higher voltage, as the induced electromotive force is directly proportional to the rate of change.

Question: How does muscle tissue contribute to the body's responses?

Answer: Muscle tissue contracts and relaxes in response to nervous stimuli, enabling movement, posture maintenance, and involuntary actions like digestion.

Question: How does the electrolysis of water demonstrate the decomposition of water molecules?

Answer: The electrolysis of water decomposes water molecules into hydrogen and oxygen gases, illustrating the breakdown of water into its constituent elements through an electrochemical process.

Question: What happens during the process of peristalsis in the esophagus?

Answer: Peristalsis involves rhythmic contractions and relaxations of the esophageal muscles, propelling the food bolus forward to the stomach.

Question: What are catalysts?

Answer: Catalysts are substances that increase the rate of a reaction without being chemically consumed during the reaction.

Question: What is the role of the thyroid gland in metabolism?

Answer: The thyroid gland regulates metabolism by secreting thyroxine, which controls the rate of energy production and consumption in cells.

Question: What is the pressure exerted by a 1-meter-high column of mercury with a density of  $13,600 \text{ kg/m}^3$ ?

Answer: The pressure exerted is calculated using  $P = h\rho g$ . For a height of 1 m, the pressure is  $P = 1 \text{ m} * 13,600 \text{ kg/m}^3 * 10 \text{ m/s}^2 = 136,000 \text{ Pa}$ .

Question: What are the principles of sustainable development?

Answer: Principles of sustainable development include economic growth, social inclusion, and environmental protection.

Question: What is the pressure at a depth of 10 m in seawater with a density of  $1050 \text{ kg/m}^3$  and  $g = 10 \text{ m/s}^2$ ?

Answer: The pressure is  $105,000 \text{ Pa}$ , calculated as  $10 \text{ m} * 1050 \text{ kg/m}^3 * 10 \text{ m/s}^2$ .

Question: What is the significance of chlorophyll in plants?

Answer: Chlorophyll allows plants to absorb light energy and produce food through photosynthesis.

Question: What is the mass of glucose required to prepare  $1 \text{ dm}^3$  of a  $1 \text{ mol/dm}^3$  glucose solution?

Answer: The mass of glucose required is  $180 \text{ g}$ .

Question: How do elephants and bats differ in their hearing capabilities?

Answer: Elephants can hear very low frequencies (infra-sound), while bats can hear very high frequencies (ultrasound).

Question: What is the purpose of using a slinky to demonstrate wave properties?

Answer: A slinky visually demonstrates wave properties such as wave propagation, compressions, and rarefactions, making it easier to understand wave behavior.

Question: Why do covalent compounds have low melting and boiling points?

Answer: Covalent compounds have low melting and boiling points because the forces between their molecules are relatively weak compared to the strong electrostatic forces in ionic compounds.

Question: How does the release of sulfur dioxide ( $\text{SO}_2$ ) contribute to the formation of acid rain?

Answer: The release of sulfur dioxide ( $\text{SO}_2$ ) contributes to the formation of acid rain by reacting with water vapor in the atmosphere to form sulfuric acid, which then falls to the ground as acid rain.

Question: How do catalysts benefit industrial chemical reactions?

Answer: Catalysts enhance reaction rates, reduce energy costs, and improve product yield in industrial chemical reactions.

Question: How do bi-concave lenses affect light rays?

Answer: Bi-concave lenses diverge light rays, making them appear to originate from a focal point on the same side as the object.

Question: How is a hydrogen ( $\text{H}_2$ ) molecule formed?

Answer: A hydrogen ( $\text{H}_2$ ) molecule is formed when two hydrogen atoms share their electrons, each achieving the stable configuration of helium.

Question: How does the periodic trend of ionisation energy help in understanding chemical reactivity?

Answer: The periodic trend of ionisation energy helps in understanding chemical reactivity by indicating how easily atoms can lose electrons to form positive ions.

Question: What materials are required for Activity 8.4?

Answer:  $50\text{ cm}^3$  of  $2\text{ mol dm}^{-3}$  sodium hydroxide solution,  $50\text{ cm}^3$  of  $2\text{ mol dm}^{-3}$  hydrochloric acid solution, two  $100\text{ cm}^3$  beakers, a thermometer, a polystyrene cup, and a glass rod.

Question: What is the role of the collecting ducts in the kidney?

Answer: The collecting ducts concentrate and transport urine from the nephrons to the renal pelvis.

Question: What is the unit of the moment of a couple of forces?

Answer: The unit of the moment of a couple of forces is Newton meter (Nm).

Question: How do Punnett squares help geneticists visualize genetic crosses?

Answer: Punnett squares help geneticists visualize genetic crosses by showing all possible combinations of alleles from two parents, allowing predictions of genotypes and phenotypes in offspring.

Question: What is the relationship between force magnitude and the moment of force in practical applications?

Answer: The moment of force in practical applications is directly proportional to the magnitude of the applied force. An increase in force results in a larger moment, making it easier to rotate the object.

Question: How does the rate of change of the magnetic field affect the induced voltage?

Answer: A faster rate of change of the magnetic field induces a higher voltage, as the induced electromotive force is directly proportional to the rate of change.

Question: How are lipids formed?

Answer: Lipids are formed by the reaction of fatty acids and glycerol.

Question: What is the equivalent resistance of a circuit with two resistors of  $10\ \Omega$  and  $20\ \Omega$  connected in series?

Answer: The equivalent resistance is  $R = 10\ \Omega + 20\ \Omega = 30\ \Omega$ .

Question: How does reducing the mass of an object affect its acceleration for a constant force?

Answer: Reducing the mass of an object increases its acceleration for a constant force, as acceleration is inversely proportional to mass.

Question: How is the height that a body falls during a given time calculated using mean velocity?

Answer: Height = Mean velocity  $\times$  Time, where mean velocity = (Initial velocity + Final velocity) / 2.

Question: What is the relationship between temperature and the kinetic energy of particles in an object?

Answer: Temperature is a measure of the mean kinetic energy of the particles (atoms or molecules) in an object. Higher temperatures correspond to higher kinetic energy and more vigorous particle motion.

Question: How does a U-magnet help study electromagnetic induction?

Answer: A U-magnet provides a strong, uniform magnetic field to observe the effects of electromagnetic induction on a current-carrying conductor.

Question: How does the weight of an object in water compare to its weight in air?

Answer: The weight of an object in water is less than its weight in air because the upthrust exerted by the water reduces the apparent weight of the object.

Question: How does the induced current direction change during coil rotation in a dynamo?

Answer: The induced current direction changes periodically, resulting in an alternating current as the coil rotates within the magnetic field.

Question: Describe the process of installing an RCCB in a household circuit.

Answer: Installing an RCCB involves connecting the device between the incoming power supply and the distribution box, ensuring proper wiring and grounding for effective protection.

Question: What is the role of the cytoskeleton in cells?

Answer: The cytoskeleton provides structural support, facilitates cell movement, and aids in intracellular transport by maintaining the cell's shape and organizing its components.

Question: At which point on the door is the force required to rotate it the maximum?

Answer: The force required to rotate the door is maximum at the point closest to the axis of rotation (hinges).

Question: What is metabolism?

Answer: Metabolism is the summation of biochemical reactions taking place in the living body, encompassing both anabolism and catabolism.

Question: Explain the construction and operation of a simple transformer, and differentiate between step-up and step-down transformers.

Answer: A transformer is a device that changes the voltage of an alternating current (AC) supply using the principles of electromagnetic induction. It consists of two insulated copper coils wound around a soft iron core. Construction: Primary Coil: The coil connected to the AC power supply, known as the input coil. Secondary Coil: The coil connected to the load, known as the output coil. Soft Iron Core: The core that links the magnetic field between the primary and secondary coils, enhancing the efficiency of induction. Operation: An alternating voltage applied to the primary coil creates an alternating current, which generates an alternating magnetic field in the soft iron core. This alternating magnetic field induces an alternating emf in the secondary coil, proportional to the rate of change of the magnetic flux. The voltage induced in the secondary coil depends on the ratio of the number of turns in the primary coil to the number of turns in the secondary coil, as described by the transformer equation:  $V_p / V_s = N_p / N_s$  Step-Up Transformers: Increase the voltage from the primary to the secondary coil. Have more turns in the secondary coil than in the primary coil. Used in power stations to step up the voltage for efficient transmission over long distances. Step-Down Transformers: Decrease the voltage from the primary to the secondary coil. Have fewer turns in the secondary coil than in the primary coil. Used in power distribution systems to step down the voltage for safe use in homes and businesses. Transformers are essential for efficiently transmitting and distributing electrical power, adapting voltage levels to suit different applications.

Question: How does the expansion of liquids differ from the expansion of solids?

Answer: The expansion of liquids typically involves an increase in volume, while the expansion of solids can involve changes in length, area, or volume. Liquids expand more uniformly and are less constrained by their structure compared to solids.

Question: What is the significance of the focal point in spherical mirrors?

Answer: The focal point is the key reference for determining where parallel rays converge (concave) or appear to diverge (convex) after reflection.

Question: What are the environmental impacts of using agrochemicals in agriculture?

Answer: Agrochemicals contaminate soil and water, harm non-target species, reduce biodiversity, and pose health risks to humans and wildlife. Their overuse can lead to long-term environmental degradation.

Question: What is the role of a transformer in an electric circuit?

Answer: A transformer changes the voltage level of an electric supply, either stepping it up or stepping it down to suit different applications.

Question: How do geneticists study the genetic basis of complex traits?

Answer: Geneticists study the genetic basis of complex traits by analyzing large populations, using genome-wide association studies, and identifying multiple genes and environmental factors that contribute to the variation in these traits.

Question: How much work is done in lifting a 5 kg object to a height of 10 m?

Answer: The work done is 500 Joules (J).

Question: What lifestyle changes can reduce the risk of kidney disease?

Answer: Reducing salt and protein intake, maintaining a healthy weight, staying hydrated, managing blood pressure and diabetes, and avoiding smoking can reduce the risk of kidney disease.

Question: Describe the process of meiosis and its significance in sexual reproduction.

Answer: Meiosis reduces the chromosome number by half, producing haploid gametes (sperm and eggs), ensuring genetic diversity and maintaining the chromosome number in offspring after fertilization.

Question: What are the characteristics of organisms in the Domain Bacteria?

Answer: Organisms in the Domain Bacteria are prokaryotes, sensitive to antibiotics, can be pathogenic, and are found everywhere in the environment.

Question: What are some applications of X-rays in medicine?

Answer: X-rays are used in medicine for imaging internal body structures, diagnosing fractures, and treating certain types of cancer.

Question: How do you calculate the voltage across a bulb in a circuit with two dry cells connected in series?

Answer: Measure the total voltage provided by the two cells and use it as the potential difference in the circuit. The voltage across the bulb is the same as the total voltage if there are no other significant resistances in the circuit.

Question: What is the role of electron sharing in the formation of covalent bonds?

Answer: Electron sharing allows atoms to achieve a stable electronic configuration, forming covalent bonds that hold the atoms together in molecules.

Question: Why are units like kilogram or gram not suitable for measuring the mass of atoms?

Answer: Units like kilogram or gram are not suitable for measuring the mass of atoms because the values obtained are extremely small and impractical for calculations. For instance, the mass of a hydrogen atom is  $1.674 \times 10^{-24}$  grams.

Question: What is the velocity of an object moving with uniform acceleration from 0 m/s to 12 m/s in 4 seconds?

Answer: The velocity is 3 m/s.

Question: What conclusion can be drawn from the experiment using black and colorless polythene on leaves?

Answer: The experiment concludes that light energy is necessary for photosynthesis, as photosynthesis only occurred in the area exposed to light through colorless polythene.

Question: What is the molar mass of calcium chloride ( $\text{CaCl}_2$ )?

Answer: The molar mass of  $\text{CaCl}_2$  is 111 g/mol.

Question: What is the significance of the resistor color code in electronics?

Answer: The resistor color code provides a standardized method for indicating the resistance value and tolerance of resistors, making it easier to identify and select the appropriate resistor for a circuit.

Question: What is the effect of placing an object at the focal point of a concave mirror?

Answer: Placing an object at the focal point results in an image formed at infinity, appearing very large and inverted.

Question: Describe the function of an electric thermostat.

Answer: An electric thermostat regulates the temperature by switching the heating or cooling device on or off to maintain the desired setpoint.

Question: How is the chemical formula of ammonia written?

Answer: The chemical formula of ammonia is  $\text{NH}_3$ , indicating one nitrogen atom and three hydrogen atoms.

Question: How are flowering plants adapted to life on land?

Answer: Flowering plants have various adaptations to conserve water and can produce flowers for sexual reproduction.

Question: How does a convex lens magnify objects?

Answer: A convex lens magnifies objects by converging light rays to a focal point, enlarging the appearance of objects placed within its focal length.

Question: What role does water play in seed germination?

Answer: Water activates enzymes in the cotyledons, leading to the digestion of stored complex food into simple nutrients, which help develop the radicle and plumule.

Question: How do copper and sulfate ions combine to form copper sulfate?

Answer: Copper ions ( $\text{Cu}^{2+}$ ) and sulfate ions ( $\text{SO}_4^{2-}$ ) combine through electrostatic attraction to form copper sulfate ( $\text{CuSO}_4$ ) with ionic bonds.

Question: What is Archimedes' principle and its significance?

Answer: Archimedes' principle states that when an object is partially or completely submerged in a fluid, the upthrust acting on it is equal to the weight of the fluid displaced by the object. It explains why objects float or sink.

Question: What happens when the forces acting on an object are not coplanar?



Answer: When the forces acting on an object are not coplanar, the object will not be in equilibrium and will move or rotate due to the unbalanced forces and moments.

Question: What is thrombosis, and what can it lead to?

Answer: Thrombosis is when blood supply to an organ is affected by a blood clot, potentially leading to paralysis or heart attacks if it occurs in the brain or coronary artery.

Question: How is the production of quicklime from limestone an endothermic reaction?

Answer: The thermal decomposition of limestone absorbs heat:  $\text{CaCO}_3 (\text{s}) \rightarrow \text{CaO} (\text{s}) + \text{CO}_2 (\text{g})$ .

Question: How does the body respond to infection?

Answer: The body responds to infection by activating the immune system, producing antibodies, and deploying white blood cells to attack and destroy pathogens.

Question: Explain the working principle of a supercapacitor and its applications.

Answer: A supercapacitor stores energy through electrostatic charge separation at the electrode-electrolyte interface, providing high power density, rapid charging and discharging, and long cycle life. It is used in applications like energy storage, power backup, and regenerative braking.

Question: What is heterotrophic nutrition?

Answer: Heterotrophic nutrition is a mode of nutrition where organisms depend on other organisms for their food, as seen in animals like cows and storks.

Question: What is the role of copper sulphate in electroplating?

Answer: Copper sulphate is used in electroplating to deposit a layer of copper on a surface.

Question: What is the molar mass of sodium chloride (NaCl)?

Answer: The molar mass of sodium chloride is 58.5 grams per mole, calculated as 23 for sodium plus 35.5 for chlorine.

Question: What is the significance of the latent heat of vaporization in phase change processes?

Answer: The latent heat of vaporization is significant in phase change processes because it quantifies the energy required to convert a liquid into a gas at its boiling point, providing insight into the energy dynamics of phase transitions.

Question: How does a photovoltaic cell generate electricity from sunlight?

Answer: A photovoltaic cell generates electricity by absorbing sunlight, which excites electrons in the semiconductor material, creating a flow of electric current.

Question: What is the function of the androecium?

Answer: The androecium, the male reproductive structure, produces pollen in the anther, which contains the male gamete cells of the plant.

Question: What is the role of the electrolyte in an electroplating setup?

Answer: The electrolyte provides a source of metal ions for the plating process, facilitating the transfer of ions between the anode and cathode and ensuring a consistent and even deposition of the metal layer.

Question: What causes herpes, and what are its symptoms?

Answer: Herpes is caused by the virus Herpes simplex and is characterized by painful blisters on sex organs and nervous system inactivation.

Question: Explain the flow of energy and nutrients in an ecosystem, including the concepts of food chains, food webs, and ecological pyramids.

Answer: Energy and nutrients flow through ecosystems, driven primarily by the sun. This flow is crucial for the maintenance and functioning of the biosphere. The concepts involved are: Food Webs: These illustrate the mutual relationships for food among organisms, forming a web-like structure where different trophic levels of many food chains interconnect. This relationship allows organisms to depend on various food sources, preventing bioaccumulation. below show examples of a food web, including plants, rabbits, rats, hornbills, hawks, and pythons. Food Chains: These depict a linear sequence of energy and material flow from producers to primary consumers and then to secondary consumers. An example is: Grass (Producer) → Grasshopper (Primary Consumer) → Toad (Secondary Consumer) → Cobra (Tertiary Consumer) → Hawk (Quaternary Consumer) . Trophic Levels: Organisms belong to different trophic levels based on their mode of nutrition, including producers (autotrophs), consumers (heterotrophs), and decomposers. Autotrophs, like green plants, convert inorganic compounds into organic food through photosynthesis or chemosynthesis. Heterotrophs, such as herbivores, carnivores, and omnivores, depend on other organisms for food. Decomposers, like bacteria and fungi, break down dead organisms and waste products, recycling nutrients. Ecological Pyramids: These graphical representations show the relationships of number, biomass, and energy among different trophic levels: Number Pyramid: Shows the number of organisms at each trophic level, which can be upright or inverted . Biomass Pyramid: Displays the total organic matter at each trophic level, usually upright but sometimes inverted in aquatic environments. Energy Pyramid: Represents the energy flow through trophic levels, always upright as only 10% of energy transfers to the next level, with 90% lost as heat. Energy flow is demonstrated by processes like photosynthesis, where green plants fix sunlight energy into glucose, which then passes through trophic levels. The inefficiency of long food chains is highlighted by energy dissipation, where shorter chains are more efficient

Question: How do you determine the center of gravity of an object using the method described in the document?

Answer: Hang the object from different points and mark the vertical lines along the string. The point where these lines intersect is the center of gravity, where the weight of the object acts.

Question: Explain the concept of phase shift in alternating current (AC) circuits.

Answer: Phase shift in AC circuits refers to the displacement of the voltage and current waveforms in time, which can affect the power transfer and efficiency of the circuit.

Question: How is carbon dioxide gas used in fire extinguishers?

Answer: Carbon dioxide, being a non-supporter of combustion, is used in fire extinguishers to smother flames and prevent fires from spreading.

Question: How do you calculate the potential difference across a bulb with a resistance of  $4\ \Omega$  and a current of  $0.8\text{ A}$ ?

Answer: Using Ohm's Law,  $V = IR$ , the potential difference is  $V = 0.8\text{ A} \times 4\ \Omega = 3.2\text{ V}$ .

Question: How does a diaphragm pressure gauge measure pressure?

Answer: A diaphragm pressure gauge measures pressure by detecting the deflection of a diaphragm under pressure, with the deflection moving an indicator to display the pressure level.

Question: What is the functional and structural unit of the kidney?

Answer: The nephron.

Question: What is the boiling point of ethanol?

Answer: The boiling point of ethanol is  $78^\circ\text{C}$ .

Question: What is a biogeochemical cycle?

Answer: A biogeochemical cycle is the movement of chemical elements between living organisms and the environment.

Question: How is the reactivity series constructed?

Answer: The reactivity series is constructed by comparing the reactions of metals with air, water, dilute acids, and salt solutions, ranking them based on their reactivity.

Question: What is cross-pollination?

Answer: Cross-pollination occurs when pollen from a flower is deposited on the stigma of a flower on the same plant or a different plant of the same species.

Question: How do ionic bonds contribute to the formation of crystalline solids?

Answer: Ionic bonds contribute to the formation of crystalline solids by organizing ions in a regular, repeating lattice structure that maximizes electrostatic attraction and stability.

Question: What is epigeal germination?

Answer: Epigeal germination is when both the plumule and cotyledons emerge from the soil. The cotyledons produce food by photosynthesis in addition to supplying stored food for the seedling. Most dicotyledonous plants show epigeal germination, such as bean and tamarind.

Question: Why is it important to consider heat loss to surroundings and absorption by the container in experiments?

Answer: Neglecting these factors leads to errors in heat change calculations, so measures like using a polystyrene cup and stirring are taken to minimize these effects.

Question: What is the composition of urine in a healthy person?

Answer: Urine typically contains about 96% water, 2% salts, 2% urea, and trace amounts of uric acid and creatinine.

Question: What is the valency of sulphur?

Answer: The valency of sulphur is 6 and 2.

Question: What is the surface area of one side of a large marble cube with a side of 2 cm?

Answer: The surface area of one side is  $4 \text{ cm}^2$  ( $2 \text{ cm} \times 2 \text{ cm}$ ).

Question: What is the significance of the reactivity series in acid-metal reactions?

Answer: The reactivity series helps predict which metals will react with acids to produce hydrogen gas.

Question: How is the chemical formula of magnesium nitride represented?

Answer: The chemical formula of magnesium nitride is  $\text{Mg}_3\text{N}_2$ , indicating three magnesium ions and two nitride ions.

Question: What is the specific heat capacity of zinc?

Answer: The specific heat capacity of zinc is  $380 \text{ J kg}^{-1} \text{ K}^{-1}$ .

Question: What are the differences between mitosis and meiosis?

Answer: Mitosis produces two identical daughter cells with the same chromosome number as the parent cell, while meiosis produces four genetically diverse haploid cells, reducing the chromosome number by half.

Question: What happens when magnesium reacts with hydrochloric acid?

Answer: When magnesium reacts with hydrochloric acid, it forms magnesium chloride and hydrogen gas:  $\text{Mg} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$ .

Question: How does the number of coil turns affect the dynamo's performance?

Answer: More coil turns increase the induced electromotive force, enhancing the dynamo's efficiency and electricity generation.

Question: What are the functions of the reproductive system?

Answer: The reproductive system produces gametes (sperm and eggs), facilitates fertilization, and supports the development of offspring.

Question: What is the atomic number of lithium?

Answer: The atomic number of lithium is 3.

Question: What role do antioxidants play in kidney health?

Answer: Antioxidants help protect kidney cells from oxidative stress and damage, reducing the risk of kidney disease.

Question: How does the first ionisation energy vary within a period?

Answer: The first ionisation energy generally increases across a period from left to right.

Question: What are the applications of electrochemical sensors?

Answer: Electrochemical sensors are used for detecting and measuring various chemical species in applications like environmental monitoring, medical diagnostics, industrial process control, and food quality testing.

Question: What is the function of a soft iron core in an electromagnet?

Answer: The soft iron core enhances the magnetic field strength, improving the efficiency of electromagnetic induction.

Question: What is the significance of vitamins in human health?

Answer: Vitamins are essential for various biochemical reactions and bodily functions, and their deficiency can lead to various health issues.

Question: What is the function of xylem parenchyma cells?

Answer: Xylem parenchyma cells are involved in the storage of food and nutrients within the xylem tissue.

Question: What is a p-type semiconductor and how is it formed?

Answer: A p-type semiconductor is formed by doping an intrinsic semiconductor with a group III element, such as boron, which creates holes by leaving one less electron for bonding, thus increasing conductivity through positive charge carriers.

Question: What are solar cells constructed using?

Answer: Solar cells are constructed using p-n junctions.

Question: What causes wheezing in individuals?

Answer: Wheezing is caused by the obstruction of airways due to mucus produced from allergies in the trachea, bronchi, bronchioles, and alveoli of the respiratory system. Harmful gases and dust particles (air pollutants and irritants) are the primary causes.

Question: Why is only 10% of energy transferred to the next trophic level?

Answer: Only 10% of energy is transferred to the next trophic level because the majority of energy is lost as heat during metabolic processes.

Question: What is the relationship between voltage, current, and power in an electric appliance?

Answer: The power ( $P$ ) of an electric appliance is the product of voltage ( $V$ ) and current ( $I$ ), expressed as  $P = VI$ .

Question: How does the induced voltage waveform in an alternating current dynamo look?

Answer: The induced voltage waveform in an alternating current dynamo is sinusoidal, alternating between positive and negative values.

Question: What is the specific heat capacity of iron?

Answer: The specific heat capacity of iron is  $460 \text{ J kg}^{-1} \text{ K}^{-1}$ .

Question: What is the electronic configuration of beryllium?

Answer: The electronic configuration of beryllium is 2, 2.

Question: What is the importance of indicating the physical state of reactants and products in heat change calculations?

Answer: It ensures accuracy, as the heat change can vary with different physical states of the substances involved.

Question: How does thermal expansion affect the design of metallic bottle lids?

Answer: Thermal expansion allows metallic bottle lids to expand when heated, making them easier to open, and contract when cooled, ensuring a secure fit.

Question: What is the boiling point of water under one atmosphere of pressure?

Answer: The boiling point of water under one atmosphere of pressure is 100°C.

Question: What factors contribute to the efficiency of modern electric cookers?

Answer: Factors contributing to the efficiency of modern electric cookers include better heat transfer, reduced heat loss, and advanced technologies like induction heating.

Question: What is the significance of the 1:2:1 ratio in Mendel's monohybrid crosses?

Answer: The 1:2:1 ratio in Mendel's monohybrid crosses represents the distribution of genotypes (homozygous dominant, heterozygous, and homozygous recessive) in the F<sub>2</sub> generation, supporting the principles of inheritance.

Question: What is the effect of connecting two dry cells in series on the potential difference in a circuit?

Answer: Connecting two dry cells in series increases the potential difference, which can increase the current in the circuit if the resistance remains constant.

Question: What is the role of water in respiration for aquatic organisms?

Answer: Water is important in respiration for aquatic organisms as Oxygen (O<sub>2</sub>) is soluble in water.

Question: How does the depth of a liquid affect the hydrostatic pressure it exerts?

Answer: Hydrostatic pressure increases with the depth of the liquid, as it is directly proportional to the height of the liquid column above the measurement point.

Question: What is the role of the Calvin cycle in carbon fixation and glucose production?

Answer: The Calvin cycle fixes atmospheric CO<sub>2</sub> into organic compounds, producing glucose and other carbohydrates for plant growth and energy.

storage.

Question: How does silver oxide decompose, and what are the products?

Answer: Silver oxide decomposes upon heating to form silver and oxygen:  
 $2\text{Ag}_2\text{O} \rightarrow 4\text{Ag} + \text{O}_2$ .

Question: What is the impact of genetic mutations on evolution?

Answer: Genetic mutations introduce new variations into a population, providing the raw material for evolution. Beneficial mutations can be passed on and become more common, while harmful mutations may be eliminated by natural selection.

Question: What are irrigation systems, and why are they important?

Answer: Irrigation systems are man-made structures such as tanks, ponds, reservoirs, canals, dams, and tunnels used to supply water for agriculture. They are important for ensuring water availability for crops.

Question: How does a hydrogen-oxygen fuel cell work?

Answer: In a hydrogen-oxygen fuel cell, hydrogen gas is oxidized at the anode to produce protons and electrons. The protons pass through an electrolyte, while the electrons travel through an external circuit, generating electricity. At the cathode, oxygen gas reacts with the protons and electrons to form water.

Question: How does the decomposition reaction of hydrogen peroxide occur?

Answer: Hydrogen peroxide decomposes to form water and oxygen gas:  
 $2\text{H}_2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{O}_2$ .

Question: How does the structure of the nephron facilitate urine formation?

Answer: The nephron's structure, including the Bowman's capsule, glomerulus, and tubules, allows for efficient filtration, reabsorption, and secretion, forming urine.

Question: What is respiration, and what does it involve?

Answer: Respiration is the oxidation of simple foods within living cells, involving the intake of oxygen and release of gaseous waste products.

Question: How do you calculate the voltage drop across each resistor in a series circuit with a known total voltage?

Answer: Calculate the voltage drop across each resistor using Ohm's Law:  $V_i = I \cdot R_i$ , where  $I$  is the total current and  $R_i$  is the resistance of each resistor.

Question: How do you calculate the current through a person's body if they touch a 120 V live wire with a body resistance of 1000  $\Omega$ ?

Answer: Using Ohm's Law,  $I = V/R = 120 \text{ V}/1000 \Omega = 0.12 \text{ A}$ .

Question: What happens when a heated piece of iron is placed in cold water?

Answer: When a heated piece of iron is placed in cold water, heat transfers from the iron to the water, raising the water's temperature and lowering the iron's temperature until thermal equilibrium is reached.

Question: What is the relationship between the force required to initiate rotation and the perpendicular distance from the axis of rotation?

Answer: The force required to initiate rotation decreases as the perpendicular distance from the axis of rotation increases, making it easier to rotate the object.

Question: What are hydrophilous flowers?

Answer: Hydrophilous flowers are pollinated by water, with staminate flowers floating to contact pistillate flowers for pollination. An example is *Vallisneria*.

Question: What is the role of the nucleolus in a cell?

Answer: The nucleolus is involved in producing and assembling ribosomal RNA and ribosomal subunits, essential for protein synthesis.

Question: Why is it important to disconnect electric appliances when not in use?

Answer: Disconnecting electric appliances when not in use prevents energy waste, reduces the risk of electrical fires, and extends the lifespan of the appliances.

Question: What causes diarrhea and how can it be managed?

Answer: Diarrhea is caused by infections from viruses, bacteria, or parasites, leading to liquid stools and dehydration. It can be managed by consuming more water and seeking medical treatment.

Question: What are the advantages of using solid-state electrolytes in batteries?

Answer: Solid-state electrolytes in batteries offer advantages like improved safety, higher energy density, longer cycle life, and the potential for flexible and lightweight designs, making them suitable for advanced energy storage applications.

Question: What causes herpes, and what are its symptoms?

Answer: Herpes is caused by the virus *Herpes simplex* and is characterized by painful blisters on sex organs and nervous system inactivation.

Question: What is the pressure exerted by a 1-meter-high column of mercury with a density of  $13,600 \text{ kg/m}^3$ ?

Answer: The pressure exerted is calculated using  $P = h\rho g$ . For a height of 1 m, the pressure is  $P = 1 \text{ m} * 13,600 \text{ kg/m}^3 * 10 \text{ m/s}^2 = 136,000 \text{ Pa}$ .

Question: What is the role of acids in cleaning agents?

Answer: Acids in cleaning agents help remove mineral deposits, rust, and stains by reacting with and dissolving the buildup.

Question: How is resistance calculated using Ohm's Law?

Answer: Resistance (R) is calculated using the formula  $R = V/I$ , where V is the potential difference and I is the current.

Question: How is the chemical formula of magnesium nitrate represented?



Answer: The chemical formula of magnesium nitrate is  $\text{Mg}(\text{NO}_3)_2$ , indicating one magnesium ion and two nitrate ions.

Question: How does a compressed gas exert pressure?

Answer: A compressed gas exerts pressure due to the force of the gas molecules colliding with the walls of the container. The more the gas is compressed, the higher the pressure.

Question: What is the boiling point of carbon dioxide during fractional distillation of atmospheric air?

Answer: Carbon dioxide boils at  $-78.5^\circ\text{C}$ .

Question: How does the galvanometer behave in an AC circuit?

Answer: In an AC circuit, the galvanometer oscillates, indicating that the current direction is alternating.

Question: Explain the function of peroxisomes.

Answer: Peroxisomes are small organelles that contain enzymes to break down fatty acids and detoxify harmful substances, such as hydrogen peroxide, into harmless products like water and oxygen.

Question: What are the environmental benefits of urban green spaces?

Answer: Urban green spaces improve air quality, reduce urban heat island effects, support biodiversity, and provide recreational opportunities. They enhance the quality of life in urban areas.

Question: How does a concave mirror form an image when the object is placed beyond the center of curvature?

Answer: The image is real, inverted, smaller than the object, and formed between the focal point and the center of curvature.

Question: What is the weight of a 1 kg object on Earth?

Answer: The weight of a 1 kg object on Earth is 9.8 N.

Question: What is coordination in the human body?

Answer: Coordination is the adaptation of the body according to changes in external and internal environments, allowing response to stimuli.

Question: What are the advantages of using lithium-ion batteries in portable electronics?

Answer: Lithium-ion batteries offer high energy density, long cycle life, low self-discharge, and lightweight properties, making them ideal for portable electronics like smartphones, laptops, and electric vehicles.

Question: What are electrochemical cells, and how are they used in everyday life?

Answer: Electrochemical cells are devices that convert chemical energy into electrical energy. They are commonly used to power everyday equipment such as toy cars, electric torches, calculators, computers, and mobile phones.

Question: How is oxygen gas used in welding?

Answer: Oxygen gas is used to generate oxy-acetylene flames for welding metals due to its ability to support combustion at high temperatures.

Question: What is the significance of phospholipids in cell membranes?

Answer: Phospholipids are a major component of cell membranes, forming a bilayer that provides structure and regulates the movement of substances in and out of the cell.

Question: What components are essential for the operation of a bicycle dynamo?

Answer: Essential components of a bicycle dynamo include the rotating coil, magnetic field, mechanical connection to the tire, and electrical circuit.

Question: What is the function of a heat sink in power electronics?

Answer: A heat sink dissipates heat generated by power electronic components, such as transistors and ICs, preventing overheating and ensuring reliable operation.

Question: What role do salivary glands play in the buccal cavity?

Answer: Salivary glands secrete saliva, which contains the enzyme salivary amylase (ptyalin) that begins the digestion of starch into maltose in the mouth.

Question: How is hydrogen gas collected by downward displacement of air?

Answer: Hydrogen gas, less dense than air, is collected by displacing air downwards in an inverted gas jar, a method known as downward displacement of air.

Question: What is the latent heat of fusion?

Answer: The latent heat of fusion is the amount of heat required to convert a unit mass of a solid into a liquid at its melting point without changing its temperature.

Question: How does a McLeod gauge measure low pressures in a gas?

Answer: A McLeod gauge measures low pressures by compressing a known volume of gas, allowing for precise pressure measurement based on the change in volume.

Question: What is the importance of cellular respiration in living organisms?

Answer: Cellular respiration is crucial for living organisms as it provides the energy needed for metabolism, growth, and repair of cells.

Question: How does the position of a compass affect its deflection near a current-carrying conductor?

Answer: The compass deflection depends on its position relative to the conductor, with different deflection directions above and below the conductor.

Question: How is the chemical formula of aluminium oxide written?

Answer: The chemical formula of aluminium oxide is  $\text{Al}_2\text{O}_3$ , indicating two aluminium ions and three oxide ions.

Question: What factors contribute to the efficiency of modern electric cookers?

Answer: Factors contributing to the efficiency of modern electric cookers include better heat transfer, reduced heat loss, and advanced technologies like induction heating.

Question: How does urbanization impact water resources?

Answer: Urbanization increases water demand, reduces water quality due to pollution, and alters natural water cycles through infrastructure development. It can lead to water scarcity and environmental degradation.

Question: How is the maximum height reached by a body projected vertically upwards calculated?

Answer: Maximum height =  $\frac{1}{2} \times \text{Initial velocity} \times \text{Time taken to reach maximum height}$ .

Question: Why does the reaction rate increase with higher concentration of reactants?

Answer: Higher concentration increases the number of reactant particles, leading to more collisions and a faster reaction rate.

Question: What is the mass fraction of magnesium carbonate in dolomite if 20g of dolomite contains 12g of  $\text{MgCO}_3$ ?

Answer: The mass fraction is 0.6 or 60%.

Question: How does the formation of an ionic bond affect the chemical properties of an ion compared to its parent atom?

Answer: The formation of an ionic bond changes the chemical properties of an ion compared to its parent atom because the ion has a different number of electrons and, consequently, a different electronic configuration, resulting in different reactivity and behavior.

Question: What is the principle of a hydraulic lift and how is it used in automotive services?

Answer: A hydraulic lift operates on Pascal's principle, using fluid pressure to lift heavy objects like cars in automotive services for maintenance and repairs.

Question: How does the reactivity of halogens change with increasing atomic number?

Answer: The reactivity of halogens decreases with increasing atomic number because it becomes harder to gain an additional electron.

Question: What is the significance of intermolecular forces in determining the physical state of a substance at room temperature?

Answer: Intermolecular forces determine the physical state of a substance at room temperature by affecting the energy required to separate molecules. Stronger intermolecular forces result in solids or liquids, while weaker forces result in gases.

Question: What characterizes weak bases?

Answer: Weak bases partially ionize in an aqueous solution, meaning only a fraction of the base molecules dissociate into ions.

Question: How does an increase in carbon dioxide levels cause global warming?

Answer: Increased carbon dioxide levels enhance the greenhouse effect, trapping more heat in the atmosphere and leading to global warming.

Question: How do viruses differ from bacteria in terms of structure and reproduction?

Answer: Viruses differ from bacteria in that they lack cellular structures, such as organelles, and can only replicate inside a host cell, while bacteria are unicellular organisms capable of independent growth and reproduction.

Question: How do you connect two dry cells to ensure a potential difference across a bulb?

Answer: Connect the positive terminal of one cell and the negative terminal of the other cell to the terminals of the bulb to create a potential difference and allow current to flow.

Question: What is the magnitude of the resultant force if two collinear forces of 10 N and 6 N act in the same direction?

Answer: The magnitude of the resultant force is 16 N.

Question: How do flowering plants reproduce?

Answer: Flowering plants reproduce sexually through flowers and have seeds covered by a fruit.

Question: What is the potential energy of a 3 kg object lifted by 2 m?

Answer: The potential energy is 60 Joules (J).

Question: How does the electronic configuration of hydrogen influence its bonding behavior?

Answer: The electronic configuration of hydrogen (1 electron) allows it to form covalent bonds by sharing its single electron with another atom to achieve a stable configuration similar to helium.

Question: How do you select an appropriate fuse for a circuit?

Answer: Select a fuse with a current rating slightly higher than the normal operating current of the circuit but lower than the maximum current that the components can safely handle.

Question: What are the main features of the Kingdom Protista?

Answer: The Kingdom Protista includes eukaryotic organisms that can be unicellular or multicellular without specialized tissues and live in water-associated environments.

Question: What is the group number of an element with 1 electron in its outermost energy level?

Answer: The group number is I (Group 1).

Question: How does the mass of an object affect its acceleration for a given force?

Answer: For a given force, the acceleration of an object is inversely proportional to its mass. A larger mass results in a smaller acceleration.

Question: What is the significance of a decoupling capacitor in electronic circuits?

Answer: A decoupling capacitor stabilizes the voltage supply by filtering out noise and voltage spikes, ensuring smooth operation of sensitive electronic components.

Question: How much heat is required to increase the temperature of 0.8 kg of aluminium from 30°C to 50°C?

Answer: The heat required is 14,400 J, calculated using the formula  $Q = mc\Delta T = 0.8 \times 900 \times (50 - 30)$ .

Question: How does deforestation contribute to soil erosion?

Answer: Deforestation removes vegetation that stabilizes soil, increasing susceptibility to erosion from wind and water. It leads to soil degradation and loss of fertility.

Question: What is the role of a mediator in mediated electrochemical oxidation?

Answer: A mediator in mediated electrochemical oxidation is a redox-active species that facilitates the transfer of electrons between the electrode and the target compound, enhancing the efficiency and selectivity of the oxidation process.

Question: How does ionisation energy vary down a group?

Answer: Ionisation energy decreases from top to bottom down a group.

Question: What is the function of the pituitary gland?

Answer: The pituitary gland secretes hormones that regulate growth, metabolism, and reproductive functions.

Question: How do viruses cause diseases in humans?

Answer: Viruses cause diseases in humans by infecting host cells, replicating, and damaging or killing the cells, leading to symptoms and immune responses.

Question: How does a battery management system (BMS) enhance the performance and safety of batteries?

Answer: A battery management system (BMS) monitors and manages the state of charge, temperature, and voltage of individual cells in a battery pack, ensuring optimal performance, preventing overcharging and deep discharging, and enhancing safety and lifespan.

Question: A - presence of a nucleus B - presence of chloroplasts C - presence of a cell wall D - presence of mitochondria Seen only in plant cells is/are (1) A. (2) A and B. (3) B and C. (4) C and D.

Answer: (3) B and C.

Question: How do nucleic acids control cellular activities?

Answer: The information to control cellular activities is present in DNA.

Question: What does a positive acceleration indicate?

Answer: A positive acceleration indicates an increase in velocity.

Question: How do the ureters function in the urinary system?

Answer: The ureters transport urine from the kidneys to the urinary bladder for temporary storage.

Question: How does the reaction of zinc with copper sulfate demonstrate a single displacement reaction?

Answer: Zinc displaces copper from copper sulfate, forming zinc sulfate and copper:  $\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$ .

Question: Calculate the potential energy of a 5 kg object at a height of 7 m.

Answer: The potential energy is 350 Joules (J).

Question: Why is it important to follow safety measures when using electric appliances?

Answer: Following safety measures prevents electric shocks, fires, and other accidents, ensuring the safe and efficient operation of electric appliances.

Question: How does genetic engineering address food security?

Answer: Genetic engineering addresses food security by developing crops with higher yields, improved nutritional content, and resistance to pests, diseases, and environmental stresses, ensuring a stable food supply for growing populations.

Question: What does a graph of voltage (V) against current (I) look like according to Ohm's Law?

Answer: According to Ohm's Law, a graph of voltage (V) against current (I) is a straight line passing through the origin, indicating a linear relationship.

Question: How does the mass of an object affect its acceleration for a given force?

Answer: For a given force, the acceleration of an object is inversely proportional to its mass. A larger mass results in a smaller acceleration.

Question: How does the position of a compass affect its deflection near a conductor?

Answer: The compass deflection depends on its position relative to the conductor, with different deflection directions above and below the conductor.

Question: What conclusion can be drawn from the experiment with aquatic plants and gas collection regarding photosynthesis?

Answer: The experiment concludes that oxygen ( $\text{O}_2$ ) is produced during photosynthesis, as indicated by the reigniting splinter.

Question: What is the relationship between the force required to initiate rotation and the perpendicular distance from the axis of rotation?

Answer: The force required to initiate rotation decreases as the perpendicular distance from the axis of rotation increases, making it easier to rotate the object.

Question: What happens to the charges on an object when it gains electrons?

Answer: When an object gains electrons, it becomes negatively charged.

Question: How does temperature affect the kinetic energy of reactants?

Answer: Higher temperatures increase the kinetic energy of reactants, resulting in more frequent and energetic collisions, and a faster reaction rate.

Question: How can you demonstrate the magnetic field around a current-carrying conductor?

Answer: You can demonstrate it by using a compass and observing the deflection of the compass needle when placed near the conductor.

Question: What are the physical properties of carbon dioxide?

Answer: Carbon dioxide is colorless, odorless, denser than air, non-flammable, and slightly soluble in water.

Question: What are the environmental impacts of using synthetic fertilizers in agriculture?

Answer: Synthetic fertilizers contribute to soil degradation, water pollution, and greenhouse gas emissions. Their overuse harms soil health, reduces biodiversity, and disrupts natural nutrient cycles.

Question: How do viruses differ from bacteria?

Answer: Viruses differ from bacteria in that they are acellular, lack cellular structures such as organelles, and can only replicate inside a host cell, while bacteria are unicellular organisms capable of independent growth and reproduction.

Question: What is the solvent in a solution?

Answer: The solvent is the component present in a greater proportion in a solution.

Question: What is the significance of the discovery of the double helix structure of DNA?

Answer: The discovery of the double helix structure of DNA by Watson and Crick provided insights into the molecular basis of inheritance, revealing how genetic information is stored, replicated, and transmitted from one generation to the next.

Question: How do calcium and chlorine atoms achieve a stable electronic configuration in calcium chloride?

Answer: Calcium atoms lose electrons to form  $\text{Ca}^{2+}$  ions, and chlorine atoms gain electrons to form  $\text{Cl}^{-}$  ions. The electrostatic attraction between these ions forms calcium chloride ( $\text{CaCl}_2$ ).

Question: What are the principal changes in fetal development during the first three months?

Answer: During the first three months, the fetus takes human form, develops a large head, starts developing nails, and differentiates male and female sex organs.

Question: How is ultrasound used to solder metals?

Answer: Ultrasound waves cause the metals to vibrate and rub against each other, generating heat that melts and solders the metals at the contact point.

Question: What test can be conducted to identify starch?

Answer: A starch test involves grinding a small amount of food with water and adding a drop of iodine solution to observe a purplish blue color.

Question: How do metals and non-metals differ in terms of electronegativity?

Answer: Metals generally have lower electronegativity values, while non-metals have higher electronegativity values.

Question: What is artificial classification?

Answer: Artificial classification groups organisms based on observable features like locomotive appendages and habitats, without considering evolutionary relationships.

Question: What is a complex microscope, and how does it work?

Answer: A complex microscope uses two lenses (objective and eyepiece) to produce high magnification of tiny objects not visible to the naked eye.

Question: How does temperature affect the kinetic energy of reactants?

Answer: Higher temperatures increase the kinetic energy of reactants, resulting in more frequent and energetic collisions, and a faster reaction rate.

Question: What does an energy level diagram for an endothermic reaction show?

Answer: It shows that the energy in the products is greater than the energy in the reactants, indicating energy is absorbed.

Question: Describe the working principle of a light-emitting diode (LED).

Answer: A light-emitting diode (LED) emits light when a forward voltage is applied, causing electrons to recombine with holes in the semiconductor material, releasing energy as photons.

Question: How do viruses hijack host cellular machinery?

Answer: Viruses hijack host cellular machinery by injecting their genetic material into host cells, taking over the cell's protein synthesis and replication mechanisms to produce new viral particles.

Question: What is the role of surface area in determining the rate of reaction?

Answer: Larger surface area allows more collisions between reactant particles, leading to a faster rate of reaction.

Question: Calculate the concentration of a solution containing 4 moles of NaOH in 2 dm<sup>3</sup> of solution.

Answer: The concentration is 2 mol/dm<sup>3</sup>.



Question: How does tightening a screw affect the moment of force required to rotate a stick?

Answer: Tightening the screw increases the moment of force required to rotate the stick, confirming that the moment depends on the magnitude of the force.

Question: What is the role of cells in multicellular organisms?

Answer: In multicellular organisms, different types of cells perform specific functions, contributing to the overall functioning and survival of the organism.

Question: Describe the process of electrochemical desalination and its advantages.

Answer: Electrochemical desalination involves removing salt ions from seawater or brackish water using electrochemical methods like capacitive deionization or electrodialysis. It offers advantages like low energy consumption, scalability, and minimal chemical use compared to traditional desalination methods.

Question: How is a chloride ion ( $\text{Cl}^-$ ) formed from a chlorine atom?

Answer: A chloride ion ( $\text{Cl}^-$ ) is formed when a chlorine atom gains one electron, resulting in a negative charge.

Question: What is the atomic number of nitrogen?

Answer: The atomic number of nitrogen is 7.

Question: What is the function of a diaphragm pressure gauge?

Answer: A diaphragm pressure gauge measures pressure by the deflection of a diaphragm under pressure, which moves an indicator to show the pressure level.

Question: How are dilute acids prepared from concentrated acids?

Answer: Dilute acids are prepared by mixing concentrated acids with water to achieve the desired concentration.

Question: What is the role of the zygote in multicellular organisms?

Answer: The zygote is the initial cell formed by the fertilization of an egg by a sperm. It undergoes cell division and differentiation to develop into a multicellular organism.

Question: What is the critical angle?

Answer: The critical angle is the angle of incidence in the denser medium at which the angle of refraction is 90 degrees.

Question: How do scientists study the inheritance of traits in plants and animals?

Answer: Scientists study inheritance by conducting experiments, observing traits, and analyzing genetic patterns over multiple generations.

Question: What is the explosive mechanism of seed dispersal?

Answer: The explosive mechanism involves the pericarp of the fruit exploding and dispersing seeds far away due to touch, moisture, or dry weather conditions.

Question: How does pressure affect the rate of reaction in gases, as shown in Fig. 17.1?

Answer: Higher pressure increases the number of collisions per unit time, resulting in a higher rate of reaction.

Question: What is the role of phloem parenchyma in nutrient transport and storage?

Answer: Phloem parenchyma cells assist in the transport and storage of nutrients within the phloem tissue, supporting overall plant growth and development.

Question: Explain the process of electrochemical synthesis of nanoparticles.

Answer: Electrochemical synthesis of nanoparticles involves the controlled reduction of metal ions in an electrolyte to form nanoparticles at the electrode surface. This method allows precise control over size, shape, and composition, used in applications like catalysis and drug delivery.

Question: Describe the process of crystallization.

Answer: Crystallization involves increasing the concentration of a solute in a solution until it exceeds the maximum solubility, causing the solute to separate out as crystals.

Question: How do you prepare a 1 mol/dm<sup>3</sup> solution of acetic acid?

Answer: Measure the required volume of acetic acid and add water to make the final volume, ensuring accurate concentration.

Question: What are the principle changes in fetal development during the eighth month?

Answer: During the eighth month, subcutaneous fat begins to deposit, and the fetus weighs about 2 kg.

Question: What is the purpose of Bisokotuwa in the Sri Lankan irrigation system?

Answer: Bisokotuwa is a rectangular stone structure that helps release water from the tank with reduced pressure. It ensures that water flows out smoothly without causing significant pressure on the tank bund.

Question: Why is it important to consider heat loss to surroundings and absorption by the container in experiments?

Answer: Neglecting these factors leads to errors in heat change calculations, so measures like using a polystyrene cup and stirring are taken to minimize these effects.

Question: What is the significance of Dalton's Law of Partial Pressures?

Answer: Dalton's Law states that the total pressure exerted by a gas mixture is equal to the sum of the partial pressures of each individual gas, important for understanding gas behavior in mixtures.

Question: What example is given to explain the resultant of two collinear forces?

Answer: An example given is a group of people pulling a fishing net in the same direction to successfully pull the net.

Question: How does the boiling point of a mixture affect its separation by distillation?

Answer: The component with the lower boiling point vaporizes first, allowing it to be separated from components with higher boiling points.

Question: What is the role of the neutral wire in an electric circuit?

Answer: The neutral wire completes the electrical circuit by carrying the current back to the power source, ensuring a continuous flow of electricity.

Question: What changes occur in the fetus during the ninth month of development?

Answer: During the ninth month, the nails of the fingers are fully grown, testes descend into the scrotum, and the body shows a full-grown nature, weighing about 2-3 kg.

Question: How does the type of electrolyte influence the products of electrolysis?

Answer: The type of electrolyte influences the products of electrolysis by determining which ions are present and available to participate in the reactions. Different electrolytes can produce different gases, metals, or other compounds.

Question: Define a vector quantity.

Answer: A vector quantity is a physical quantity that has both magnitude and direction.

Question: What is the importance of pure breeding in genetic experiments?

Answer: Pure breeding ensures that the traits being studied are consistent and predictable, allowing for accurate observations of inheritance patterns.

Question: What is the purpose of a voltmeter in a circuit?

Answer: A voltmeter is used to measure the potential difference (voltage) between two points in a circuit.

Question: How does the periodic table help in predicting the properties of elements?

Answer: The periodic table helps in predicting the properties of elements based on their position, which reflects their atomic structure and similar properties within groups and periods.

Question: What are unisexual flowers?

Answer: Unisexual flowers have either male or female reproductive parts and are classified into staminate (male) and pistillate (female) flowers.

Question: Describe the role of motor neurons.

Answer: Motor neurons transmit impulses from the central nervous system to muscles and glands, initiating movement and responses.

Question: How do ultrasound waves assist in medical diagnostics for heart conditions?

Answer: Ultrasound waves are used to visualize the heart's internal structures, measure blood flow, and assess the heart's size and function.

Question: How do different musical instruments produce the same note with different waveforms?

Answer: Different instruments produce unique waveforms due to their construction and the way they generate sound, even when playing the same note.

Question: How do ionic and covalent bonds differ in terms of strength and stability?

Answer: Ionic bonds are generally stronger and more stable due to the electrostatic attraction between ions, while covalent bonds vary in strength but are usually less stable due to the sharing of electrons.

Question: What are some common sexually transmitted diseases?

Answer: Common sexually transmitted diseases include gonorrhea, syphilis, herpes, and AIDS.

Question: How is the chemical formula of sulphuric acid written?

Answer: The chemical formula of sulphuric acid is  $\text{H}_2\text{SO}_4$ , indicating two hydrogen atoms, one sulphur atom, and four oxygen atoms.

Question: What is the pressure exerted at a depth of 2 meters in a tank with water density of  $1000 \text{ kg/m}^3$  and  $g = 10 \text{ m/s}^2$ ?

Answer: The pressure is  $20,000 \text{ Pa}$ , calculated as  $2 \text{ m} \times 1000 \text{ kg/m}^3 \times 10 \text{ m/s}^2$ .

Question: How does velocity affect the kinetic energy of an object?

Answer: Velocity affects the kinetic energy quadratically; increasing the velocity results in a quadratic increase in kinetic energy.

Question: Calculate the energy consumption of a 6V bicycle bulb drawing 0.6A for 5 minutes.

Answer: The energy consumption is  $E = VIt = 6\text{V} \times 0.6\text{A} \times 5 \times 60\text{s} = 1080\text{J}$ .

Question: What is the importance of differential expansion in freezing for aquatic life?

Answer: Differential expansion in freezing keeps water at the bottom, providing a living environment for aquatic organisms.

Question: Describe an activity to investigate the maximum frictional force exerted on an object.

Answer: An activity to investigate the maximum frictional force involves attaching a Newton balance to a block of wood and gradually increasing the applied force until the block just starts to move, recording the force at that moment.

Question: What is twig grafting?

Answer: Twig grafting involves selecting a twig from a fruit-bearing plant, cutting it, fixing it to the stock with their cambium in contact, and wrapping the area with polythene strips until the twig starts growing.

Question: How does the use of nanomaterials enhance the performance of electrochemical sensors?

Answer: The use of nanomaterials enhances the performance of electrochemical sensors by providing a high surface area, improved conductivity, and increased sensitivity, enabling the detection of low concentrations of analytes and rapid response times.

Question: How can traditional knowledge and technology benefit agriculture?

Answer: Traditional knowledge and technology in agriculture, such as using local seeds and traditional cultivation methods, can enhance productivity and sustainability. These practices often require fewer chemical inputs and are more environmentally friendly.

Question: What are the observations when heating calcium carbonate?

Answer: When calcium carbonate is heated, it decomposes to form calcium oxide and carbon dioxide gas, observable as the solid turns to a white powder and gas bubbles form:  $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$ .

Question: What is ultraviolet radiation, and how is it generated?

Answer: Ultraviolet radiation is a type of ray with frequencies higher than visible violet light, generated by the sun, electric discharges, and mercury vapor lamps.

Question: What is the relationship between temperature and kinetic energy in particles?

Answer: Temperature is directly related to the kinetic energy of particles; higher temperatures correspond to higher kinetic energy and more vigorous particle motion.

Question: What is the significance of the electrochemical series in predicting the outcome of electrolysis?

Answer: The electrochemical series helps predict which ions will be reduced or oxidized, guiding the selection of suitable electrodes and electrolytes.

Question: What is the significance of the overall electrolytic reaction for acidulated water?

Answer: The overall electrolytic reaction for acidulated water,  $2\text{H}_2\text{O} (\text{l}) \rightarrow 2\text{H}_2 (\text{g}) + \text{O}_2 (\text{g})$ , demonstrates the decomposition of water into hydrogen and oxygen gases, highlighting the practical application of electrolysis in producing these gases.

Question: What is an energy pyramid?

Answer: An energy pyramid represents the amount of energy available at each trophic level in an ecosystem.

Question: How do lysosomes maintain cellular health?

Answer: Lysosomes degrade damaged or unnecessary cellular components, preventing the accumulation of waste and maintaining cellular health through autophagy.

Question: Describe the role of an electricity meter in monitoring energy consumption.

Answer: An electricity meter monitors energy consumption by recording the total kilowatt hours (kWh) of electricity used by the household, providing data for billing and energy management.

Question: How does a silicon-controlled rectifier (SCR) control high power?

Answer: A silicon-controlled rectifier (SCR) conducts current when triggered by a gate signal, used for controlling high power in applications like motor drives and light dimmers.

Question: How is the chemical formula of magnesium hydroxide written?

Answer: The chemical formula of magnesium hydroxide is  $\text{Mg}(\text{OH})_2$ , indicating one magnesium ion and two hydroxide ions.

Question: How does the orientation of a coil affect the induced electromotive force?

Answer: The orientation of the coil relative to the magnetic field affects the induced electromotive force, with maximum induction occurring when the coil intersects the field lines perpendicularly.

Question: What is the role of a buck converter in power electronics?

Answer: A buck converter steps down a higher DC voltage to a lower DC voltage, providing efficient voltage regulation for electronic devices.

Question: How does the adrenal gland respond to stress?

Answer: The adrenal gland secretes adrenaline and cortisol, preparing the body for a fight or flight response by increasing heart rate, blood pressure, and energy availability.

Question: What causes gonorrhea, and what are its symptoms?

Answer: Gonorrhea is caused by the bacterium *Neisseria gonorrhoeae* and is characterized by secretions from sex organs, pain, and blockage of the fallopian tube.

Question: How is the chemical formula of aluminium oxide represented?

Answer: The chemical formula of aluminium oxide is  $\text{Al}_2\text{O}_3$ , indicating two aluminium ions and three oxide ions.

Question: Explain the role of the nuclear envelope in protecting genetic material.

Answer: The nuclear envelope separates the nucleus from the cytoplasm, protecting genetic material and regulating the exchange of materials, maintaining the integrity of DNA.

Question: What is the momentum of a 500 g object moving at 10 m/s?

Answer: The momentum is  $p = m \times v = 0.5 \times 10 = 5 \text{ kg m/s}$ .

Question: What is the principal axis in the context of spherical mirrors?

Answer: The principal axis is the line joining the pole and the center of curvature of the mirror, perpendicular to the mirror's surface at the pole.

Question: How does the kidney's glomerular filtration rate (GFR) indicate kidney function?

Answer: GFR measures how well the kidneys filter blood, with lower rates indicating reduced kidney function and potential kidney disease.

Question: How can the strength of an acid or base be estimated using indicators?

Answer: Indicators change color in the presence of acids and bases, providing an approximate measure of their strength.

Question: What factors affect the frequency of sound generated by string instruments?

Answer: The frequency depends on the length, tension, and mass per unit length of the vibrating string.

Question: How does the density of water factor into heat change calculations?

Answer: It is used to determine the mass of the solution, which is necessary for calculating heat change.

Question: What is the nutritional mode of cyanobacteria?

Answer: Cyanobacteria are autotrophic, performing photosynthesis to produce their food.

Question: How do you create a combination of resistors with a resistance of  $40\ \Omega$  using  $20\ \Omega$  resistors?

Answer: Connect two  $20\ \Omega$  resistors in series. The equivalent resistance is  $\Sigma = 20\ \Omega + 20\ \Omega = 40\ \Omega$ .

Question: How is a virtual image formed by a plane mirror?

Answer: A virtual image is formed where rays appear to converge behind the mirror. This image cannot be projected on a screen as no actual light rays pass through the image location.

Question: How does the specific heat capacity of mercury affect its use in thermometers?

Answer: The specific heat capacity of mercury allows it to respond quickly to temperature changes, making it suitable for use in thermometers.

Question: What is the nature of the image formed by a concave lens?

Answer: A concave lens forms a virtual, upright, and smaller image of the object.

Question: What is the effect of applying a larger force on the acceleration of a trolley?

Answer: Applying a larger force increases the acceleration of the trolley, as acceleration is directly proportional to the force applied.

Question: How does the body respond to high internal temperature?

Answer: By dilating blood vessels in the skin and increasing sweat production to release heat and lower body temperature.

Question: How do viruses spread between hosts?

Answer: Viruses spread between hosts through various transmission methods, including direct contact, airborne particles, bodily fluids, and vectors such as insects.

Question: What is the significance of Mendel's work in the field of genetics?

Answer: Mendel's work laid the foundation for the field of genetics, providing the first scientific explanation of how traits are inherited through generations.

Question: Describe the motion of an object with a non-uniform speed.

Answer: An object with non-uniform speed travels different distances in equal time intervals.

Question: What is the valency of potassium?

Answer: The valency of potassium is 1.

Question: What is the role of a reference electrode in electrochemical measurements?

Answer: A reference electrode provides a stable and known potential against which the potential of the working electrode can be measured. It is essential for accurate and reproducible electrochemical measurements.

Question: What are the three domains of life?

Answer: The three domains of life are Archaea, Bacteria, and Eukarya.

Question: What factors affect the resistance of the human body?

Answer: Factors affecting body resistance include the contact area, pressure, moisture, and the path of current through the body.

Question: What is the significance of the Tafel equation in electrochemistry?

Answer: The Tafel equation relates the overpotential to the current density in an electrochemical reaction, providing insights into reaction kinetics and mechanisms. It helps in determining the exchange current density and the Tafel slope, which are important parameters in electrode characterization.

Question: What is the significance of using dilute solutions in heat change experiments?

Answer: Dilute solutions ensure that the specific heat capacity and density are close to those of water, simplifying calculations.

Question: What are the sources of particulate matter in the air?

Answer: Sources of particulate matter in the air include industrial emissions, vehicle exhaust, construction activities, and natural sources such as wildfires and volcanic eruptions.

Question: How do lysosomes degrade cellular waste?

Answer: Lysosomes contain hydrolytic enzymes that break down cellular waste, debris, and foreign invaders, playing a key role in cellular cleanup and recycling.

Question: How do musical instruments produce unique sound qualities?



Answer: Musical instruments produce unique sound qualities due to differences in their waveforms, even when playing the same note.

Question: How does Newton's third law explain the motion of a swimmer?

Answer: In swimming, the swimmer pushes water backward with their hands (action), and the water pushes the swimmer forward with an equal and opposite force (reaction), propelling the swimmer forward.

Question: How do you calculate the potential difference across a bulb with a resistance of  $4\ \Omega$  and a current of  $0.8\text{ A}$ ?

Answer: Using Ohm's Law,  $V = IR$ , the potential difference is  $V = 0.8\text{ A} \times 4\ \Omega = 3.2\text{ V}$ .

Question: What is the deceleration during the last 3 seconds for an object that comes to rest from a velocity of  $15\text{ m/s}$ ?

Answer: Deceleration =  $(0 - 15\text{ m/s}) / 3\text{ s} = -5\text{ m/s}^2$ .

Question: What is the purpose of the test button on an RCCB?

Answer: The test button on an RCCB is used to check its functionality by simulating a fault, ensuring the RCCB can effectively disconnect the power supply during an actual fault.

Question: How does the orientation of the coil affect the induced voltage in a dynamo?

Answer: The orientation of the coil affects the induced voltage, with maximum values generated when the coil is perpendicular to the magnetic field lines.

Question: How does solubility impact the design of separation processes in chemical engineering?

Answer: Solubility impacts the design of separation processes by determining the choice of solvents, extraction methods, and purification techniques to achieve efficient separation of components.

Question: What are opaque objects, and can you give an example?

Answer: Opaque objects do not allow light to pass through them at all, such as stones and bricks.

Question: What is the equivalent resistance of resistors connected in parallel?

Answer: The equivalent resistance of resistors connected in parallel is given by the reciprocal of the sum of the reciprocals of their individual resistances:  $1/R = 1/R_1 + 1/R_2 + 1/R_3 + \dots$

Question: How do lysosomes maintain cellular health?

Answer: Lysosomes degrade damaged or unnecessary cellular components, preventing the accumulation of waste and maintaining cellular health through autophagy.

Question: How do scientists study the genetic basis of inherited traits?

Answer: Scientists study the genetic basis of inherited traits through experiments, genetic crosses, and analysis of DNA sequences to understand how traits are passed down from one generation to the next.

Question: What are the main biological processes that take place in the human body?

Answer: Digestion, respiration, blood circulation, excretion, and coordination.

Question: How does a logic analyzer help in digital circuit debugging?

Answer: A logic analyzer captures and displays multiple digital signals, allowing engineers to analyze and debug the behavior of digital circuits by observing timing and logic states.

Question: What are the potential health risks associated with exposure to heavy metals in the environment?

Answer: Potential health risks associated with exposure to heavy metals in the environment include neurological disorders, kidney damage, respiratory issues, and increased cancer risk.

Question: What is steam distillation used for?

Answer: Steam distillation is used to extract volatile compounds from plant materials without decomposition by supplying heat through steam.

Question: How is the quality of sound determined by its waveform?

Answer: The waveform of a sound determines its unique quality or timbre, allowing us to distinguish between different sound sources.

Question: Describe the process of protein modification in the Golgi apparatus.

Answer: The Golgi apparatus modifies proteins by adding carbohydrates and lipids, sorts them, and packages them into vesicles for transport to their final destinations.

Question: What is the primary component of biogas used as fuel, and where is it found?

Answer: The primary component of biogas used as fuel is methane, which is also found in marsh gas produced during the decay of organic matter in marshes.

Question: Explain the importance of grounding in electric circuits.

Answer: Grounding provides a safe path for electric current to flow to the earth in case of a fault, preventing electric shocks and protecting appliances from damage.

Question: How should several people exert force to push a car whose engine is not functioning?

Answer: Several people should exert force in the same direction and along the same line of action to effectively push the car. This ensures that the resultant force is maximized and the car moves in the desired direction.

Question: Describe the process of starch testing in leaves to confirm photosynthesis.

Answer: Boil a leaf in water, then in alcohol, wash it, and add iodine solution. If the leaf turns blue or dark purple, starch is present, confirming photosynthesis.

Question: How do aquatic plants perform photosynthesis differently from terrestrial plants?

Answer: Aquatic plants absorb CO<sub>2</sub> and dissolved oxygen directly from the water, and their leaves have adaptations to facilitate gas exchange in submerged environments.

Question: What is the role of the magnetic poles in generating force on a conductor?

Answer: The magnetic poles create a magnetic field that interacts with the current in the conductor, generating a force that causes movement.

Question: What is the focal point of a curved mirror?

Answer: The focal point is the point where parallel rays of light converge or appear to diverge after reflecting from the mirror. It is located at the midpoint between the pole and the center of curvature.

Question: Describe the process of exocytosis in cells.

Answer: Exocytosis involves vesicles fusing with the plasma membrane to release their contents outside the cell, essential for secretion of hormones, neurotransmitters, and waste products.

Question: What is the importance of the number of turns in a coil for electromagnetic devices?

Answer: More turns in a coil increase the induced electromotive force, enhancing the performance of electromagnetic devices like generators and transformers.

Question: How do you calculate the power dissipated by a resistor with a known resistance and voltage drop?

Answer: The power dissipated is  $P = V^2 / R$ , where  $V$  is the voltage drop and  $R$  is the resistance.

Question: What is the role of chloroplasts in photosynthesis?

Answer: Chloroplasts contain chlorophyll, which absorbs light energy and drives the synthesis of glucose from CO<sub>2</sub> and water during photosynthesis.

Question: How do bacteria reproduce?

Answer: Bacteria reproduce asexually through binary fission, and cyanobacteria can reproduce by fragmentation and budding.

Question: What occurs when calcium carbonate decomposes upon heating?

Answer: Calcium carbonate decomposes to form calcium oxide and carbon dioxide gas:  $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$ .

Question: Why is it important to use energy-efficient lighting in households?

Answer: Using energy-efficient lighting reduces electricity consumption, lowers utility bills, and decreases the environmental impact of energy production.

Question: What are the potential impacts of rising global temperatures on ecosystems?

Answer: Rising global temperatures alter habitat conditions, disrupt migration patterns, and increase the frequency of extreme weather events. They affect species distribution, reproductive processes, and ecosystem stability.

Question: What are some common uses of ultrasound waves in technology and medicine?

Answer: Ultrasound waves are used in SONAR for sea depth measurement, medical diagnostics for internal organ examination, and lithotripsy for treating bladder stones.

Question: What is the role of carbon monoxide in the blast furnace?

Answer: Carbon monoxide acts as a reducing agent, reducing iron ore to liquid iron by reacting with iron(III) oxide to form carbon dioxide.

Question: What is the first ionisation energy?

Answer: The first ionisation energy is the minimum energy required to remove an electron from an atom in the gaseous state to form a unipositive gaseous ion.

Question: What are some applications of X-rays in everyday life?

Answer: X-rays are used in medical imaging, security screening, and material inspection.

Question: Discuss the right-hand grip rule and Maxwell's corkscrew rule for determining the direction of the magnetic field around a current-carrying conductor.

Answer: Two common rules used to determine the direction of the magnetic field around a current-carrying conductor are the right-hand grip rule and Maxwell's corkscrew rule. Right-Hand Grip Rule: Method: Hold the conductor with your right hand, with your thumb pointing in the direction of the current flow. The curl of your other four fingers around the conductor shows the direction of the magnetic field. Application: This rule is useful for quickly determining the direction of the magnetic field in practical situations, such as wiring and circuit design. Maxwell's Corkscrew Rule: Method: Imagine turning a corkscrew in the direction of the current flow. The direction in which the corkscrew rotates represents the direction of the magnetic field. Application: This rule provides a visual and intuitive way to understand the relationship between current flow and the resulting magnetic field. Both rules help visualize the circular nature of the magnetic field lines around a current-carrying conductor, aiding in the analysis and design of electromagnetic systems.

Question: How do chloroplasts and mitochondria interact in plant cells?

Answer: Chloroplasts produce glucose and oxygen through photosynthesis, which mitochondria use in cellular respiration to produce ATP, creating an interdependent energy cycle in plant cells.

Question: What is the function of the retina in the human eye?

Answer: The retina detects light and converts it into electrical signals sent to the brain for visual perception.

Question: How does magnesium react when heated in air?

Answer: When heated in air, magnesium burns with a bright white flame, forming white magnesium oxide.

Question: What is the function of the diaphragm in respiration?

Answer: The diaphragm contracts and flattens to create a vacuum that draws air into the lungs during inhalation and relaxes to expel air during exhalation.

Question: How does pressure affect the solubility of a gas in water?

Answer: Increasing the pressure of a gas in contact with water increases its solubility in water.

Question: What is the significance of Boyle's Law in understanding gas behavior?

Answer: Boyle's Law states that the pressure of a gas is inversely proportional to its volume at constant temperature. This law is crucial for understanding how gases respond to changes in pressure and volume.

Question: What is the valency of carbon?

Answer: The valency of carbon is 4.

Question: How are fatty acids and glycerol absorbed in the small intestine?

Answer: Fatty acids and glycerol are absorbed into lacteals within the villi and eventually enter the bloodstream.

Question: What is the purpose of the axle in an alternating current dynamo?

Answer: The axle rotates the coil within the magnetic field, enabling continuous induction of electromotive force and generation of alternating current.

Question: What charge does an electron have?

Answer: An electron has a negative charge.

Question: What are minerals and their importance?

Answer: Minerals are important nutrient constituents for life processes in organisms, absorbed as trace or macro elements.

Question: How can renewable energy sources help combat climate change?

Answer: Renewable energy sources, such as solar, wind, and hydroelectric power, help combat climate change by reducing greenhouse gas emissions and dependence on fossil fuels.

Question: What is the role of guard cells in plants?

Answer: Guard cells regulate the opening and closing of stomata, controlling gas exchange and water loss in plants.

Question: What is the principle behind the use of chromatography for separating components?

Answer: Different components have varying affinities for the stationary and mobile phases, causing them to move at different rates and separate.

Question: How does the strength of the magnetic field affect the performance of a dynamo?

Answer: A stronger magnetic field increases the induced electromotive force, improving the dynamo's performance and electricity generation.

Question: What is the chemical formula for potassium bromide?

Answer: The chemical formula for potassium bromide is KBr.

Question: What are the uses of sulphuric acid in the paint industry?

Answer: Sulphuric acid is used in the production of pigments and other components in the paint industry.

Question: What happens when an object is pulled in opposite directions with forces that are not along the same line?

Answer: When an object is pulled in opposite directions with forces that are not along the same line, it will not be in equilibrium and will move in the direction of the resultant force.

Question: What is the role of a diaphragm in a pressure sensor?

Answer: The diaphragm in a pressure sensor flexes under pressure, converting the mechanical deformation into an electrical signal for pressure measurement.

Question: consider a situation where a child is walking 60 m from A to B along the straight line. Thereafter, if the child walks another 40 m along the same direction and reaches point C. What is the displacement if a child walks back 60 m after reaching point B?

Answer: The displacement is zero (0).

Question: Consider a situation where a child is walking 60 m from A to B along the straight line. Thereafter, if the child walks another 40 m along the same direction and reaches point C. What is the total displacement?

Answer: The total displacement is 100 m.

Question: What are the deficiency symptoms of potassium in the human body?

Answer: Deficiency symptoms of potassium include muscle weakening and psychological disorders.

Question: What is the role of the enzyme Rubisco in the Calvin cycle?

Answer: Rubisco catalyzes the fixation of CO<sub>2</sub> to ribulose-1,5-bisphosphate, initiating the Calvin cycle and leading to the production of glucose.

Question: What is the role of slag in the blast furnace?

Answer: Slag, formed from impurities reacting with calcium oxide, floats on molten iron, allowing it to be removed separately, and protects the iron from re-oxidation.

Question: Why is biodiversity important for ecosystems?

Answer: Biodiversity is important for ecosystems because it enhances resilience, stability, and productivity, providing essential services such as pollination, nutrient cycling, and climate regulation.

Question: What is the significance of a negative slope on a displacement-time graph?

Answer: A negative slope indicates that the object is moving in the opposite direction.

Question: How does the speed of sound in steel compare to water?

Answer: The speed of sound in steel is much higher, about 5000 m/s, compared to 1400 m/s in water.

Question: What is the effect of hydrochloric acid on metals?

Answer: Hydrochloric acid reacts with metals to produce hydrogen gas and the corresponding metal salt.

Question: What is vaporization, and how does it differ from evaporation?

Answer: Vaporization is the conversion of a liquid into a gaseous state, which can occur through boiling at the boiling point or through evaporation at temperatures below the boiling point. Evaporation occurs only at the surface of a liquid exposed to air, while boiling involves vaporization throughout the liquid.

Question: How does increasing the mass of a vehicle affect its acceleration for a constant force?

Answer: Increasing the mass of a vehicle decreases its acceleration for a constant force, as acceleration is inversely proportional to mass.

Question: How does the heat of reaction for solid sodium hydroxide differ from its aqueous solution?

Answer: The heat change is different due to the additional energy required to dissolve the solid before reacting.

Question: How does the cytoskeleton support cellular structure?

Answer: The cytoskeleton is a network of protein filaments and tubules that provide structural support, maintain cell shape, facilitate cell movement, and assist in intracellular transport.

Question: What is the function of the ovaries?

Answer: The ovaries produce ova (egg cells) and contain primary follicles at various stages of development. They also produce hormones such as estrogen and progesterone.

Question: What is the importance of the vector nature of momentum?

Answer: The vector nature of momentum means it has both magnitude and direction. The direction of momentum is the same as the direction of the velocity of the object.

Question: What is the significance of the "reduce, reuse, recycle" concept?

Answer: The "reduce, reuse, recycle" concept is significant because it encourages minimizing waste generation, reusing materials, and recycling products to conserve resources and protect the environment.

Question: How does thermal expansion affect the design of bridges?

Answer: Thermal expansion affects the design of bridges by requiring expansion joints to accommodate changes in length due to temperature

variations, preventing structural damage and ensuring stability.

Question: What is the reaction between sodium and hydrochloric acid?

Answer: Sodium reacts with hydrochloric acid to form sodium chloride and hydrogen gas:  $2\text{Na} + 2\text{HCl} \rightarrow 2\text{NaCl} + \text{H}_2$ .

Question: How does the choice of electrode material affect the selectivity of electrochemical reactions?

Answer: The choice of electrode material affects the selectivity of electrochemical reactions by influencing the adsorption of reactants, reaction pathways, and product formation. Suitable electrode materials enhance the desired reactions while minimizing side reactions.

Question: Where can collenchyma tissue be found in plants?

Answer: Collenchyma tissue forms a cylindrical layer beneath the epidermis of herbaceous stems and is found in the veins of dicot leaves.

Question: What type of image is formed when an object is placed between the mirror and the focal point of a concave mirror?

Answer: An upright, virtual, and larger-than-object image is formed.

Question: How is Newton's second law of motion mathematically represented?

Answer: Newton's second law is mathematically represented as  $F=ma$ , where  $F$  is the force,  $m$  is the mass, and  $a$  is the acceleration.

Question: What are the methods of dispersal of fruits and seeds?

Answer: The four principal methods of dispersal are by animals, water, wind, and explosive mechanisms.

Question: What are the reproductive structures of fungi?

Answer: Fungi reproduce through structures like spores, which can be observed under a microscope.

Question: What is the hearing range of the human ear?

Answer: The hearing range of the human ear is generally from 20 Hz to 20,000 Hz.

Question: How does the nasal cavity prepare inhaled air before it reaches the lungs?

Answer: The nasal cavity humidifies, warms, and filters the air, trapping dust and microorganisms in mucus and removing them with ciliary action.

Question: What is the general trend in density of elements down a group?

Answer: The density of elements generally increases down a group.

Question: How are ionic bonds different from covalent bonds?

Answer: Ionic bonds are formed by the electrostatic attraction between oppositely charged ions, while covalent bonds are formed by the sharing of electrons between atoms.

Question: What are the consequences of insulin deficiency?



Answer: Insulin deficiency can lead to diabetes, characterized by high blood glucose levels due to impaired glucose conversion and storage.

Question: How does a vacuum cleaner utilize the concept of pressure difference?

Answer: A vacuum cleaner creates a low-pressure area inside it, causing atmospheric pressure to push dirt and debris into the cleaner through the nozzle.

Question: What is the significance of polar covalent bonds in biological molecules?

Answer: Polar covalent bonds are significant in biological molecules because they create partial charges that allow for interactions with other molecules, facilitating processes like hydrogen bonding and enzyme-substrate binding.

Question: Describe the function of fuses in protecting electric circuits.

Answer: Fuses protect electric circuits by breaking the circuit when the current exceeds a safe level, preventing overheating and potential fires.

Question: Describe the process and observations when heating a mothball on a metal spoon.

Answer: When a metal spoon is heated strongly and a mothball is placed on it, the mothball melts and vaporizes. If another spoon is used to cover it, a white powdery residue forms on the inner side of the spoon as the vapor condenses.

Question: How do percussion instruments produce sound?

Answer: Percussion instruments produce sound by the vibration of stretched membranes, metal rods, or metal plates.

Question: How do geneticists use symbols to represent alleles?

Answer: Geneticists use capital letters for dominant alleles and lowercase letters for recessive alleles, simplifying the notation of genotypes and inheritance patterns.

Question: How is carbon dioxide gas used in fire extinguishers?

Answer: Carbon dioxide, being a non-supporter of combustion, is used in fire extinguishers to smother flames and prevent fires from spreading.

Question: How does the speed of sound change with different media?

Answer: The speed of sound varies with the medium; it is slower in air, faster in water, and even faster in solids like steel.

Question: What is the chemical formula for calcium oxide?

Answer: The chemical formula for calcium oxide is  $\text{CaO}$ .

Question: How do fungi reproduce?

Answer: Fungi reproduce through both sexual and asexual methods, including spore formation, budding, and fragmentation.

Question: Describe the function of alveoli in the lungs.

Answer: Alveoli are tiny air sacs where gas exchange occurs, with oxygen diffusing into blood capillaries and carbon dioxide diffusing out to be exhaled.

Question: What is the concentration of a solution containing 4 mol of NaOH in 2 dm<sup>3</sup> of water?

Answer: The concentration is 2 mol/dm<sup>3</sup>.

Question: How does the specific heat capacity of mercury affect its use in thermometers?

Answer: The specific heat capacity of mercury allows it to respond quickly to temperature changes, making it suitable for use in thermometers.

Question: What are the benefits of using fuel cells for stationary power generation?

Answer: Fuel cells for stationary power generation offer high efficiency, low emissions, reliable operation, and the ability to use various fuels like hydrogen and natural gas, providing a clean and sustainable energy solution for buildings and industries.

Question: What is the significance of a 0.7 V base-emitter voltage in a transistor?

Answer: When the base-emitter voltage reaches 0.7 V, the transistor begins to conduct, allowing collector current (I<sub>C</sub>) to flow.

Question: What is the significance of the octet rule in chemical reactions?

Answer: The octet rule is significant in chemical reactions because it explains the tendency of atoms to gain, lose, or share electrons to achieve a stable configuration of eight electrons in their valence shell.

Question: How does the latent heat of vaporization differ from the latent heat of fusion?

Answer: The latent heat of vaporization is the heat required to convert a unit mass of a liquid into a gas at its boiling point without changing its temperature, whereas the latent heat of fusion is the heat required to convert a solid into a liquid.

Question: What is an example of a polar inorganic solute and solvent pair?

Answer: An example is ammonia (polar inorganic solute) dissolving in water (polar solvent).

Question: What is the significance of grafting in plant propagation?

Answer: Grafting allows the propagation of plants with desirable traits, including disease resistance and strong root systems, by fusing the stock and scion.

Question: What are the key features of Arthropods?

Answer: Arthropods are triploblastic, coelomic, have jointed limbs, segmented bodies forming functional segments called Tagma, a chitinous cuticle acting as an exoskeleton, bilateral symmetry, and show sexual dimorphism.

Question: What are the symptoms and treatment of tuberculosis?

Answer: Symptoms of tuberculosis include coughing blood, fever, tiredness, weight loss, and loss of appetite. It can be treated with proper medical intervention and prevented with vaccines.

Question: Explain the operation of a digital multimeter.

Answer: A digital multimeter measures electrical quantities such as voltage, current, and resistance by converting analog signals to digital data and displaying the values on a digital screen.

Question: What are the features of vertebrates in the class Amphibia?

Answer: Vertebrates in the class Amphibia have eyes without eyelids, require water to complete their life cycle, undergo metamorphosis, have thin mucous skin with glands, pentadactyle limbs, a three-chambered heart, and respire through lungs, moist skin, and buccal cavity.

Question: How does the high specific heat capacity of water influence its use in industrial cooling systems?

Answer: Water's high specific heat capacity allows it to absorb and store large amounts of heat, making it effective for regulating temperatures in industrial cooling systems.

Question: What are the properties of weak bases?

Answer: Weak bases partially ionize in water, releasing a lower concentration of hydroxyl ions (OH<sup>-</sup>).

Question: Describe the reactivity of zinc with hydrochloric acid.

Answer: Zinc reacts with hydrochloric acid, producing zinc chloride and hydrogen gas:  $\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$ .

Question: What is the relationship between force and mass for a given acceleration?

Answer: For a given acceleration, force is directly proportional to mass. An increase in mass results in an increase in force required to achieve the same acceleration.

Question: What are the features of gymnosperms?

Answer: Gymnosperms have true tissue differentiation, possess vascular tissues, reproduce sexually by seeds, and are autotrophic and photosynthetic.

Question: Explain the operation of a relay in an electrical circuit.

Answer: A relay is an electrically operated switch that uses a small control current to open or close a larger load circuit, providing isolation and control in various applications.

Question: How does the resistance of a light-dependent resistor change with light intensity?

Answer: The resistance of a light-dependent resistor decreases with increasing light intensity and increases with decreasing light intensity.

Question: What are the four types of cells that make up xylem tissue?

Answer: The four types of cells in xylem tissue are xylem vessel elements, tracheids, xylem fibers, and xylem parenchyma.

Question: What is the nitrogen cycle?

Answer: The nitrogen cycle is the process by which nitrogen is converted between its various chemical forms, making it available for use by living organisms.

Question: What is the difference between clockwise and anti-clockwise moments?

Answer: Clockwise moments cause rotation in the clockwise direction, while anti-clockwise moments cause rotation in the anti-clockwise direction. The moment is classified based on the direction of rotation.

Question: What are the sources of greenhouse gas emissions in agriculture?

Answer: Sources of greenhouse gas emissions in agriculture include enteric fermentation in livestock, rice paddies, the use of synthetic fertilizers, and the burning of agricultural residues.

Question: How does the frequency of electromagnetic waves vary across the spectrum?

Answer: The frequency of electromagnetic waves increases from radio waves to gamma rays, with radio waves having the lowest frequency and gamma rays having the highest.

Question: What are the standards of binomial nomenclature?

Answer: The standards include using Latin or Greek for names, capitalizing the first letter of the generic name, underlining handwritten names, and italicizing printed names.

Question: How do transition metals differ from alkali metals in terms of properties?

Answer: Transition metals have higher melting points, higher densities, and greater hardness compared to alkali metals.

Question: What are the vertical columns in the Periodic Table called?

Answer: The vertical columns in the Periodic Table are called groups.

Question: What is cellular respiration?

Answer: Cellular respiration is the process by which stored food is transformed into energy inside the cells through a series of biochemical reactions.

Question: How do ligaments and tendons contribute to joint stability and movement?

Answer: Ligaments connect bones and stabilize joints, while tendons connect muscles to bones, enabling movement.

Question: Explain the function of a transistor in electronic circuits.

Answer: A transistor functions as a switch or amplifier in electronic circuits by controlling the flow of current between its terminals using a small input current or voltage.

Question: What is the role of catalysts in biological systems?

Answer: Catalysts, often enzymes, accelerate biochemical reactions, ensuring efficient metabolic processes in living organisms.

Question: How does photosynthesis demonstrate an endothermic process?

Answer: It absorbs solar energy to convert carbon dioxide and water into glucose and oxygen.

Question: What is the atomic number of helium?

Answer: The atomic number of helium is 2.

Question: What are the changes that occur in the female reproductive system during puberty?

Answer: Changes in the female reproductive system during puberty include the growth of pubertal hair, widened pubic region, growth of mammary glands, increased body fat, and the start of the menstrual cycle.

Question: What is the resultant force if one child pushes an object with 5 N and another child pulls it with 7 N in the same direction?

Answer: The resultant force is 12 N in the same direction.

Question: What is the kinetic energy of a 1 kg object moving at 10 m/s?

Answer: The kinetic energy is 50 Joules (J).

Question: What is the role of the cathode in electroplating?

Answer: The cathode is the object to be plated, where metal ions are reduced and deposited as a thin metallic layer, providing the desired coating and enhancing the object's properties.

Question: What is the principle behind sonar technology?

Answer: Sonar technology uses sound waves to detect objects underwater by emitting sound pulses and measuring their reflection

Question: How did Mendel's experiments contribute to our understanding of dominant and recessive traits?

Answer: Mendel's experiments showed that dominant traits mask recessive traits in the F1 generation but that recessive traits reappear in the F2 generation, demonstrating the principles of dominance and recessiveness.

Question: Define power in physics.

Answer: Power is the amount of work done in a unit time or the rate of doing work.

Question: What are the deficiency symptoms of sulphur in plants?

Answer: Deficiency symptoms of sulphur in plants include chlorosis in veins and areas between veins.

Question: How does the reduction of H<sup>+</sup> ions at the cathode during the electrolysis of acidulated water occur?

Answer: H<sup>+</sup> ions are reduced at the cathode by gaining electrons to form hydrogen gas:  $2\text{H}^+ (\text{aq}) + 2\text{e}^- \rightarrow \text{H}_2 (\text{g})$ .

Question: How does the design of an electrochemical cell impact its performance?

Answer: The design of an electrochemical cell impacts its performance by influencing factors like electrode configuration, electrolyte composition, ion transport, and heat management. Optimal design ensures efficient reactions, high power output, and long cell life.

Question: How does the myelin sheath enhance the function of neurons?

Answer: The myelin sheath insulates axons, increasing the speed of impulse transmission along the neuron.

Question: What is the relationship between the force required to initiate rotation and the perpendicular distance from the axis of rotation?

Answer: The force required to initiate rotation decreases as the perpendicular distance from the axis of rotation increases, making it easier to rotate the object.

Question: How is hydrogen gas collected by downward displacement of water?

Answer: Hydrogen gas, less dense than water, is collected by displacing water in an inverted gas jar, a method known as downward displacement of water.

Question: How can individuals reduce their ecological footprint?

Answer: Individuals can reduce their ecological footprint by conserving energy, reducing waste, using sustainable transportation, consuming less meat, and supporting environmentally friendly products and practices.

Question: Describe the process of electrochemical water splitting and its significance.

Answer: Electrochemical water splitting involves the use of electricity to split water into hydrogen and oxygen gases. It is significant for producing clean hydrogen fuel and oxygen, providing a sustainable energy solution and reducing dependence on fossil fuels.

Question: How do bacteria contribute to the ecosystem?

Answer: Bacteria play essential roles in ecosystems by decomposing organic matter, fixing nitrogen, and participating in various biochemical cycles, thereby maintaining environmental balance.

Question: What is the role of lenses in cameras?

Answer: Camera lenses adjust their curvature and position to focus light on the film or sensor, capturing clear images.

Question: How does particle size influence the rate of reaction?

Answer: Smaller particle size increases the surface area, leading to more collision sites and a faster rate of reaction.

Question: What is the role of a printed circuit board (PCB) in electronic devices?

Answer: A printed circuit board (PCB) provides a platform for mounting electronic components and interconnecting them with conductive tracks, ensuring reliable and compact circuit assembly.

Question: How is the potential energy of an object affected by its height?

Answer: The potential energy of an object increases with its height, as it is directly proportional to the height.

Question: How does the process of secretion contribute to urine formation?

Answer: Secretion involves the transfer of waste products and excess ions from the blood into the nephron tubules, ensuring their removal in urine.

Question: How is the Kingdom Animalia divided?

Answer: The Kingdom Animalia is divided into invertebrates (without a vertebral column) and vertebrates (with a vertebral column).

Question: How do changes in atmospheric pressure influence the human body?

Answer: Changes in atmospheric pressure can affect the human body, causing discomfort in the ears and sinuses, and influencing conditions like altitude sickness.

Question: Why are solar cells considered a solution to the future power and energy crisis?

Answer: Solar cells are considered a solution to the future power and energy crisis because they operate with free solar radiation, do not emit harmful substances, and have a long lifetime.

Question: How does the speed of a rotating coil affect the generated voltage?

Answer: Faster rotation of the coil increases the rate of change of the magnetic field, generating higher voltage.

Question: What is the role of friction in daily activities?

Answer: Friction plays a crucial role in daily activities by providing the necessary grip and resistance for walking, driving, and holding objects. It prevents slipping and allows for controlled motion.

Question: Explain the purpose of a voltage stabilizer in power supplies.

Answer: A voltage stabilizer maintains a constant output voltage despite fluctuations in the input voltage, protecting sensitive electronic devices from damage.

Question: Describe an experiment to observe the magnetic effect of a current-carrying conductor, including the setup, procedure, and observations.

Answer: To observe the magnetic effect of a current-carrying conductor, an experiment can be conducted using simple apparatus such as a compass, a straight copper wire, batteries, connecting wires, and a switch. Setup: Place a compass on a table and align it along the north-south direction. Position a straight copper wire (AB) horizontally above the compass, also aligned along the north-south direction. Connect the wire to a battery and a switch using connecting wires. Procedure: Close the switch to allow current to flow through the copper wire AB. Observe the compass needle. The compass needle will deflect, indicating the presence of a magnetic field around the current-carrying conductor. Open the switch to stop the current flow. The compass needle will return to its original north-south alignment. Repeat the experiment by placing the compass above and below the wire to observe

the direction of the magnetic field. Observations: When the current flows through the wire, the compass needle deflects due to the magnetic field generated by the current. The direction of the deflection changes when the compass is placed above or below the wire, demonstrating the circular nature of the magnetic field around the conductor. Reversing the direction of the current changes the direction of the needle's deflection, confirming that the direction of the magnetic field depends on the direction of the current flow. This experiment clearly shows that a magnetic field is created around a conductor when an electric current flows through it, and the direction of this field depends on the direction of the current.

Question: Give examples of inherited characteristics in humans.

Answer: Examples include skin color, hair type, earlobe attachment, tongue folding ability, thumb position, and presence of dimples.

Question: How can thermal expansion be demonstrated using a metal ball and a ring?

Answer: Thermal expansion can be demonstrated by heating a metal ball that just passes through a ring. Upon heating, the ball expands and cannot pass through the ring. When cooled, the ball contracts and passes through the ring again.

Question: What are the physical properties of hydrogen gas?

Answer: Hydrogen gas is colorless, odorless, less dense than air, combustible, and slightly soluble in water.

Question: How is the chemical formula of potassium hydroxide written?

Answer: The chemical formula of potassium hydroxide is KOH, indicating one potassium ion and one hydroxide ion.

Question: What is the formula to calculate the pressure exerted by a liquid column?

Answer: The formula to calculate the pressure exerted by a liquid column is  $P = h\rho g$ , where  $h$  is the height of the column,  $\rho$  is the density of the liquid, and  $g$  is gravitational acceleration.

Question: What occurs during the proliferation phase of the uterine cycle?

Answer: During the proliferation phase, the uterine lining rebuilds under the influence of estrogen, forming a new cell layer and blood capillaries, typically lasting about ten days.

Question: Describe the mechanical process of digestion.

Answer: Mechanical digestion involves physically breaking down food into smaller pieces, such as chewing by teeth, to facilitate chemical digestion.

Question: Calculate the potential energy of a child weighing 35 kg climbing a staircase to a height of 4 m.

Answer: The potential energy is 1400 Joules (J).

Question: Define potential energy.

Answer: Potential energy is the energy stored in an object due to its position or shape.



Question: How is the Fahrenheit scale defined?

Answer: The Fahrenheit scale is defined by taking the melting point of ice as 32°F and the boiling point of water as 212°F, with the range between the two points divided into 180 divisions.

Question: How do plant cells differ from animal cells in terms of organelles?

Answer: Plant cells have a cell wall, chloroplasts, and a large central vacuole, while animal cells have centrioles and lysosomes, which are typically absent in plant cells.

Question: What is the electronic configuration of nitrogen?

Answer: The electronic configuration of nitrogen is 2, 5.

Question: How does steam distillation prevent the decomposition of essential oils?

Answer: By extracting oils at temperatures below their boiling points, preventing heat-induced degradation.

Question: How does the release of greenhouse gases from transportation contribute to climate change?

Answer: Transportation emissions release greenhouse gases such as carbon dioxide and methane into the atmosphere. They trap heat, increase global temperatures, and contribute to climate change.

Question: What are the principal changes in fetal development during the first three months?

Answer: During the first three months, the fetus takes human form, develops a large head, starts developing nails, and differentiates male and female sex organs.

Question: What are the two types of transistors based on their structure?

Answer: The two types of transistors based on their structure are npn and pnp transistors.

Question: Experimental determination of the heat change of the reaction between sodium hydroxide (NaOH) and hydrochloric acid (HCl) Materials required : - 50 cm<sup>3</sup> of 2 mol dm<sup>-3</sup> sodium hydroxide solution, 50 cm<sup>3</sup> of 2 mol dm<sup>-3</sup> hydrochloric acid solution, two 100 cm<sup>3</sup> beakers, a thermometer of range 0-100 °C, a polystyrene cup, a glass rod Method : - To two beakers, measure 50 cm<sup>3</sup> of the sodium hydroxide solution and 50 cm<sup>3</sup> of the hydrochloric acid solution separately using the measuring cylinder. With the thermometer, measure the initial temperatures of the two solutions. (After measuring the temperature of the solution of the base, wash the thermometer before measuring the temperature of the acid solution . Mix these two solutions in a polystyrene cup, stir with the glass rod and record the maximum temperature. What is the importance of stirring the mixture well in the Activity?

Answer: To keep the temperature uniform throughout the mixture.

Question: How does the addition of sulfuric acid to water affect the electrolysis process?

Answer: Adding sulfuric acid increases the concentration of H<sup>+</sup> ions, enhancing the conductivity of the solution and improving the efficiency and

speed of electrolysis.

Question: How does the release of carbon monoxide (CO) impact human health?

Answer: Carbon monoxide is a toxic gas that interferes with oxygen transport in the blood, causing headaches, dizziness, and at high levels, can be fatal. It poses significant health risks, particularly in enclosed spaces.

Question: What are the three main types of musical instruments?

Answer: The three main types are string instruments, percussion instruments, and wind instruments.

Question: How does the release of chlorofluorocarbons (CFCs) affect the ozone layer?

Answer: The release of chlorofluorocarbons (CFCs) affects the ozone layer by breaking down ozone molecules, leading to ozone depletion and the formation of ozone holes, which allow harmful UV radiation to reach the Earth's surface.

Question: How is carbon dioxide collected by upward displacement of air?

Answer: Carbon dioxide, denser than air, is collected by allowing it to displace air upwards in an inverted gas jar, a method known as upward displacement of air.

Question: What happens to the induced current when the coil in a dynamo is vertical?

Answer: When the coil is vertical, the induced current becomes zero as the conductors do not intersect the magnetic field lines.

Question: What is the principle behind the operation of a bicycle dynamo?

Answer: The principle behind a bicycle dynamo is electromagnetic induction, where mechanical rotation induces an electromotive force in the coil.

Question: What is cellular respiration, and why is it considered an exothermic reaction?

Answer: Cellular respiration is the process of breaking down glucose to produce energy, releasing heat in the process.

Question: Why do ionic compounds have high melting and boiling points?

Answer: Ionic compounds have high melting and boiling points because the strong electrostatic forces between oppositely charged ions require a lot of energy to break.

Question: What is the importance of wave motion in energy transmission?

Answer: Wave motion allows energy to be transmitted from one point to another without transferring the substance of the medium.

Question: How do sound waves travel through air?

Answer: Sound waves travel through air as longitudinal waves, with particles oscillating back and forth in the direction of wave propagation.

Question: How does the specific heat capacity of a substance affect its temperature change?

Answer: Substances with higher specific heat capacities experience smaller temperature changes when the same amount of heat is supplied compared to substances with lower specific heat capacities.

Question: What happens to the light rays coming parallel to the principal axis of a convex lens?

Answer: Light rays parallel to the principal axis bend towards the principal axis after passing through the lens, converging at the focal point.

Question: What is the molar mass of glucose ( $C_6H_{12}O_6$ )?

Answer: The molar mass of glucose is 180 grams per mole, calculated as  $6 \times 12$  for carbon,  $12 \times 1$  for hydrogen, and  $6 \times 16$  for oxygen.

Question: What are the causes of deforestation?

Answer: Causes of deforestation include logging, agricultural expansion, urbanization, and infrastructure development.

Question: What is the Paris Agreement?

Answer: The Paris Agreement is an international treaty aimed at limiting global warming to well below  $2^\circ\text{C}$  above pre-industrial levels and pursuing efforts to limit it to  $1.5^\circ\text{C}$ .

Question: How does the expansion of gases demonstrate the concept of thermal expansion?

Answer: In an experiment with a plastic bottle and a balloon, placing the bottle in warm water causes the air inside to expand, inflating the balloon. When cooled, the air contracts, deflating the balloon, showing the expansion and contraction of gases with temperature changes.

Question: What is the valency of phosphorus?

Answer: The valency of phosphorus is 5 and 3.

Question: How are algae classified based on their color?

Answer: Algae are classified into different groups based on their color, such as green, brown, and red algae.

Question: How is Fleming's left-hand rule used to find the direction of the force on a conductor?

Answer: According to Fleming's left-hand rule, if the thumb, index finger, and middle finger of the left hand are oriented perpendicular to one another, with the middle finger pointing in the direction of current flow and the index finger pointing in the direction of the magnetic field, the thumb points in the direction of the force.

Question: How do you apply a couple of forces to rotate a rod without causing linear motion?

Answer: Apply a couple of forces by exerting equal and opposite forces along the same plane at different points on the rod, resulting in rotation around a point between the forces without causing linear motion.

Question: How is static electricity generated?

Answer: Static electricity is generated by rubbing materials together, which transfers electrons between the surfaces, creating an imbalance of charges.

Question: What is the resultant force if one child pushes an object with 5 N and another child pulls it with 7 N in the same direction?

Answer: The resultant force is 12 N in the same direction.

Question: What is vegetative propagation by stem cuttings?

Answer: Vegetative propagation by stem cuttings involves planting stem cuttings from a mother plant to produce new plants, commonly used for plants like roses and bougainvillea.

Question: What is the purpose of the axle in an alternating current dynamo?

Answer: The axle rotates the coil within the magnetic field, enabling continuous induction of electromotive force and generation of alternating current.

Question: What is the significance of solubility in biological systems?

Answer: Solubility is crucial in biological systems for nutrient absorption, drug delivery, and metabolic processes, ensuring that necessary compounds are available in soluble form.

Question: What is the atomic number of argon?

Answer: The atomic number of argon is 18.

Question: What is the role of the plumule in seed germination?

Answer: The plumule is the part of the seedling that develops into the shoot system, including the stem and leaves.

Question: What hormones are secreted by the pancreas, and what are their functions?

Answer: The pancreas secretes insulin, which converts glucose into glycogen, and glucagon, which converts glycogen into glucose.

Question: What is the role of coke in the blast furnace?

Answer: Coke burns in air to form carbon dioxide, which reacts with more coke to produce carbon monoxide. Carbon monoxide then reduces iron ore to liquid iron.

Question: How is atmospheric pressure measured using a mercury barometer?

Answer: Atmospheric pressure is measured using a mercury barometer by the height of the mercury column in a glass tube. The height of the column represents the atmospheric pressure exerted on the mercury in the container.

Question: How does the diaphragm contribute to breathing?

Answer: The diaphragm contracts and flattens during inhalation, increasing thoracic cavity volume and drawing air into the lungs; it relaxes during exhalation, decreasing volume and expelling air.

Question: How does increasing the mass of an object affect its momentum for a constant velocity?

Answer: Increasing the mass of an object increases its momentum for a constant velocity, as momentum is the product of mass and velocity.

Question: How does a moving coil microphone generate electrical signals?

Answer: A moving coil microphone generates electrical signals by vibrating a coil within a magnetic field, inducing an electromotive force corresponding to sound waves.

Question: What are the key features of fish (Pisces)?

Answer: Fish have a bony or cartilaginous endoskeleton, streamlined bodies, scales, fins for swimming, a lateral line system for detecting vibrations, a two-chambered heart, gills for respiration, and are cold-blooded.

Question: How do you determine the number of moles in a given mass of a compound?

Answer: The number of moles in a given mass of a compound is determined by dividing the mass by the molar mass of the compound,  $n = m/M$ .

Question: How does the induced current direction change during coil rotation in a dynamo?

Answer: The induced current direction changes periodically, resulting in an alternating current as the coil rotates within the magnetic field.

Question: How does the electrochemical reduction of nitrogen to ammonia contribute to sustainable agriculture?

Answer: The electrochemical reduction of nitrogen to ammonia provides a sustainable alternative to the Haber-Bosch process by using renewable electricity to produce ammonia, reducing greenhouse gas emissions and energy consumption associated with conventional ammonia production.

Question: How do Punnett squares help predict genetic outcomes?

Answer: Punnett squares visualize the possible combinations of alleles from two parents, allowing predictions of the genotypes and phenotypes of offspring.

Question: Calculate the kinetic energy of a 4 kg object moving at 10 m/s.

Answer: The kinetic energy is 200 Joules (J).

Question: What are the characteristics of organisms in the Domain Archaea?

Answer: Organisms in the Domain Archaea are prokaryotes that can live in extreme environments and are not sensitive to most antibiotics.

Question: Describe the process of cytokinesis in cell division.

Answer: Cytokinesis is the final stage of cell division, where the cytoplasm divides, resulting in two separate daughter cells, each with its own nucleus and organelles.

Question: How does the power consumption of LED televisions compare to that of older CRT televisions?

Answer: LED televisions consume significantly less power than older CRT televisions, making them more energy-efficient and cost-effective.

Question: What happens if you push a table and it does not move?

Answer: If you push a table and it does not move, you need to increase the force until it overcomes the resistive force of friction.

Question: What is the significance of the Human Genome Project?

Answer: The Human Genome Project aimed to map the entire human genome, identifying all genes and their functions. This project has provided valuable insights into genetic disorders, human evolution, and personalized medicine.

Question: Describe the reactivity of metals with air, providing examples.

Answer: Metals react with air at different rates. For example, sodium reacts quickly and forms sodium oxide, while magnesium reacts less readily, forming magnesium oxide upon heating. Iron rusts over time, forming iron oxide, while metals like gold and platinum do not oxidize easily.

Question: What is the atomic number of boron?

Answer: The atomic number of boron is 5.

Question: How is ground layering performed?

Answer: Ground layering involves making a small cut on the underside of a branch close to the ground, bending and burying the branch in the soil, and separating it from the mother plant once roots develop.

Question: How is average speed different from instantaneous speed?

Answer: Average speed is the total distance traveled divided by the total time taken, while instantaneous speed is the speed of an object at a particular instant.

Question: What is polyvinyl chloride (PVC), and how is it formed?

Answer: Polyvinyl chloride (PVC) is formed by the polymerization of chloroethene, resulting in long chains of repeating units of  $-\text{CH}_2-\text{CHCl}-$ .

Question: How is the electrolysis of copper sulfate solution used in electroplating?

Answer: Electroplating with copper sulfate solution involves using a copper anode and an object to be plated as the cathode. Copper ions are reduced and deposited on the object.

Question: How does body temperature change during the menstrual cycle?

Answer: Body temperature slightly increases during the secretory phase of the menstrual cycle due to the influence of progesterone.

Question: What is the relationship between force, mass, and acceleration?

Answer: The relationship is defined by Newton's second law,  $F=ma$ , where force is the product of mass and acceleration. For a constant mass, force and acceleration are directly proportional.

Question: How do microtubules support intracellular transport?

Answer: Microtubules serve as tracks for motor proteins like kinesin and dynein, facilitating the transport of vesicles, organelles, and other cargo within the cell.

Question: What is the chemical formula for calcium sulfate?

Answer: The chemical formula for calcium sulfate is  $\text{CaSO}_4$ .

Question: What is upthrust and how is it experienced by objects in a liquid?

Answer: Upthrust is the upward force exerted by a liquid on an object immersed in it. It is experienced as a reduction in the apparent weight of the object due to the liquid's buoyant force.

Question: What are lysosomes, and what is their role in the cell?

Answer: Lysosomes are membrane-bound organelles containing digestive enzymes that break down waste materials, cellular debris, and foreign invaders like bacteria, aiding in cellular cleanup and recycling.

Question: How do dominant and recessive traits affect the appearance of offspring?

Answer: Dominant traits are expressed when present, while recessive traits are only expressed when both alleles are recessive, affecting the appearance of offspring based on their genotypes.

Question: What role do environmental policies play in mitigating climate change?

Answer: Environmental policies regulate greenhouse gas emissions, promote renewable energy, encourage energy efficiency, and support conservation efforts. They are essential for addressing climate change and protecting the environment.

Question: How do geneticists study the genetic basis of complex diseases?

Answer: Geneticists study the genetic basis of complex diseases by identifying genetic variants associated with disease risk, conducting genome-wide association studies, and investigating gene-environment interactions that contribute to disease development.

Question: How do ultrasound waves help in the examination of a fetus during pregnancy?

Answer: Ultrasound waves create images of the fetus, allowing healthcare providers to monitor the fetus's development and health.

Question: Describe the mechanical process of digestion.

Answer: Mechanical digestion involves physically breaking down food into smaller pieces, such as chewing by teeth, to facilitate chemical digestion.

Question: How does the body maintain electrolyte balance?

Answer: The body maintains electrolyte balance through the kidneys' regulation of sodium, potassium, calcium, and other ions in the blood.

Question: How does the body regulate the volume and concentration of urine?

Answer: The body regulates urine volume and concentration through hormonal control, primarily by antidiuretic hormone (ADH) and aldosterone, affecting water and sodium reabsorption.

Question: Calculate the number of molecules in 0.5 moles of carbon dioxide (CO<sub>2</sub>).

Answer: The number of molecules in 0.5 moles of carbon dioxide is  $3.011 \times 10^{23}$ , calculated as  $0.5 \times 6.022 \times 10^{23}$ .

Question: What is climate change?

Answer: Climate change refers to long-term changes in temperature, precipitation, and other atmospheric conditions on Earth, primarily caused by human activities.

Question: How does the speed of motion affect electromagnetic induction?

Answer: Faster motion of the magnet or coil increases the rate of change of the magnetic field, inducing a larger electromotive force.

Question: What is the significance of the temperature change in a chemical reaction?

Answer: It indicates the amount of heat evolved or absorbed, helping classify the reaction as exothermic or endothermic.

Question: How does the electrolysis of acidulated water produce hydrogen gas?

Answer: Hydrogen gas is produced at the cathode by the reduction of H<sup>+</sup> ions:  $2\text{H}^+ (\text{aq}) + 2\text{e}^- \rightarrow \text{H}_2 (\text{g})$ .

Question: What is the role of carbon dioxide in photosynthesis?

Answer: Carbon dioxide acts as a raw material for photosynthesis, enabling plants to produce food and supporting the food chain for all living beings.

Question: What is the principle behind the operation of a pitot tube in measuring fluid flow?

Answer: A pitot tube measures fluid flow by comparing the static and dynamic pressures of the fluid, with the difference indicating the flow velocity.

Question: How does the sharing of electrons lead to the formation of covalent bonds in heteroatomic molecules?

Answer: The sharing of electrons between atoms of different elements in heteroatomic molecules allows them to achieve stable electronic configurations, forming covalent bonds.

Question: What is the observation when a pencil is placed inside a glass of water?

Answer: The pencil appears to be bent due to the refraction of light.

Question: What is the significance of a triple bond in a nitrogen (N<sub>2</sub>) molecule?

Answer: A triple bond in a nitrogen (N<sub>2</sub>) molecule involves the sharing of three pairs of electrons between two nitrogen atoms, resulting in a very strong and stable bond.



Question: What are some common uses of electromagnets in everyday life?  
Answer: Common uses include electric motors, magnetic locks, relays, and magnetic separation equipment.

Question: How do geneticists study the inheritance of behavioral traits?  
Answer: Geneticists study the inheritance of behavioral traits by analyzing genetic differences between individuals, using animal models, and conducting twin and family studies to understand the heritability of behaviors.

Question: How does climate change affect weather patterns?  
Answer: Climate change leads to more frequent and severe weather events such as hurricanes, droughts, heatwaves, and floods. It disrupts weather patterns and increases the intensity of natural disasters.

Question: Why is it important to measure the initial and final temperatures accurately in heat change experiments?  
Answer: Accurate temperature measurements are crucial for calculating the correct amount of heat change in the reaction.

Question: Describe the difference between a bipolar junction transistor (BJT) and a field-effect transistor (FET).  
Answer: A BJT controls current using both electron and hole charge carriers, while a FET controls current using only one type of charge carrier (electrons or holes) and relies on an electric field to modulate the conductivity of a channel.

Question: What are the benefits of sustainable energy use in architecture?  
Answer: Sustainable energy use in architecture includes maintaining good indoor air circulation, using natural sunlight for heating, and reducing electrical energy consumption for air conditioning. These practices lower operational costs and minimize environmental impact.

Question: What are the main features of the Kingdom Animalia?  
Answer: The Kingdom Animalia includes multicellular animals that are unable to produce their own food and are heterotrophic.

Question: Explain the concept of overpotential in electrolysis.  
Answer: Overpotential is the extra voltage required beyond the theoretical voltage to drive a non-spontaneous electrochemical reaction. It accounts for factors like electrode surface properties and reaction kinetics.

Question: How does electromagnetic induction enable the operation of a moving coil microphone?  
Answer: Electromagnetic induction enables the microphone to convert sound waves into electrical signals by inducing a current in the vibrating coil.

Question: Describe the role of the pancreas in digestion.  
Answer: The pancreas secretes digestive enzymes into the duodenum through the pancreatic duct, aiding in the breakdown of proteins, starch, and lipids.

Question: What is albinism, and how is it inherited?

Answer: Albinism is a genetic disorder caused by a mutation in the gene responsible for melanin production. It results in a lack of pigmentation in the skin, hair, and eyes. It is inherited in an autosomal recessive manner.

Question: What are the principle changes in fetal development during the seventh month?

Answer: During the seventh month, the eyelids open, and the skin becomes wrinkled.

Question: What is the relationship between heat capacity and mass?

Answer: Heat capacity is directly proportional to mass. Larger masses have higher heat capacities, meaning they require more heat to achieve the same temperature change as smaller masses of the same substance.

Question: How is the speed of sound related to temperature?

Answer: The speed of sound increases with temperature; for example, it is about 350 m/s in air at 30°C compared to 330 m/s at 0°C.

Question: What did Mendel conclude from his monohybrid cross experiments?

Answer: Mendel concluded that certain traits are dominant and others are recessive. The recessive traits may not appear in the F1 generation but reappear in the F2 generation.

Question: What is the reaction between acids and bases?

Answer: Acids react with bases to form salts and water, a process known as neutralization.

Question: What is the atomic number of beryllium?

Answer: The atomic number of beryllium is 4.

Question: How do acids and bases affect the color of indicators?

Answer: Acids and bases cause indicators to change color, with specific colors corresponding to different pH levels, helping to identify the nature of a solution.

Question: How are glucose and other monosaccharides absorbed in the small intestine?

Answer: Glucose, galactose, and fructose are absorbed into the blood capillaries of the villi and transported to the liver and other body parts.

Question: How does a moving coil microphone generate electrical signals?

Answer: A moving coil microphone generates electrical signals by vibrating a coil within a magnetic field, inducing an electromotive force corresponding to sound waves.

Question: How are images formed by convex lenses affected by object distance?

Answer: The image's position, size, and nature (real or virtual) change depending on whether the object is within the focal length, at the focal point, or beyond twice the focal length.

Question: What is energy in physics?

Answer: Energy is the ability to do work, measured in Joules (J).

Question: What is the role of platelets in blood tissue?

Answer: Platelets are involved in blood clotting, helping to stop bleeding and initiate the healing process after injury.

Question: How is the chemical formula of ammonia represented?

Answer: The chemical formula of ammonia is  $\text{NH}_3$ , indicating one nitrogen atom and three hydrogen atoms.

Question: Describe the reactivity of potassium with water.

Answer: Potassium reacts very vigorously with water, producing potassium hydroxide and hydrogen gas:  $2\text{K} + 2\text{H}_2\text{O} \rightarrow 2\text{KOH} + \text{H}_2$ .

Question: What is the chemical formula for ammonium nitrate?

Answer: The chemical formula for ammonium nitrate is  $\text{NH}_4\text{NO}_3$ .

Question: What is the total resistance of a circuit with a combination of series and parallel resistors?

Answer: Calculate the equivalent resistance of parallel groups first, then add the series resistances to find the total resistance.

Question: How does the diaphragm movement in a microphone relate to sound waves?

Answer: The diaphragm moves in response to sound waves, causing the attached coil to move within a magnetic field and generate an alternating current corresponding to the sound.

Question: What is the significance of secondary sexual characteristics?

Answer: Secondary sexual characteristics differentiate males and females and indicate sexual maturity, preparing the body for reproduction.

Question: How do you determine the resistance value of a resistor with color bands red, violet, brown, and gold?

Answer: The first two bands (red and violet) represent the digits 2 and 7. The third band (brown) represents the multiplier  $10^1$ . The fourth band (gold) represents the tolerance  $\pm 5\%$ . The resistance value is  $27 \times 10^1 = 270\Omega$ .

Question: What is the role of environmental policies in protecting ecosystems?

Answer: Environmental policies protect ecosystems by regulating activities that impact the environment, promoting conservation, and ensuring sustainable use of natural resources.

Question: What is the relationship between the focal length and the radius of curvature in spherical mirrors?

Answer: The focal length is half of the radius of curvature, with the radius of curvature being twice the focal length.

Question: Explain the concept of environmental equilibrium and its significance.

Answer: Environmental equilibrium, also known as ecological balance, refers to the stable and balanced relationship between organisms and their physical environment. This equilibrium is crucial for the survival of organisms as it ensures that the interactions between the biotic (living) and abiotic (non-living) components are harmonious. Components such as soil, water, air, temperature, rainfall, humidity, and sunlight play vital roles in maintaining this balance. Environmental equilibrium is significant because any small change in the environment can disrupt this balance, affecting the existence of organisms. The environment has a natural ability to restore its conditions, but modern human activities, such as deforestation, pollution, and urbanization, increasingly challenge this equilibrium. The disruption can lead to adverse effects like climate change, loss of biodiversity, and degradation of ecosystems.

Question: How is the depth of the sea measured using ultrasound waves?

Answer: Ultrasound pulses are emitted by a ship's SONAR system, and the time taken for the pulses to return after reflecting from the sea bottom is used to calculate the depth.

Question: How are components with lower boiling points separated in a fractionating tower?

Answer: They are separated at the upper levels of the tower, where the temperature is lower.

Question: How does the magnetic field in a transformer vary?

Answer: The magnetic field varies alternately due to the alternating current in the primary coil, inducing an alternating voltage in the secondary coil.

Question: What is the function of the calyx?

Answer: The calyx, comprised of sepals, protects the flower parts when the flower is in the bud stage.

Question: How does temperature affect the efficiency of an electrochemical cell?

Answer: Temperature affects the efficiency of an electrochemical cell by influencing reaction rates and ion mobility. Higher temperatures generally increase reaction rates but can also increase side reactions and decrease cell lifespan.

Question: How does the boiling point difference affect the efficiency of fractional distillation?

Answer: A larger boiling point difference makes it easier to separate the components, while a smaller difference requires more precise control.

Question: How does human activity affect ecological balance?

Answer: Human activity, including increased population and industrialization, disrupts ecological balance by causing environmental pollution, habitat destruction, and depletion of natural resources.

Question: What are some examples of polysaccharides?

Answer: Examples of polysaccharides include cellulose, starch, and glycogen.

Question: What is the significance of the turning effect of a force in practical applications?

Answer: The turning effect of a force is significant in practical applications such as opening doors, using wrenches, and rotating objects, where the ease of rotation depends on the applied moment.

Question: How does the release of chlorofluorocarbons (CFCs) affect the ozone layer?

Answer: The release of chlorofluorocarbons (CFCs) affects the ozone layer by breaking down ozone molecules, leading to ozone depletion and the formation of ozone holes, which allow harmful UV radiation to reach the Earth's surface.

Question: What is the role of lenses in telescopes?

Answer: Lenses in telescopes gather and focus light from distant objects, enabling detailed observation of celestial bodies.

Question: How do you determine the direction of the resultant force for two collinear forces acting in opposite directions?

Answer: The direction of the resultant force is in the direction of the larger force.

Question: How does a McLeod gauge measure low pressures in gases?

Answer: A McLeod gauge measures low pressures by compressing a known volume of gas, allowing for precise pressure measurement based on the change in volume.

Question: What are the ethical considerations of genetic engineering?

Answer: Ethical considerations include concerns about the safety of genetically modified organisms, potential environmental impacts, and the moral implications of altering the genetic makeup of living organisms.

Question: What is the relationship between surface area and reaction rate?

Answer: A larger surface area increases the rate of reaction by providing more sites for reactant collisions.

Question: What is the function of SONAR in ships?

Answer: SONAR is used to measure the depth of the sea by emitting ultrasound pulses and measuring the time taken for the pulses to return after reflecting from the sea bottom.

Question: How does a membrane electrode assembly (MEA) function in a fuel cell?

Answer: A membrane electrode assembly (MEA) in a fuel cell consists of a proton-conducting membrane sandwiched between two electrodes (anode and cathode). It facilitates the electrochemical reactions, allowing protons to pass through the membrane while electrons flow through an external circuit, generating electricity.

Question: How do invasive species impact ecosystems?

Answer: Invasive species impact ecosystems by outcompeting native species for resources, altering habitats, and disrupting ecological processes.

Question: Calculate the amount of oxygen in moles in 32 grams of oxygen (O<sub>2</sub>)?

Answer: The amount of oxygen in 32 grams is 1 mole, calculated as  $32/32 = 1$  mole.

Question: How does the induced voltage waveform in an alternating current dynamo look?

Answer: The induced voltage waveform in an alternating current dynamo is sinusoidal, alternating between positive and negative values.

Question: How does a thermistor control temperature in electronic devices?

Answer: A thermistor controls temperature by changing its resistance with temperature variations, allowing electronic devices to monitor and adjust their thermal conditions for optimal performance.

Question: What is the significance of Mendel's laws of inheritance?

Answer: Mendel's laws of inheritance, including the law of segregation and the law of independent assortment, provide the foundational principles for understanding how traits are inherited and predict the outcomes of genetic crosses.

Question: How do non-flowering seedless plants differ from flowering plants?

Answer: Non-flowering seedless plants do not produce flowers or seeds, while flowering plants produce flowers and have seeds covered by a fruit.

Question: What happens when the concentration of hydrochloric acid increases in the reaction with magnesium ribbon?

Answer: The speed of fizzing and gas bubble evolution increases, indicating a higher rate of reaction.

Question: What is the relationship between temperature and kinetic energy in particles?

Answer: Temperature is directly related to the kinetic energy of particles; higher temperatures correspond to higher kinetic energy and more vigorous particle motion.

Question: How do lenses help in vision correction for farsightedness?

Answer: Lenses for farsightedness use convex lenses to converge light rays before they enter the eye, aiding in clear vision of close objects.

Question: What is the reaction between calcium and hydrochloric acid?

Answer: Calcium reacts with hydrochloric acid to form calcium chloride and hydrogen gas:  $\text{Ca} + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2$ .

Question: How does the structure of the small intestine aid in nutrient absorption?

Answer: The small intestine's long length, circular folds, villi, and microvilli increase the surface area for efficient nutrient absorption.

Question: What is the significance of the electronic configuration in determining the reactivity of an element?

Answer: The electronic configuration determines the stability of an element's valence shell, influencing its tendency to gain, lose, or share electrons, and thus its chemical reactivity.

Question: Why is the volume of gas liberated at the cathode greater than at the anode during the electrolysis of acidulated water?

Answer: The volume of hydrogen gas produced at the cathode is greater because the molar ratio of hydrogen to oxygen in water is 2:1.

Question: How can the composition of mixtures like weedicides and insecticides be accurately prepared?

Answer: They must be prepared in correct compositions as prescribed, ensuring the right proportions for effectiveness.

Question: What is the potential energy of a 2 kg object at a height of 10 m?

Answer: The potential energy is 200 Joules (J).

Question: How do you calculate the moment of a force applied to a stick pivoted at one end?

Answer: Calculate the moment by multiplying the applied force by the perpendicular distance from the pivot point to the line of action of the force (Moment = Force  $\times$  Perpendicular distance).

Question: Describe the process of electrochemical etching and its applications.

Answer: Electrochemical etching involves the controlled removal of material from a workpiece using an anodic dissolution process. It is used for creating intricate patterns, microfabrication, and surface texturing in industries like electronics and aerospace.

Question: What is the function of a proximity sensor in automation?

Answer: A proximity sensor detects the presence of objects by emitting an electromagnetic field or light beam and sensing changes when an object enters the field or reflects the light.

Question: How does nicotine in cigarette smoke affect the heart?

Answer: Nicotine temporarily increases the heart rate.

Question: Define static electricity.

Answer: Static electricity consists of charges that are deposited on the surfaces of insulators and do not flow.

Question: Describe the operation of a low-pass filter in signal processing.

Answer: A low-pass filter allows low-frequency signals to pass through while attenuating high-frequency signals, used to remove noise and smooth signals in signal processing.

Question: What is the valency of silicon?

Answer: The valency of silicon is 4.

Question: How is the human reproductive process regulated?

Answer: The human reproductive process is regulated by hormones such as FSH, LH, testosterone, estrogen, and progesterone, secreted by various endocrine glands.

Question: What is the formula to calculate the gradient of a graph?

Answer:  $\text{Gradient} = (\text{Change in y-coordinates}) / (\text{Change in x-coordinates})$ .

Question: What is the chemical formula for potassium fluoride?

Answer: The chemical formula for potassium fluoride is KF.

Question: Explain the construction and operation of a DC motor, including the role of each component.

Answer: A DC motor converts electrical energy into mechanical energy using the principles of electromagnetism. The main components of a DC motor include the armature, magnetic poles, commutator, and brushes.

Construction: Armature: The armature is a coil of wire wrapped around a core, typically made of iron or steel, to enhance the magnetic effects. The armature is placed between the magnetic poles. Magnetic Poles: These are typically permanent magnets or electromagnets that create a magnetic field in which the armature operates. Commutator: The commutator consists of two split rings connected to the ends of the coil. It rotates with the armature and reverses the direction of current flow in the coil each half turn. Brushes: The brushes are made of conductive material that maintains electrical contact with the rotating commutator, allowing current to flow into the armature. Operation: When a current flows through the motor, it enters the split ring X through brush P and flows through the wire loop ABCD, exiting through split ring Y and brush Q. The current passing through the loop creates a magnetic field around the coil. According to Fleming's left-hand rule, the force on segment AB acts downwards, while the force on segment CD acts upwards, creating a couple that rotates the armature clockwise. When the coil and the split rings rotate 180 degrees, the brushes switch contact with the split rings, reversing the current direction in the coil. This continuous switching ensures that the forces on AB and CD maintain the same rotational direction, resulting in continuous clockwise rotation of the armature. The DC motor effectively converts electrical energy into mechanical energy through the interaction of magnetic fields and current-carrying conductors.

Question: How is blood pressure measured, and what are normal values?

Answer: Blood pressure is measured in millimeters of mercury (mmHg) using a sphygmomanometer. Normal systolic pressure is 110-120 mmHg, and diastolic pressure is 70-80 mmHg.

Question: What is the impact of changing current direction on a compass near a conductor?

Answer: Changing the current direction reverses the compass needle's deflection, indicating the change in the magnetic field direction.

Question: What is the purpose of a load resistor in electronic circuits?

Answer: A load resistor is used to simulate a load in electronic circuits, providing a known resistance for testing and measuring circuit performance.



Question: What structures are adapted for sexual reproduction in animals?  
Answer: In animals, the male and female reproductive systems are adapted for sexual reproduction.

Question: What is the significance of power factor correction in electrical systems?

Answer: Power factor correction improves the efficiency of electrical systems by reducing reactive power, minimizing energy losses, and lowering utility bills.

Question: What does Snell's law of refraction state?

Answer: Snell's law states that the ratio of the sine of the angle of incidence to the sine of the angle of refraction is a constant for two given media.

Question: What is the significance of Mendel's work in understanding genetic inheritance?

Answer: Mendel's work provided the first scientific evidence of how traits are inherited, leading to the development of the field of genetics and our understanding of hereditary traits.

Question: How do geneticists study the inheritance of behavioral traits?

Answer: Geneticists study the inheritance of behavioral traits by analyzing genetic differences between individuals, using animal models, and conducting twin and family studies to understand the heritability of behaviors.

Question: What is photochemical smog, and what causes it?

Answer: Photochemical smog is a yellow-colored mist formed due to the reaction between sunlight and chemicals in vehicle emissions. It causes eye irritation, vision impairment, and respiratory disorders.

Question: What are chemical bonds?

Answer: Chemical bonds are attractive forces or bindings among atoms or ions resulting from the rearrangement of electrons in the valence shells to stabilize the atoms.

Question: What are the deficiency symptoms of phosphorous in plants?

Answer: Deficiency symptoms of phosphorous in plants include retarded growth of roots and red and purple patches on leaves.

Question: What are groups in the Periodic Table?

Answer: Groups are the vertical columns in the Periodic Table.

Question: How is the chemical formula of potassium hydroxide written?

Answer: The chemical formula of potassium hydroxide is KOH, indicating one potassium ion and one hydroxide ion.

Question: What is an example calculation involving a transformer?

Answer: For a transformer with 500 turns in the primary coil and 5000 turns in the secondary coil, and an input voltage of 12V, the output voltage can be calculated as  $V_s = V_p * (N_s/N_p) = 12V * (5000/500) = 120V$ . If a 2A

current flows through the primary, the secondary current can be calculated as  $I_s = I_p * (V_p/V_s) = 2A * (12V/120V) = 0.2A$ .

Question: What factors determine the magnitude of induced voltage in a coil?

Answer: Factors determining the magnitude of induced voltage include the number of coil turns, magnetic field strength, and speed of motion.

Question: Describe the structure of ethane.

Answer: Ethane has a molecular formula of  $C_2H_6$ , with a structure where two carbon atoms are bonded to each other and each carbon atom is bonded to three hydrogen atoms.

Question: What factors determine the magnitude of induced voltage in a coil?

Answer: Factors determining the magnitude of induced voltage include the number of coil turns, magnetic field strength, and speed of motion.

Question: What is the significance of the cell wall in protecting plant cells?

Answer: The cell wall provides structural support, protects against mechanical damage, pathogens, and osmotic stress, and maintains cell shape in plant cells.

Question: What is the impact of solubility on the crystallization process?

Answer: Solubility influences the crystallization process by determining the conditions under which solute particles come out of solution to form crystals.

Question: What determines the pitch of sound in percussion instruments?

Answer: The pitch depends on the area and tension of the vibrating membrane or metal plate.

Question: What is the correct path along which an impulse travels in a reflex arc? (1) motor neuron → sensory neuron → effector (2) motor neuron → spinal cord → sense organ (3) sensory neuron → spinal cord → motor neuron (4) receptor organ → motor neuron → sensory neuron

Answer: (3) sensory neuron → spinal cord → motor neuron

Question: How do you determine the molar mass of a compound?

Answer: The molar mass of a compound is determined by summing the molar masses of its constituent atoms, each multiplied by the number of times the atom appears in the formula.

Question: How do longitudinal waves propagate through a slinky?

Answer: Longitudinal waves propagate through a slinky by creating compressions and rarefactions as the slinky is pushed and pulled along its length.

Question: How does an aneroid barometer measure atmospheric pressure?

Answer: An aneroid barometer measures atmospheric pressure using a sealed, air-evacuated cavity with flexible walls. Changes in pressure cause the walls to flex, moving an indicator to show the pressure on a scale.

Question: What is the function of a rubber sucker and how does it adhere to surfaces?

Answer: A rubber sucker adheres to surfaces by removing most of the air between the sucker and the surface, creating a lower pressure inside the sucker than the atmospheric pressure outside, which presses the sucker onto the surface.

Question: What is a trophic level?

Answer: A trophic level is a specific level in a food chain, representing the position an organism occupies according to its mode of nutrition.

Question: How do atoms with low electronegativity form ionic bonds?

Answer: Atoms with low electronegativity tend to lose electrons easily and form ionic bonds by transferring electrons to atoms with high electronegativity, resulting in the formation of oppositely charged ions that attract each other.

Question: How does the design of an electrochemical cell impact its performance?

Answer: The design of an electrochemical cell impacts its performance by influencing factors like electrode configuration, electrolyte composition, ion transport, and heat management. Optimal design ensures efficient reactions, high power output, and long cell life.

Question: What is the role of a fractionating tower in crude oil refining?

Answer: The fractionating tower controls the temperature at different levels to separate hydrocarbons based on their boiling points.

Question: How do Punnett squares help geneticists visualize genetic crosses?

Answer: Punnett squares help geneticists visualize genetic crosses by showing all possible combinations of alleles from two parents, allowing predictions of genotypes and phenotypes in offspring.

Question: How do you determine the direction of rotation caused by a moment of force?

Answer: Determine the direction of rotation by observing whether the applied force causes clockwise or anti-clockwise rotation, classifying the moment accordingly.

Question: What can be observed in tomato and brinjal plants regarding inherited characteristics?

Answer: Tomato and brinjal plants exhibit different shapes of fruits, which are examples of inherited characteristics that vary within the species.

Question: What is the role of the plumule in seed germination?

Answer: The plumule is the part of the seedling that develops into the shoot system, including the stem and leaves.

Question: What is the significance of potassium in the human body?

Answer: Potassium is important for controlling the ionic balance of the fluid in the cell, heart and muscle activity, and transmission of nerve impulses.

Question: How is electrochemical impedance spectroscopy used to study electrochemical systems?

Answer: Electrochemical impedance spectroscopy (EIS) measures the impedance of an electrochemical system over a range of frequencies, providing information on reaction kinetics, charge transfer resistance, and diffusion processes, useful for characterizing batteries, fuel cells, and corrosion.

Question: How does mass affect the kinetic energy of an object?

Answer: Mass affects kinetic energy directly; increasing the mass increases the kinetic energy proportionally.

Question: What is the effect of thermal expansion on the design of railway tracks?

Answer: Thermal expansion affects the design of railway tracks by requiring expansion gaps to accommodate the tracks' length changes due to temperature variations, preventing deformation and ensuring safe operation.

Question: Describe the process of photosynthesis in chloroplasts.

Answer: Photosynthesis in chloroplasts involves capturing light energy with chlorophyll, converting carbon dioxide and water into glucose and oxygen, providing energy for the plant.

Question: What is the significance of Mendel's laws of inheritance?

Answer: Mendel's laws of inheritance, including the law of segregation and the law of independent assortment, provide the foundational principles for understanding how traits are inherited and predict the outcomes of genetic crosses.

Question: Calculate the velocity of a 500 g object with a kinetic energy of 9 J.

Answer: The velocity is 6 m/s.

Question: What changes occur in the fetus during the eighth month of development?

Answer: During the eighth month, subcutaneous fat begins to deposit and the fetus weighs about 2 kg.

Question: What are the uses of citric acid in the food industry?

Answer: Citric acid is used as a flavoring agent, preservative, and pH adjuster in the food industry.

Question: How do you achieve equilibrium in a system of forces acting on an object suspended by multiple strings?

Answer: Achieve equilibrium by ensuring that the forces exerted by the strings balance the weight of the object. The tensions in the strings must be equal and opposite to the weight, and their lines of action must intersect at a common point.

Question: How is the total distance traversed by a child walking from point A to point C via point B calculated?

Answer: The total distance traversed is the sum of the distances of each segment of the path taken.

Question: How does the efficiency of an electric iron affect energy consumption?

Answer: The efficiency of an electric iron affects energy consumption by determining how much of the supplied electric energy is converted into useful heat for ironing clothes.

Question: What is the characteristic taste of acids?

Answer: Acids have a sour taste.

Question: What are the environmental benefits of using electrochemical water treatment methods?

Answer: Electrochemical water treatment methods offer environmental benefits by providing efficient removal of contaminants, reducing chemical usage, minimizing sludge production, and allowing on-site treatment without hazardous byproducts.

Question: Describe how energy transformations occur in a roller coaster.

Answer: In a roller coaster, potential energy at the highest points is converted into kinetic energy as it descends, and kinetic energy is converted back into potential energy as it ascends.

Question: What is the specific heat capacity of aluminium, and how is it measured?

Answer: The specific heat capacity of aluminium is  $900 \text{ J kg}^{-1} \text{ K}^{-1}$ . It is measured by supplying a known amount of heat to a known mass of aluminium and recording the resulting temperature change.

Question: Explain the function of an analog-to-digital converter (ADC) in data acquisition systems.

Answer: An ADC converts analog signals into digital data, allowing analog inputs to be processed by digital systems for data acquisition and analysis.

Question: How do you express the composition of a solution in terms of mass/volume (m/v)?

Answer:  $m/v = \text{Mass of solute} / \text{Volume of solution}$ .

Question: How are exothermic and endothermic reactions different in terms of energy content?

Answer: Exothermic reactions have products with lower energy than reactants, while endothermic reactions have products with higher energy than reactants.

Question: What is the role of epithelial tissue in absorption?

Answer: Epithelial tissue in the digestive tract absorbs digestive end products, facilitating nutrient uptake into the bloodstream.

Question: What is the common molecular formula for carbohydrates?

Answer: The common molecular formula for carbohydrates is  $C_x(H_2O)_y$ .

Question: How does sex-linked inheritance affect the expression of genetic disorders?

Answer: Sex-linked inheritance, particularly involving genes on the X chromosome, affects males more frequently because they have only one X chromosome. Recessive genes on the X chromosome are expressed in males, while females can be carriers.

Question: What happens if a force of 25 N is applied in the opposite direction to a 20 N force acting on an object?

Answer: If a force of 25 N is applied in the opposite direction to a 20 N force, the object will move in the direction of the 25 N force with a resultant force of 5 N acting on it.

Question: What is the role of the large intestine in water absorption?

Answer: The large intestine absorbs water from the remaining indigestible food matter, forming semi-solid fecal matter for excretion.

Question: How is the chemical formula of magnesium nitrate represented?

Answer: The chemical formula of magnesium nitrate is  $\text{Mg}(\text{NO}_3)_2$ , indicating one magnesium ion and two nitrate ions.

Question: How do mechanical waves differ from electromagnetic waves in terms of propagation?

Answer: Mechanical waves require a medium to propagate, while electromagnetic waves can propagate through a vacuum.

Question: What is homeostasis?

Answer: Homeostasis is the maintenance of a constant internal environment, ensuring stable conditions within a narrow range that cells can tolerate.

Question: Describe the structure of a neuron.

Answer: A neuron is composed of a cell body containing the nucleus and organelles, dendrites that receive stimuli, and an axon that transmits impulses away from the cell body. Most axons are myelinated, with interrupted places called nodes of Ranvier.

Question: How is the resultant force of two parallel forces acting along the same direction demonstrated?

Answer: It is demonstrated by using Newton balances and a strip of wood to show that the sum of the forces from two balances is equal to the force measured by a third balance.

Question: What is the chemical formula for carbon dioxide?

Answer: The chemical formula for carbon dioxide is  $\text{CO}_2$ .

Question: Describe the purpose of a power amplifier in audio systems.

Answer: A power amplifier increases the power of audio signals, driving speakers to produce sound at higher volumes and with better clarity.

Question: What are the potential benefits of gene therapy?

Answer: Gene therapy has the potential to treat or cure genetic disorders by replacing faulty genes with healthy ones, correcting genetic defects at

their source, and providing long-lasting or permanent therapeutic effects.

Question: How is the heat change of a reaction expressed experimentally?

Answer: By measuring the temperature change and using the formula  $Q = mc\theta$ , considering the specific heat capacity and mass of the solution.

Question: How do covalent bonds contribute to the stability of a molecule?

Answer: Covalent bonds contribute to the stability of a molecule by allowing atoms to share electrons, achieving a stable electronic configuration similar to noble gases.

Question: What happens to the charges on an object when it gains electrons?

Answer: When an object gains electrons, it becomes negatively charged.

Question: What is the significance of the lines of action of forces in maintaining equilibrium in a system of three parallel forces?

Answer: The lines of action of the three parallel forces must be aligned for equilibrium to be maintained. Forces that are not aligned will result in a net moment, causing the object to rotate or move.

Question: What is the function of chlorophyll in photosynthesis?

Answer: Chlorophyll is a green pigment in chloroplasts that absorbs light energy, which is essential for the photosynthesis process.

Question: What is the significance of the cell cycle in maintaining genetic stability?

Answer: The cell cycle ensures accurate DNA replication and distribution to daughter cells, maintaining genetic stability and preventing mutations or chromosomal abnormalities.

Question: What is the significance of lignin deposition in sclerenchyma tissues?

Answer: Lignin deposition strengthens sclerenchyma cell walls, making them rigid and durable, providing mechanical support and protection to the plant.

Question: How do you calculate the displacement traveled under uniform velocity for an object moving at 15 m/s for 6 seconds?

Answer: Displacement = Velocity  $\times$  Time = 15 m/s  $\times$  6 s = 90 meters.

Question: What is a hydraulic press and how does it work?

Answer: A hydraulic press operates on the principle of pressure transmission through liquids. It consists of two pistons of different areas connected by a liquid-filled cylinder. A small force applied on the smaller piston generates a larger force on the larger piston.

Question: Explain the concept of a concentration cell.

Answer: A concentration cell is an electrochemical cell where the electrodes are made of the same material, but the electrolyte concentrations differ. The cell generates a potential difference due to the concentration gradient, driving the flow of ions from high to low concentration.

Question: How does acute renal failure differ from chronic renal failure?

Answer: Acute renal failure is the temporary loss of kidney function for a few hours or days, often reversible with immediate treatment. Chronic renal failure, on the other hand, is a gradual and irreversible loss of kidney function over time.

Question: What changes occur in the fetus during the fifth month of development?

Answer: During the fifth month, the fetus is completely covered with hair, the mother can feel fetal movements, and the fetal heartbeat can be observed.

Question: What is the purpose of grooves on tire surfaces?

Answer: The purpose of grooves on tire surfaces is to increase friction with the road, prevent skidding, and improve traction, especially on wet surfaces.

Question: How is the chemical formula of water written?

Answer: The chemical formula of water is  $H_2O$ , indicating two hydrogen atoms and one oxygen atom.

Question: How do different animals use sound waves for communication and navigation?

Answer: Animals like bats and dolphins use ultrasound waves for communication, navigation, and locating prey, while elephants use infra-sound for long-distance communication.

Question: What is the significance of the turning effect of a force in practical applications?

Answer: The turning effect of a force is significant in practical applications such as opening doors, using wrenches, and rotating objects, where the ease of rotation depends on the applied moment.

Question: What is the role of Newton's third law in the formation of a force couple?

Answer: Newton's third law states that for every action force, there is an equal and opposite reaction force. This principle is applied in the formation of a force couple, where the reaction force at the pivot creates the couple.

Question: Explain the concept of static friction with an example.

Answer: Static friction is the force that prevents a stationary object from moving. For example, a table resists movement when a small force is applied because static friction balances the applied force.

Question: What are the principle changes in fetal development during the first three months?

Answer: During the first three months, the fetus takes human form, develops a large head, starts developing nails, and differentiates male and female sex organs.

Question: What factors affect the rate of heat transfer by conduction in a solid?



Answer: The rate of heat transfer by conduction in a solid is affected by the material's thermal conductivity, the temperature gradient, and the cross-sectional area through which heat is transferred.

Question: What are the conditions for equilibrium in an object under the action of three forces that are not parallel?

Answer: The three forces must be coplanar, their lines of action must intersect at a common point, and the resultant of any two forces must be equal in magnitude and opposite in direction to the third force.

Question: What is nuclear waste?

Answer: Nuclear waste is radioactive waste generated from nuclear reactors, research facilities, and medical treatments.

Question: What are some common animal viral diseases?

Answer: Common animal viral diseases include influenza, common cold, dengue, and AIDS.

Question: Describe the physical properties of sodium metal.

Answer: Sodium is a soft metal that can easily be cut with a knife. It floats on water because its density ( $0.97 \text{ g/cm}^3$ ) is less than that of water. Sodium is also a conductor of heat and electricity.

Question: What is an electric current?

Answer: An electric current is the flow of electric charges through a conductor.

Question: How do rabbits and dolphins differ in their hearing capabilities?

Answer: Rabbits and dolphins can hear ultrasound frequencies above 20,000 Hz, while humans cannot hear these high frequencies.

Question: How do you calculate the current flowing through a nichrome wire coil with a resistance of  $12 \Omega$  and a potential difference of 6 V?

Answer: Using Ohm's Law,  $I = V/R$ , the current is  $I = 6 \text{ V} / 12 \Omega = 0.5 \text{ A}$ .

Question: How does the efficiency of an electric iron affect energy consumption?

Answer: The efficiency of an electric iron affects energy consumption by determining how much of the supplied electric energy is converted into useful heat for ironing clothes.

Question: What happens when a plastic rod is rubbed against hair?

Answer: When a plastic rod is rubbed against hair, it can attract tiny bits of paper due to static electricity.

Question: How is the atomic mass unit currently defined?

Answer: The atomic mass unit is currently defined as  $1/12$  the mass of a carbon-12 ( $^{12}\text{C}$ ) isotope.

Question: What is the basic organizational level of an organism?

Answer: The basic organizational level of an organism is the cell. Multicellular organisms possess tissues, organs, and system-level complex organization.

Question: Describe the reaction of iron with steam.

Answer: When iron reacts with steam, it forms iron oxide and hydrogen gas:  $3\text{Fe} + 4\text{H}_2\text{O} \rightarrow \text{Fe}_3\text{O}_4 + 4\text{H}_2$ .

Question: What is the specific heat capacity of glass?

Answer: The specific heat capacity of glass is  $840 \text{ J kg}^{-1} \text{ K}^{-1}$ .

Question: What is the power dissipated by a  $5 \Omega$  resistor with a voltage drop of  $10 \text{ V}$  across it?

Answer: Using  $P = V^2/R$ , the power dissipated is  $P = (10 \text{ V})^2 / 5 \Omega = 20 \text{ W}$ .

Question: What safety measures should be taken when working with high-voltage equipment?

Answer: Safety measures include wearing appropriate protective gear, ensuring proper grounding, maintaining a safe distance from live wires, and following all safety protocols and regulations.

Question: How do atoms achieve a stable electronic configuration in ionic bonds?

Answer: Atoms achieve a stable electronic configuration in ionic bonds by transferring electrons, resulting in the formation of positively and negatively charged ions that attract each other.

Question: What is the balanced equation for the reaction between aluminum and oxygen?

Answer: The balanced equation for aluminum reacting with oxygen is:  $4\text{Al} + 3\text{O}_2 \rightarrow 2\text{Al}_2\text{O}_3$ , ensuring equal numbers of aluminum and oxygen atoms on both sides.

Question: What is the potential difference across a bulb connected to a  $3 \text{ V}$  power supply with a resistance of  $6 \Omega$ ?

Answer: The potential difference is  $3 \text{ V}$ , assuming the power supply voltage is the same as the voltage across the bulb.

Question: What is the purpose of a surge protector in an electric circuit?

Answer: A surge protector prevents damage to electrical appliances by absorbing and diverting excess voltage from power surges or lightning strikes.

Question: What changes occur in the fetus during the seventh month of development?

Answer: During the seventh month, the eyelids open and the skin becomes wrinkled.

Question: How is the chemical formula of chlorine heptoxide represented?

Answer: The chemical formula of chlorine heptoxide is  $\text{Cl}_2\text{O}_7$ , indicating two chlorine atoms and seven oxygen atoms.

Question: Describe the equilibrium of a framed picture hanging on the wall.

Answer: The framed picture is in equilibrium because the tensions in the two strings balance the weight of the picture. The three forces are coplanar, and their lines of action intersect at a common point.

Question: What is the total surface area of eight small marble cubes with all sides exposed?

Answer: The total surface area is  $48 \text{ cm}^2$  ( $6 \text{ cm}^2 \times 8$ ).

Question: What are some locations where epithelial tissues are found in the body?

Answer: Epithelial tissues are found in the wall of blood capillaries, thyroid gland, lining of the nasal cavity, wall of the urinary bladder, and skin (epidermis).

Question: How do you measure the voltage across a component in a parallel circuit?

Answer: The voltage across each component in a parallel circuit is the same as the voltage across the entire circuit.

Question: How do geneticists use bioinformatics in genetic research?

Answer: Bioinformatics combines biology, computer science, and statistics to analyze and interpret large-scale genetic data, helping to identify genes associated with diseases, understand genetic variation, and predict the effects of genetic mutations.

Question: How do you calculate the displacement of a body moving at a uniform acceleration?

Answer:  $\text{Displacement} = \text{Mean Velocity} \times \text{Time}$

Question: How does a compass work?

Answer: A compass works by using a small magnet mounted on a pivot that aligns itself along the north-south direction in the presence of the earth's magnetic field.

Question: How does Newton's first law explain the need for headrests in vehicles?

Answer: Headrests in vehicles provide support to the head, preventing whiplash during sudden stops. Newton's first law explains that the head tends to remain in motion when the vehicle stops, and the headrest provides the necessary external force to stop the motion.

Question: What is the velocity-time graph for a body reaching its maximum height after being projected vertically upwards?

Answer: The velocity-time graph is a straight line with a negative slope, starting from the initial velocity and reaching zero at the maximum height.

Question: What is the significance of the coelom in Annelids?

Answer: The coelom provides an independent movement for the gut wall irrespective of the body movements.

Question: Describe the process of meiosis and its significance in sexual reproduction.

Answer: Meiosis reduces the chromosome number by half, producing haploid gametes (sperm and eggs), ensuring genetic diversity and maintaining the chromosome number in offspring after fertilization.

Question: What is the function of the peroxisome in cells?

Answer: Peroxisomes contain enzymes that detoxify harmful substances, such as hydrogen peroxide, and play a role in lipid metabolism and the breakdown of fatty acids.

Question: What are parallel forces?

Answer: Parallel forces are forces that have parallel but different lines of action.

Question: What adaptations do fruits dispersed by water have?

Answer: Fruits dispersed by water have porous or fibrous pericarps, floatation-suited pericarps, and air-filled shells.

Question: What is the resultant force of two parallel forces acting along the same direction?

Answer: The resultant force is the sum of the two forces.

Question: What is puberty in humans?

Answer: Puberty, or adolescence, is the stage of sexual maturity when secondary sexual characteristics begin to appear, differentiating males and females.

Question: How does the diaphragm in a moving coil microphone respond to sound?

Answer: The diaphragm vibrates in response to sound waves, moving the attached coil within a magnetic field and generating an alternating current.

Question: What is the maximum number of electrons the second energy level can hold?

Answer: The second energy level can hold a maximum of 8 electrons.

Question: What happens to the flower after fertilization?

Answer: After fertilization, the ovary develops into a fruit, the ovary wall becomes the pericarp, and the fertilized ovule develops into a seed.

Question: What is the impact of genetic mutations on evolution?

Answer: Genetic mutations introduce new variations into a population, providing the raw material for evolution. Beneficial mutations can be passed on and become more common, while harmful mutations may be eliminated by natural selection.

Question: Describe the function of a voltage stabilizer.

Answer: A voltage stabilizer maintains a constant output voltage despite fluctuations in the input voltage, protecting sensitive electronic devices from damage.

Question: What are the industrial applications of electrolysis for metal extraction?

Answer: Industrial applications include extracting metals like sodium and aluminum from their ores, refining impure metals, and producing chemicals like sodium hydroxide and chlorine.

Question: What causes syphilis, and what are its symptoms?

Answer: Syphilis is caused by the bacterium *Treponema pallidum* and presents with painless blisters, fever, and throat pain. It can spread to other organs if untreated.

Question: How is the amount of a substance in moles related to its mass and molar mass?

Answer: The amount of a substance in moles is related to its mass and molar mass by the formula  $n = m/M$ , where  $n$  is the number of moles,  $m$  is the mass, and  $M$  is the molar mass.

Question: What role does the axle play in an alternating current dynamo?

Answer: The axle rotates the coil within the magnetic field, enabling continuous induction of electromotive force and generation of alternating current.

Question: What is the magnitude and direction of the resultant force if two collinear forces of 10 N and 6 N act in opposite directions?

Answer: The magnitude of the resultant force is 4 N in the direction of the 10 N force.

Question: What is the difference between artificial and natural classification?

Answer: Artificial classification groups organisms based on observable features without considering evolutionary relationships, while natural classification considers evolutionary relationships and various biological features.

Question: How do environmental changes, such as increased CO<sub>2</sub> levels, impact photosynthesis?

Answer: Increased CO<sub>2</sub> levels can enhance photosynthesis rates, as CO<sub>2</sub> is a key substrate, but other factors like nutrient availability and temperature also play a role.

Question: How does the electronic configuration of a sodium atom change when it becomes a sodium ion (Na<sup>+</sup>)?

Answer: The electronic configuration of a sodium atom changes from 2, 8, 1 to 2, 8 when it loses one electron to become a sodium ion (Na<sup>+</sup>).

Question: What are the changes that occur in the female reproductive system during puberty?

Answer: Changes in the female reproductive system during puberty include the growth of pubertal hair, widened pubic region, growth of mammary glands, increased body fat, and the start of the menstrual cycle.

Question: What are the consequences of untreated hypertension?

Answer: Untreated hypertension can lead to heart disease, stroke, kidney damage, and vision loss.

Question: What are the main types of neurons in the nervous system?

Answer: Sensory neurons, motor neurons, and interneurons.

Question: What is the significance of the critical point in phase diagrams of substances?

Answer: The critical point in phase diagrams represents the highest temperature and pressure at which a substance can exist as a liquid and gas in equilibrium.

Question: What is the reaction between aluminum and hydrochloric acid?

Answer: Aluminum reacts with hydrochloric acid to form aluminum chloride and hydrogen gas:  $2\text{Al} + 6\text{HCl} \rightarrow 2\text{AlCl}_3 + 3\text{H}_2$ .

Question: Why is it necessary to use appropriate fuses in domestic circuits?

Answer: Appropriate fuses protect domestic circuits from overcurrent, preventing potential damage to appliances and reducing the risk of electrical fires.

Question: Why does the rate of reaction increase with higher concentration of reactants?

Answer: Higher concentration increases the number of reactant particles, leading to more collisions and a faster reaction rate.

Question: How is urine formed and transported in the urinary system?

Answer: Blood is filtered in the kidneys, forming urine, which is transported through the ureters to the bladder and then expelled through the urethra.

Question: What is the significance of the area under a velocity-time graph?

Answer: The area represents the total displacement of the object.

Question: What is the effect of thermal expansion on the design of railway tracks?

Answer: Thermal expansion affects the design of railway tracks by requiring expansion gaps to accommodate the tracks' length changes due to temperature variations, preventing deformation and ensuring safe operation.

Question: What is the role of the armature in a DC motor?

Answer: The armature is the rotating coil in a DC motor, generating rotational motion when a current passes through it.

Question: How does the RCCB protect against electric shocks?

Answer: The RCCB detects current leaks to the ground and automatically disconnects the power supply, preventing electric shocks and potential injuries.

Question: What is the chemical formula for disaccharides?

Answer: The chemical formula for disaccharides is  $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ .

Question: How does the electronic configuration of carbon influence the formation of covalent bonds?

Answer: The electronic configuration of carbon (2, 4) allows it to form four covalent bonds by sharing its electrons with other atoms, enabling the formation of various organic compounds.

Question: Explain the purpose of a fuse in an electric circuit.

Answer: A fuse protects the electric circuit by breaking the connection when the current exceeds a certain level, preventing overheating and

potential fire hazards.

Question: Why are electron microscopes needed to observe most organelles?

Answer: Most organelles cannot be observed through a light microscope and require the higher resolution of an electron microscope.

Question: Describe the effect of acids, bases, and salts on the rusting of iron, including experimental setups and observations.

Answer: The rusting of iron is influenced by the presence of acids, bases, and salts. Experiments can be conducted to observe these effects.

**Effect of Acids on Rusting:** Materials Required: Three boiling tubes Water Lime juice Dilute hydrochloric acid (HCl) Iron nails Method: Place an iron nail in each boiling tube. Add ordinary water to the first tube, water mixed with lime juice to the second, and water mixed with dilute HCl to the third. Allow them to stand for a day and observe. Observations: The nails in the tubes with lime juice and dilute HCl rust more than the nail in ordinary water. Conclusion: Acids accelerate the rusting of iron.

**Effect of Salts on Rusting:** Materials Required: Two boiling tubes Solid sodium chloride (NaCl) Iron nails Method: Place a clean iron nail in each boiling tube. Add ordinary water to one tube and water mixed with sodium chloride to the other. Allow them to stand for a day and observe. Observations: The nail in the tube with sodium chloride solution rusts more than the nail in ordinary water. Conclusion: Salts, like sodium chloride, accelerate the rusting of iron.

**Effect of Bases on Rusting:** Materials Required: Two boiling tubes Sodium hydroxide (NaOH) solution Iron nails Method: Place a clean iron nail in each boiling tube. Add ordinary water to one tube and sodium hydroxide solution to the other. Allow them to stand for a day and observe. Observations: The nail in ordinary water rusts, while the nail in sodium hydroxide solution shows significantly less rusting. Conclusion: Bases decrease the rate of rusting of iron.

Question: What is the effect of a concave mirror on light rays that come from the focal point?

Answer: Light rays that come from the focal point are reflected parallel to the principal axis.

Question: What is the distance if path Q is used from A to B?

Answer: The distance is 200 m.

Question: How does the electrolysis of water illustrate the principles of oxidation and reduction?

Answer: The electrolysis of water shows the reduction of  $H^+$  ions to hydrogen gas at the cathode and the oxidation of  $OH^-$  ions to oxygen gas at the anode, demonstrating electron transfer in redox reactions.

Question: What are extrinsic semiconductors and how are they formed?

Answer: Extrinsic semiconductors are formed by doping intrinsic semiconductors with impurity atoms to increase their electrical conductivity. There are two types: n-type (doped with group V elements) and p-type (doped with group III elements).

Question: How do fungi reproduce?

Answer: Fungi reproduce through both sexual and asexual methods, including spore formation, budding, and fragmentation, depending on the species and environmental conditions.

Question: How do telescopes use convex lenses?

Answer: Telescopes use convex lenses to gather and focus light from distant objects, creating clear images for observation.

Question: How does reducing surface roughness affect friction?

Answer: Reducing surface roughness decreases friction because smoother surfaces have less resistance to motion.

Question: How is the chemical formula of water represented?

Answer: The chemical formula of water is  $H_2O$ , indicating two hydrogen atoms and one oxygen atom.

Question: How do you find the resultant force of two collinear forces acting in opposite directions?

Answer: The resultant force is given by the difference between the two forces, in the direction of the larger force.

Question: How do coir ropes benefit from frictional forces?

Answer: Coir ropes benefit from frictional forces because the friction among the coir fibers prevents them from separating, maintaining the rope's strength and integrity.

Question: What are the consequences of eutrophication?

Answer: The consequences of eutrophication include loss of water transparency, reduced biodiversity, death of aquatic plants and animals, and an unpleasant odor due to anaerobic decomposition.

Question: How is the mole concept used in chemical calculations?

Answer: The mole concept is used in chemical calculations to quantify the amount of substances involved in reactions, allowing for the use of balanced chemical equations to determine proportions and quantities.

Question: What materials are not attracted by magnets?

Answer: Materials such as plastic, wood, paper, and rubber are not attracted by magnets.

Question: What are the effects of ground-level ozone on human health?

Answer: The effects of ground-level ozone on human health include respiratory problems, aggravated asthma, reduced lung function, and increased risk of respiratory infections.

Question: What are the features of vertebrates in the class Reptilia?

Answer: Vertebrates in the class Reptilia have dry skin with scales, pentadactyle limbs, a heart with two atria and an incompletely divided ventricle, lungs for respiration, and are cold-blooded with internal fertilization.

Question: How does the speed of a wave relate to its wavelength and period?



Answer: The speed ( $v$ ) of a wave is equal to the wavelength ( $\lambda$ ) divided by the period ( $T$ ), expressed as  $v = \lambda/T$ .

Question: What is the angle of incidence in light refraction?

Answer: The angle between the incident ray and the normal to the surface at the point of incidence.

Question: How do convex lenses help in vision correction?

Answer: Convex lenses converge light rays to focus on the retina, correcting farsightedness by enabling clear vision of nearby objects.

Question: What is the balanced chemical equation for the reaction between sodium and oxygen?

Answer: The balanced chemical equation for sodium reacting with oxygen is:  $4\text{Na} + \text{O}_2 \rightarrow 2\text{Na}_2\text{O}$ .

Question: What materials are commonly found in electronic waste?

Answer: Common materials found in electronic waste include lead, mercury, cadmium, beryllium, arsenic, and polyvinyl chloride (PVC).

Question: How does the specific heat capacity of ethanol make it suitable for use in thermometers?

Answer: Ethanol has a high expansion relative to most other liquids and increases uniformly with temperature, making it suitable for use in thermometers.

Question: Describe the process of protein modification in the Golgi apparatus.

Answer: The Golgi apparatus modifies proteins by adding carbohydrates and lipids, sorts them, and packages them into vesicles for transport to their final destinations.

Question: Explain the sources and effects of industrial waste on the environment.

Answer: Industrial waste refers to the byproducts of industrial processes that cannot be reused and are often harmful to the environment. These wastes include hydrocarbons, heavy metals, and other pollutants that are released during various industrial activities. Hydrocarbons: These are compounds made of carbon and hydrogen. They are released into the environment through bacterial activity on organic matter in marshy lands, the combustion of liquid petroleum fuels like petrol and diesel, and the use of lubrication oils. Methane ( $\text{CH}_4$ ), the simplest hydrocarbon, is released during the decomposition of organic matter in anaerobic conditions. Greenhouse Gases: These include carbon dioxide ( $\text{CO}_2$ ), methane ( $\text{CH}_4$ ), and chlorofluorocarbons (CFCs). They trap heat in the earth's atmosphere, leading to global warming.  $\text{CO}_2$  is released from burning fossil fuels,  $\text{CH}_4$  from decomposing organic matter in landfills and marshes, and CFCs from refrigeration and air conditioning units. The increase in greenhouse gases enhances the greenhouse effect, causing the earth's temperature to rise and leading to climate change. Heavy Metals: These metals have high densities and include mercury (Hg), arsenic (As), chromium (Cr), cadmium (Cd), and lead (Pb). They are released through various industrial activities such as mining, electroplating, and the use of certain pigments. For

example, arsenic is released from excessive use of agrochemicals, and lead from leaded petrol. These metals accumulate in the environment and can cause severe health issues like cancer, neurological damage, and organ failure. Particulate Matter: This includes both solid and liquid particles suspended in the air, such as carbon particles, heavy metal particles, dust, and water droplets. These particles can cause respiratory problems and other health issues. The release of these industrial wastes has significant adverse effects on the environment. It leads to air, water, and soil pollution, which can harm plant and animal life, degrade ecosystems, and pose serious health risks to humans.

Question: How does the depth of a liquid column affect the pressure it exerts?

Answer: The pressure exerted by a liquid column increases with the depth of the column because the weight of the liquid above that point increases.

Question: Describe an experiment to measure the power and energy consumption of an electric appliance, including the setup, procedure, and calculations.

Answer: To measure the power and energy consumption of an electric appliance, we can conduct an experiment using a known voltage source, an ammeter, and a stopwatch. Materials Required: Voltage source (e.g., battery), ammeter, stopwatch, electric appliance (e.g., bulb), connecting wires. Setup: Connect the electric appliance to the voltage source using connecting wires. Include an ammeter in the circuit to measure the current flowing through the appliance. Procedure: Turn on the electric appliance and start the stopwatch. Measure the voltage (V) across the appliance using the voltage source specification. Record the current (I) flowing through the appliance using the ammeter. After a specific time (t), stop the stopwatch and note the elapsed time. Calculations: Power Calculation:  $P = V \times I$  Example: For a bulb connected to a 12 V source drawing 0.5 A,  $P = 12 \times 0.5 = 6$  W Energy Consumption Calculation:  $E = P \times t$  Convert time to seconds if measured in minutes or hours. Example: If the bulb operates for 10 minutes (600 seconds),  $E = 6 \times 600 = 3600$  J This experiment demonstrates how to calculate the power and energy consumption of an electric appliance, providing insights into its efficiency and operational cost.

Question: How have scientists shown the need for water in photosynthesis using isotopes?

Answer: Scientists used water with O-18 isotope, showing that the oxygen end product contains O-18, confirming that water is needed for photosynthesis.

Question: What are the advantages of using solid-state electrolytes in batteries?

Answer: Solid-state electrolytes in batteries offer advantages like improved safety, higher energy density, longer cycle life, and the potential for flexible and lightweight designs, making them suitable for advanced energy storage applications.

Question: How is the concentration of a solution expressed in parts per million (ppm)?

Answer:  $\text{ppm} = (\text{Mass of solute} / \text{Mass of solution}) \times 1,000,000$ .

Question: How is aluminum extracted using electrolysis?

Answer: Aluminum is extracted using electrolysis of molten aluminum oxide (alumina) dissolved in cryolite. At the cathode, aluminum ions ( $\text{Al}^{3+}$ ) are reduced to form aluminum metal, and at the anode, oxide ions ( $\text{O}^{2-}$ ) are oxidized to form oxygen gas.

Question: How does the density of a liquid affect the pressure it exerts?

Answer: The density of a liquid directly affects the pressure it exerts; higher density liquids exert more pressure at a given depth compared to lower density liquids.

Question: How does the electrolysis of acidulated water produce oxygen gas?

Answer: Oxygen gas is produced at the anode by the oxidation of  $\text{OH}^-$  ions:  $4\text{OH}^- (\text{aq}) \rightarrow \text{O}_2 (\text{g}) + 2\text{H}_2\text{O} (\text{l}) + 4\text{e}^-$ .

Question: Describe the reactivity of calcium with hydrochloric acid.

Answer: Calcium reacts with hydrochloric acid to form calcium chloride and hydrogen gas:  $\text{Ca} + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2$ .

Question: What are the benefits of recycling?

Answer: Benefits of recycling include reducing waste, conserving natural resources, saving energy, reducing pollution, and creating jobs.

Question: Describe the role of connective tissue in blood vessels.

Answer: Connective tissue in blood vessels provides structural support, elasticity, and strength, allowing vessels to withstand blood pressure and facilitate circulation.

Question: Explain the process of electrochemical synthesis of nanoparticles.

Answer: Electrochemical synthesis of nanoparticles involves the controlled reduction of metal ions in an electrolyte to form nanoparticles at the electrode surface. This method allows precise control over size, shape, and composition, used in applications like catalysis and drug delivery.

Question: How is blood glucose level regulated?

Answer: Blood glucose level is regulated by insulin and glucagon. Insulin converts glucose to glycogen when levels are high, and glucagon converts glycogen to glucose when levels are low.

Question: What are the uses of oxygen gas?

Answer: Oxygen is essential for respiration and combustion, used in underwater diving and space travel, generates oxy-acetylene flames for welding, and is a raw material in producing sulfuric and nitric acids.

Question: What is the significance of using distilled water in the electrolysis of acidulated water?

Answer: Distilled water is free of impurities that could interfere with the electrolysis process, ensuring accurate results.

Question: What are the sources of electronic waste in modern technology?  
Answer: Sources of electronic waste in modern technology include discarded electronic devices such as computers, televisions, cell phones, and household appliances.

Question: How does the epiglottis function during swallowing?  
Answer: The epiglottis closes the trachea during swallowing, preventing food from entering the respiratory tract and directing it into the esophagus.

Question: What are the uses of natural polymers like rubber and proteins?  
Answer: Natural polymers like rubber are used for making tires and tubes, while proteins are essential for biological functions in living organisms.

Question: Calculate the kinetic energy of a 2 kg object moving at 9 m/s.  
Answer: The kinetic energy is 81 Joules (J).

Question: How does the induced current direction change during coil rotation in a dynamo?  
Answer: The induced current direction changes periodically, resulting in an alternating current as the coil rotates within the magnetic field.

Question: What are the deficiency symptoms of iodine?  
Answer: Deficiency symptoms of iodine include lethargic attitude towards studies and limited body height.

Question: How is the chemical formula of aluminium oxide written?  
Answer: The chemical formula of aluminium oxide is  $\text{Al}_2\text{O}_3$ , indicating two aluminium ions and three oxide ions.

Question: How is the chemical formula of potassium hydroxide written?  
Answer: The chemical formula of potassium hydroxide is  $\text{KOH}$ , indicating one potassium ion and one hydroxide ion.

Question: How does the body eliminate excess nitrogenous waste?  
Answer: Excess nitrogenous waste, primarily in the form of urea and uric acid, is filtered by the kidneys and excreted in urine.

Question: What is the role of a frequency synthesizer in communication systems?  
Answer: A frequency synthesizer generates precise and stable frequencies for communication systems, enabling accurate frequency control and modulation for signal transmission and reception.

Question: What happens to the current flow in a transistor when the base-emitter voltage is less than 0.7 V?  
Answer: When the base-emitter voltage is less than 0.7 V, there is no collector current ( $I_C$ ) in the transistor.

Question: What are the benefits of using LED lights in terms of energy efficiency?  
Answer: LED lights are highly energy-efficient, consuming less power and lasting longer than traditional incandescent and fluorescent bulbs, reducing energy costs and environmental impact.

Question: What happens to vehicle speed in heavy traffic?

Answer: In heavy traffic, vehicles have to slow down or even stop.

Question: What are the main features of the Domain Bacteria?

Answer: The Domain Bacteria includes prokaryotes that are sensitive to antibiotics, can be pathogenic, and are found everywhere in the environment.

Question: What happens when one person pushes a motor car with insufficient force?

Answer: When one person pushes a motor car with insufficient force, the car does not move.

Question: What is the refractive index of glass relative to air?

Answer: 1.5.

Question: How do wind instruments produce sound?

Answer: Wind instruments produce sound by the vibrations of air columns within the instrument.

Question: What is the total current in a circuit with resistors of 10  $\Omega$ , 20  $\Omega$ , and 30  $\Omega$  connected in parallel with a 12 V power supply?

Answer: Calculate the current through each resistor using  $I = V/R$ , then sum the currents to find the total current.

Question: What are the properties of concentrated acids?

Answer: Concentrated acids are highly corrosive, can cause severe burns, and react vigorously with various substances.

Question: How is zinc used to demonstrate a single displacement reaction with hydrochloric acid?

Answer: Zinc displaces hydrogen from hydrochloric acid, forming zinc chloride and hydrogen gas:  $\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$ .

Question: What is the specific latent heat of fusion of ice?

Answer: The specific latent heat of fusion of ice is  $3.36 \times 10^5$  J/kg.

Question: Discuss the types and causes of non-contagious diseases prevalent in modern societies, with specific examples.

Answer: Non-contagious diseases, also known as non-communicable diseases (NCDs), are not transmitted from one person to another. They are often chronic and progress slowly. These diseases have become a significant health concern in modern societies due to various factors including lifestyle changes, environmental pollution, and genetic predispositions. Below are some examples and their causes: Chronic Kidney Disease (CKD): CKD or renal failure is characterized by the gradual loss of kidney function. It can be acute (temporary) or chronic (irreversible). Causes: Diabetes, high blood pressure, constant urinary infections, bladder stones, intoxication from snake venom or agrochemicals, and allergies. Symptoms: Frequent urination at night, little or no urine output, back pain, swelling of feet and ankles, weakness, pale skin, and rashes on palms and soles. Diabetes: Diabetes is a condition where blood glucose levels are

abnormally high due to the pancreas' inability to produce enough insulin. Causes: Dysfunction or inborn absence of beta cells in the pancreas, sedentary lifestyle, consumption of high-glycemic foods, lack of exercise, and mental stress. Consequences: Uncontrolled diabetes can lead to kidney damage and blindness. Cancer: Cancer involves uncontrolled cell division in any part of the body. Causes: Exposure to harmful radiation, intake of heavy metals, and environmental pollutants. Industrialization has increased the presence of these carcinogens in the environment. Heart Diseases: These include conditions where the blood vessels, heart muscles, valves, or rhythm do not function properly. Causes: Sedentary lifestyle, lack of physical exercise, poor diet, and mental stress. The industrialization and modern conveniences have reduced physical activities, contributing to heart diseases. Pulmonary Diseases: These diseases affect the respiratory organs and tissues, including the trachea, bronchi, and alveoli. Causes: Harmful gases emitted from vehicles and factories contribute significantly to pulmonary diseases. Wheezing: Wheezing is caused by obstruction in the airways due to mucus production. Causes: Allergies, air pollutants, and irritants like dust particles. Gastritis: Gastritis involves inflammation of the stomach lining due to increased acidity. Causes: Irregular meal times, consumption of oily and acidic foods, and mental stress. Cataracts: Cataracts result from changes in the proteins of the eye lens, leading to loss of transparency. Causes: Exposure to ultraviolet rays due to ozone layer depletion and harmful gases from factories.

Question: How do ammonium and chloride ions combine to form ammonium chloride?

Answer: Ammonium ions ( $\text{NH}_4^+$ ) and chloride ions ( $\text{Cl}^-$ ) combine through electrostatic attraction to form ammonium chloride ( $\text{NH}_4\text{Cl}$ ) with ionic bonds.

Question: What are the main layers of the skin?

Answer: The main layers of the skin are the epidermis (outer layer), dermis (middle layer with blood vessels and nerves), and subcutaneous tissue (fat and connective tissue).

Question: How does the specific heat capacity of a substance relate to its heat capacity?

Answer: The specific heat capacity of a substance is the heat capacity per unit mass. The heat capacity of an object can be obtained by multiplying its specific heat capacity by its mass.

Question: What is the role of carbon monoxide in the blast furnace?

Answer: Carbon monoxide acts as a reducing agent, reducing iron ore to liquid iron by reacting with iron(III) oxide to form carbon dioxide.

Question: How does the use of pesticides affect soil health?

Answer: Pesticides harm beneficial soil microorganisms, disrupt soil nutrient cycles, and reduce soil fertility. Their overuse can lead to decreased agricultural productivity and environmental harm.

Question: How do concave mirrors form inverted images?

Answer: Concave mirrors form inverted images when the object is placed beyond the focal point, causing reflected rays to converge and form an

upside-down image.

Question: Describe the mechanical process of digestion.

Answer: Mechanical digestion involves physically breaking down food into smaller pieces, such as chewing by teeth, to facilitate chemical digestion.

Question: What is the relationship between magnetic field strength and induced voltage?

Answer: The induced voltage is directly proportional to the magnetic field strength, with stronger fields generating higher voltage.

Question: What is the balanced chemical equation for the reaction between potassium and water?

Answer: The balanced chemical equation for potassium reacting with water is:  $2K + 2H_2O \rightarrow 2KOH + H_2$ .

Question: What products are formed when hydrogen peroxide decomposes?

Answer: When hydrogen peroxide decomposes, it forms water and oxygen:  $2H_2O_2 \rightarrow 2H_2O + O_2$ .

Question: What occurs in the medium-sized tanks during salt production?

Answer: Further evaporation causes calcium sulfate to crystallize and settle at the bottom.

Question: What adaptations do fruits dispersed by animals have?

Answer: Fruits dispersed by animals have succulent edible parts, attractive colors, hooks or hairs for attachment, and shapes that attract animals.

Question: What are the types of particulate matter found in the air?

Answer: The types of particulate matter found in the air are solid particulate matter, such as carbon particles, heavy metal particles, ash, dust, and asbestos, and liquid particulate matter, such as water droplets, liquid organic particles, and mercury droplets.

Question: What are the main features of the Kingdom Protista?

Answer: The Kingdom Protista includes eukaryotic organisms that can be unicellular or multicellular without specialized tissues and live in water-associated environments.

Question: What is the specific heat capacity of water, and why is it significant?

Answer: The specific heat capacity of water is  $4200 \text{ J kg}^{-1} \text{ K}^{-1}$ . It is significant because it allows water to absorb and store large amounts of heat, moderating temperature changes and making it useful in various applications.

Question: How does the release of sulfur hexafluoride (SF<sub>6</sub>) contribute to climate change?

Answer: Sulfur hexafluoride is a potent greenhouse gas with a high global warming potential. It traps heat in the atmosphere, contributing significantly to global warming and climate change.

Question: What safety precautions should be taken when using electric irons?

Answer: Safety precautions include using rubber slippers or mats, ensuring the iron is unplugged when not in use, and keeping the iron away from flammable materials.

Question: How do you measure the resistance of a nichrome wire coil in a circuit?

Answer: Connect the nichrome wire coil in series with an ammeter and a power supply, measure the current, and use a voltmeter to measure the voltage across the coil. Calculate the resistance using Ohm's Law.

Question: What are the conditions for maintaining equilibrium in a system of forces acting on an object?

Answer: The conditions for maintaining equilibrium are that the forces must be coplanar, their lines of action must intersect at a common point, and the resultant of any two forces must be equal in magnitude and opposite in direction to the third force.

Question: How do geneticists predict the outcomes of genetic crosses?

Answer: Geneticists use Punnett squares and probability calculations to predict the outcomes of genetic crosses, estimating the likelihood of different genotypes and phenotypes in offspring.

Question: Describe the working principle of an electric field sensor.

Answer: An electric field sensor detects the presence and strength of electric fields by measuring the voltage or current induced by the field, used in applications like touch sensing and proximity detection.

Question: What is the pitch of a sound wave with a frequency of 256 Hz?

Answer: The pitch corresponds to the musical note middle C, with a frequency of 256 Hz.

Question: What are the environmental impacts of using agrochemicals in agriculture?

Answer: The environmental impacts of using agrochemicals in agriculture include soil and water contamination, harm to non-target species, reduced biodiversity, and potential health risks to humans and wildlife.

Question: How do microtubules facilitate chromosome movement during cell division?

Answer: Microtubules form the mitotic spindle, attaching to chromosomes and moving them to opposite poles of the cell, ensuring accurate segregation during division.

Question: What is the formula for calculating the moment of a force applied to a pivoted rod?

Answer: The formula for calculating the moment of a force applied to a pivoted rod is  $\text{Moment} = \text{Force} \times \text{Perpendicular distance from the pivot point to the line of action of the force}$ .

Question: How do protists contribute to aquatic ecosystems?



Answer: Algae, a type of protist, act as primary producers in aquatic food chains.

Question: How do you measure the resistance of a conductor using a circuit?

Answer: To measure the resistance of a conductor, connect the conductor in series with an ammeter and a power supply, and measure the current. Then, use a voltmeter to measure the voltage across the conductor and calculate resistance using Ohm's Law.

Question: What are infra-sound and ultrasound?

Answer: Infra-sound refers to sounds with frequencies below 20 Hz, and ultrasound refers to sounds with frequencies above 20,000 Hz.

Question: Describe the process of phagocytosis by white blood cells.

Answer: Phagocytosis involves white blood cells engulfing and digesting foreign particles, bacteria, and dead cells to protect the body from infections.

Question: What is the electronic configuration of helium?

Answer: The electronic configuration of helium is 2.

Question: How do geneticists use model organisms in genetic research?

Answer: Geneticists use model organisms such as fruit flies, mice, and yeast because they have short lifespans, well-understood genetics, and can be easily manipulated in the lab to study genetic principles and disorders.

Question: How does a concave mirror reflect light rays coming along the principal axis?

Answer: Light rays coming along the principal axis reflect back along the same path.

Question: What are the characteristics of images formed by plane mirrors?

Answer: Images formed by plane mirrors are virtual, laterally inverted, and the distance from the object to the mirror is equal to the distance from the image to the mirror.

Question: What causes diarrhea and how can it be managed?

Answer: Diarrhea is caused by infections from viruses, bacteria, or parasites, leading to liquid stools and dehydration. It can be managed by consuming more water and seeking medical treatment.

Question: How does a bicycle dynamo convert mechanical energy into electrical energy?

Answer: A bicycle dynamo converts mechanical energy from the rotating tire into electrical energy by inducing a current in the rotating coil within a magnetic field.

Question: How do geneticists use symbols to represent alleles?

Answer: Geneticists use capital letters for dominant alleles and lowercase letters for recessive alleles, simplifying the notation of genotypes and inheritance patterns.

Question: What are the primary elements found in nucleic acids?

Answer: The primary elements found in nucleic acids are Carbon (C), Hydrogen (H), Oxygen (O), Nitrogen (N), and Phosphorous (P).

Question: What hormones are secreted by the ovaries, and what are their functions?

Answer: The ovaries secrete oestrogen and progesterone, which develop secondary sexual characteristics in girls, and maintain pregnancy and the menstrual cycle.

Question: How is the relative molecular mass of sucrose ( $C_{12}H_{22}O_{11}$ ) calculated?

Answer: The relative molecular mass of sucrose is calculated by summing the relative atomic masses of its constituent atoms:  $12 \times 12$  for carbon,  $22 \times 1$  for hydrogen, and  $11 \times 16$  for oxygen, resulting in 342.

Question: What is the role of hydrogen bonds in determining the properties of water?

Answer: Hydrogen bonds are responsible for many of water's unique properties, such as high boiling point, high specific heat capacity, and its ability to act as a solvent for many substances.

Question: How do ball bearings reduce friction in machines?

Answer: Ball bearings reduce friction by allowing rolling motion instead of sliding motion between contact surfaces, significantly reducing frictional resistance.

Question: What are endothermic reactions, and give an example from the document?

Answer: Endothermic reactions absorb heat from the surroundings. An example is the reaction between citric acid and sodium bicarbonate.

Question: What are the industrial applications of electrolysis for producing chemicals?

Answer: Industrial applications include the production of chemicals like sodium hydroxide, chlorine, hydrogen, and oxygen through the electrolysis of various solutions, providing essential raw materials for numerous industries.

Question: What is the role of sensory neurons?

Answer: Sensory neurons transmit impulses from sensory organs to the central nervous system.

Question: What is the charge of an electron?

Answer: An electron has a negative charge.

Question: What is the resultant force when two bulls exert forces of 100 N and 80 N while ploughing a field?

Answer: The resultant force is 180 N.

Question: How is the chemical formula of magnesium hydroxide written?

Answer: The chemical formula of magnesium hydroxide is  $Mg(OH)_2$ , indicating one magnesium ion and two hydroxide ions.

Question: How does the electronic configuration of nitrogen influence its bonding behavior?

Answer: The electronic configuration of nitrogen (2, 5) allows it to form three covalent bonds by sharing its valence electrons with other atoms to achieve a stable configuration.

Question: What is the balanced chemical equation for photosynthesis?

Answer: The balanced chemical equation for photosynthesis is:  $6\text{CO}_2 + 6\text{H}_2\text{O} + \text{light energy} + \text{chlorophyll} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$ .

Question: What enzymes are present in the stomach, and what do they digest?

Answer: Pepsin and hydrochloric acid in the stomach digest proteins into smaller peptides.

Question: How do lenses aid in the function of optical instruments like binoculars?

Answer: Lenses in binoculars magnify distant objects by converging light rays to create clear, enlarged images.

Question: How does kidney function influence the body's electrolyte balance?

Answer: The kidneys regulate electrolyte levels by filtering and reabsorbing ions like sodium, potassium, calcium, and phosphate.

Question: What is the kinetic energy of an 800 g object projected vertically upwards at 20 m/s?

Answer: The kinetic energy is 160 Joules (J).

Question: What is the significance of the five-kingdom classification system?

Answer: The five-kingdom classification system, introduced by Robert Whittaker, helps categorize organisms into more specific groups based on their characteristics.

Question: Calculate the amount of oxygen in moles in 32 grams of oxygen ( $\text{O}_2$ )?

Answer: The amount of oxygen in 32 grams is 1 mole, calculated as  $32/32 = 1$  mole.

Question: What is the role of villi in the small intestine?

Answer: Villi increase the surface area for nutrient absorption, with each villus containing blood capillaries and lacteals to transport absorbed nutrients.

Question: What is the electronic configuration of oxygen?

Answer: The electronic configuration of oxygen is 2, 6.

Question: Describe the reactivity of calcium with hydrochloric acid.

Answer: Calcium reacts with hydrochloric acid to form calcium chloride and hydrogen gas:  $\text{Ca} + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2$ .

Question: What is the definition of average speed?

Answer: Average speed is the total distance traveled divided by the total time taken.

Question: What is the formula for calculating the quantity of heat?

Answer: The formula for calculating the quantity of heat is  $Q = mc\Delta T$ , where  $Q$  is the quantity of heat,  $m$  is the mass,  $c$  is the specific heat capacity, and  $\Delta T$  is the temperature change.

Question: How is potassium permanganate used to prepare oxygen gas in the laboratory?

Answer: Potassium permanganate is heated to decompose it into potassium manganate, manganese dioxide, and oxygen gas, collected by downward displacement of water.

Question: How is the chemical formula of aluminium oxide written?

Answer: The chemical formula of aluminium oxide is  $Al_2O_3$ , indicating two aluminium ions and three oxide ions.

Question: What is the significance of the cytoskeleton in cell division?

Answer: The cytoskeleton forms the mitotic spindle, which ensures accurate segregation of chromosomes during cell division, maintaining genetic stability.

Question: What is the role of chromosomes in genetic inheritance?

Answer: Chromosomes carry genes that determine traits and transmit genetic information from one generation to the next, playing a crucial role in inheritance.

Question: How does the coin at the bottom of a container with water appear when viewed from above?

Answer: The coin appears to be slightly raised above the bottom level of the container.

Question: How does chemical digestion differ from mechanical digestion?

Answer: Chemical digestion involves breaking down complex molecules into simpler ones through enzymatic action, making them absorbable by the body.

Question: What happens when the forces acting on an object are not coplanar?

Answer: When the forces acting on an object are not coplanar, the object will not be in equilibrium and will move or rotate due to the unbalanced forces and moments.

Question: What is the role of the liver in metabolism?

Answer: The liver processes nutrients, detoxifies harmful substances, produces bile, and regulates blood glucose levels.

Question: How does the efficiency of a microwave oven compare to that of traditional cookers?

Answer: Microwave ovens are more efficient than traditional cookers because they generate heat directly inside the food, reducing energy loss.

and cooking time.

Question: How can the effect of a catalyst on a reaction be demonstrated experimentally?

Answer: By comparing the rate of gas evolution in reactions with and without the catalyst, the effect of the catalyst can be observed.

Question: What is the role of slag in the blast furnace?

Answer: Slag, formed from impurities reacting with calcium oxide, floats on molten iron, allowing it to be removed separately, and protects the iron from re-oxidation.

Question: What safety precautions should be taken when using electric irons?

Answer: Safety precautions include using rubber slippers or mats, ensuring the iron is unplugged when not in use, and keeping the iron away from flammable materials.

Question: How does the specific heat capacity of concrete compare to other building materials?

Answer: Concrete has a higher specific heat capacity compared to many other building materials, meaning it can absorb and store more heat energy, making it useful for thermal mass in buildings.

Question: What are the main components of blood?

Answer: Blood consists of plasma (55%) and blood corpuscles (45%), including red blood cells, white blood cells, and platelets.

Question: How is the direction of force represented?

Answer: The direction of force is represented by a straight line called the line of action of the force, indicating the direction in which the force is applied.

Question: What is the result of the reaction between acids and carbonates?

Answer: Acids react with carbonates to produce carbon dioxide gas, water, and a salt.

Question: What is the role of hydrogen bonds in determining the density of ice compared to liquid water?

Answer: Hydrogen bonds in ice create an open lattice structure, making ice less dense than liquid water, which allows ice to float on water.

Question: Why are grooves etched on tires?

Answer: Grooves are etched on tires to increase the friction between the tire and the road surface, preventing skidding and improving grip.

Question: Describe the function of a low-dropout regulator (LDO) in voltage regulation.

Answer: An LDO regulates the output voltage with a small difference between the input and output voltages, providing efficient and stable power supply for sensitive electronic circuits.

Question: How do lysosomes degrade cellular waste?

Answer: Lysosomes contain hydrolytic enzymes that break down cellular waste, debris, and foreign invaders, playing a key role in cellular cleanup and recycling.

Question: What is the chemical formula of magnesium oxide?

Answer: The chemical formula of magnesium oxide is  $\text{MgO}$ , indicating one magnesium ion and one oxide ion.

Question: How do you find the resultant force when two collinear forces act in opposite directions?

Answer: The resultant force is found by subtracting the smaller force from the larger force, in the direction of the larger force.

Question: How do ionic and covalent bonds differ in terms of melting and boiling points?

Answer: Ionic bonds result in higher melting and boiling points due to strong electrostatic attractions between ions, while covalent bonds typically result in lower melting and boiling points due to weaker intermolecular forces.

Question: How is the chemical formula of hydrogen sulphide represented?

Answer: The chemical formula of hydrogen sulphide is  $\text{H}_2\text{S}$ , indicating two hydrogen atoms and one sulphur atom.

Question: How do optical fibers use total internal reflection?

Answer: Optical fibers transmit light signals over long distances with minimal loss of intensity by using total internal reflection.

Question: What is the purpose of using a compass in studying magnetic fields?

Answer: A compass helps visualize the direction of magnetic fields by showing the direction in which the compass needle aligns itself.

Question: How does the induced voltage waveform in an alternating current dynamo look?

Answer: The induced voltage waveform in an alternating current dynamo is sinusoidal, alternating between positive and negative values.

Question: What occurs when zinc reacts with hydrochloric acid?

Answer: Zinc reacts with hydrochloric acid, producing zinc chloride and hydrogen gas:  $\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$ . Bubbles of hydrogen are observed.

Question: What is the total displacement of an object with multiple segments of motion in the same direction?

Answer: The total displacement is the sum of the magnitudes of all the segments.

Question: How does the electrolysis of copper sulfate solution demonstrate the transfer of copper ions?

Answer: The electrolysis of copper sulfate solution demonstrates the transfer of  $\text{Cu}^{2+}$  ions from the anode to the cathode, where they are reduced and deposited as copper metal.

Question: What is the role of peroxisomes in detoxifying harmful substances?

Answer: Peroxisomes contain enzymes that detoxify harmful substances like hydrogen peroxide, converting them into water and oxygen, protecting the cell from oxidative damage.

Question: What material is commonly used in light-emitting diodes (LEDs)?

Answer: Gallium arsenide (GaAs) is commonly used in light-emitting diodes (LEDs).

Question: How do inherited characteristics vary within a species?

Answer: Inherited characteristics vary within a species due to the combination of different alleles, leading to a wide range of phenotypic variations among individuals.

Question: What are some examples of gymnosperms?

Answer: Examples of gymnosperms include Cycas and Pinus.

Question: What is Archimedes' principle and its significance?

Answer: Archimedes' principle states that when an object is partially or completely submerged in a fluid, the upthrust acting on it is equal to the weight of the fluid displaced by the object. It explains why objects float or sink.

Question: How does solvent extraction work for medicinal plants?

Answer: The plant parts are shaken with an organic solvent, dissolving the medicinal compounds, which are then separated by evaporating the solvent.

Question: How does the experiment with a U-tube and balloon demonstrate gas pressure?

Answer: The experiment shows that the pressure in the arm of the U-tube with the balloon (compressed air) is higher than in the other arm, causing the water levels to differ, demonstrating that compressed gas exerts pressure.

Question: What is the significance of the center of curvature in spherical mirrors?

Answer: The center of curvature is the center of the hypothetical sphere from which the mirror segment is derived, and it helps determine the curvature and focal properties of the mirror.

Question: What is the principle behind the operation of a hydraulic brake system?

Answer: A hydraulic brake system operates on Pascal's principle, transmitting pressure from the brake pedal through the brake fluid to apply force to the brake pads, stopping the vehicle.

Question: What are the three methods of heat transfer, and how do they operate?

Answer: The three methods of heat transfer are conduction, convection, and radiation. Conduction transfers heat through direct contact, convection transfers heat through fluid motion, and radiation transfers heat through

electromagnetic waves.

Question: How is the chemical formula of water written?

Answer: The chemical formula of water is  $\text{H}_2\text{O}$ , indicating two hydrogen atoms and one oxygen atom.

Question: What is the formula for the moment of a couple of forces in a given scenario?

Answer: The formula for the moment of a couple of forces is  $\text{Moment} = \text{Force} \times \text{Perpendicular distance between the lines of action of the two forces}$ .

Question: What is the effect of solvent polarity on the solubility of solutes?

Answer: Solvent polarity influences the solubility of solutes by determining the strength and type of interactions between solute and solvent molecules.

Question: How does a supercapacitor differ from a traditional capacitor?

Answer: A supercapacitor differs from a traditional capacitor by offering much higher capacitance and energy storage capability, achieved through electrostatic charge separation at the electrode-electrolyte interface, allowing rapid charging and discharging.

Question: What is the significance of a triple bond in a nitrogen ( $\text{N}_2$ ) molecule?

Answer: A triple bond in a nitrogen ( $\text{N}_2$ ) molecule involves the sharing of three pairs of electrons between two nitrogen atoms, resulting in a very strong and stable bond.

Question: How does the coil's position affect the electromotive force in an alternating current dynamo?

Answer: The electromotive force varies with the coil's position, reaching maximum values when the coil intersects the magnetic field lines perpendicularly.

Question: What are the potential benefits of personalized medicine?

Answer: Personalized medicine tailors medical treatments to an individual's genetic profile, improving the effectiveness of treatments, reducing side effects, and allowing for earlier diagnosis and prevention of diseases.

Question: What is the role of an electrolyte in a lithium-ion battery?

Answer: The electrolyte in a lithium-ion battery facilitates the movement of lithium ions between the anode and cathode during charging and discharging, enabling the electrochemical reactions that store and release energy.

Question: What is the significance of the F1 generation in Mendel's experiments?

Answer: The F1 generation showed the dominance of certain traits, with all offspring exhibiting the dominant trait, providing insight into the inheritance patterns of genes.

Question: How is the chemical formula of calcium oxide written?



Answer: The chemical formula of calcium oxide is  $\text{CaO}$ , indicating one calcium ion and one oxide ion.

Question: How does deforestation contribute to climate change?

Answer: Deforestation reduces the Earth's capacity to absorb carbon dioxide, leading to increased greenhouse gas levels in the atmosphere. It contributes to global warming and disrupts the carbon cycle.

Question: What is the primary function of carbohydrates?

Answer: The primary function of carbohydrates is to provide energy for the body's metabolic processes.

Question: What is the formula for the moment of a couple of forces?

Answer: The moment of a couple of forces is calculated as the product of one of the forces and the perpendicular distance between the lines of action of the two forces ( $\text{Moment} = \text{Force} \times \text{Perpendicular distance}$ ).

Question: How are branched and cross-linked polymers different from linear polymers?

Answer: Branched polymers have side chains attached to the main chain, while cross-linked polymers have polymer chains interconnected, providing different physical properties.

Question: What are the three methods of heat transfer?

Answer: The three methods of heat transfer are conduction, convection, and radiation.

Question: Explain the importance of cell division in tissue repair.

Answer: Cell division is crucial for tissue repair, as it replaces damaged or dead cells with new cells, maintaining tissue integrity and function.

Question: Describe the function of a residual current device (RCD).

Answer: A residual current device (RCD) detects imbalance between live and neutral currents and disconnects the circuit to prevent electric shocks.

Question: What is the displacement from A to B?

Answer: The displacement is 160 m to the east.

Question: What is the role of stomata in plants?

Answer: Stomata are small openings on the surface of leaves that regulate gas exchange and water loss, playing a crucial role in photosynthesis and respiration.

Question: Describe the equilibrium of a framed picture hanging on the wall.

Answer: The framed picture is in equilibrium because the tensions in the two strings balance the weight of the picture. The three forces are coplanar, and their lines of action intersect at a common point.

Question: How do step-up transformers work?

Answer: Step-up transformers increase the output voltage by having more turns in the secondary coil than in the primary coil.

Question: What happens when an object is subjected to an unbalanced force?

Answer: When an object is subjected to an unbalanced force, it experiences a change in motion, resulting in acceleration in the direction of the force.

Question: How is power calculated?

Answer: Power (P) = Work done (W) / Time (t).

Question: What is the role of lipids as an energy source?

Answer: Lipids act as an energy source, producing more energy during burning compared to carbohydrates and proteins.

Question: What is the difference between polar and non-polar covalent bonds?

Answer: Polar covalent bonds have an unequal sharing of electrons between atoms with different electronegativities, resulting in partial charges, while non-polar covalent bonds have equal sharing of electrons between atoms with similar electronegativities.

Question: What are some uses of sodium hydroxide in industries?

Answer: Sodium hydroxide is used in soap making, paper production, and petroleum refining.

Question: How is acceleration defined?

Answer: Acceleration is the rate of change of velocity.

Question: How much heat is required to increase the temperature of 2 kg of iron from 25°C to 65°C?

Answer: The heat required is 36,800 J, calculated using the formula  $Q = mc\Delta T = 2 \times 460 \times (65 - 25)$ .

Question: What is the function of vitamin C?

Answer: Vitamin C is important for keeping skin healthy, forming enamel, and synthesizing collagen fibers.

Question: What is the function of the androecium?

Answer: The androecium, the male reproductive structure, produces pollen in the anther, which contains the male gamete cells of the plant.

Question: What is the function of a sluice gate in a tank?

Answer: A sluice gate controls the release of water from the tank. It is built using large stones to withstand high water pressure and is designed to release water at different pressure levels to minimize damage to the tank bund.

Question: What are the four principal parts of a flower?

Answer: The four principal parts of a flower are the calyx, corolla, androecium (stamen), and gynoecium (pistil).

Question: How do you determine if a potential difference exists across a bulb in a circuit?

Answer: Use a voltmeter to measure the potential difference across the terminals of the bulb in the circuit.

Question: Materials required: - A small beaker, a piece of magnesium strip, dilute hydrochloric acid, a thermometer Method: - Add about 10 cm<sup>3</sup> of dilute hydrochloric acid to a small beaker and measure its temperature. Add a piece of magnesium ribbon about 2 cm long into it. Measure the temperature at the end of the reaction again. Record your observations. What materials are required for this Activity?  
Answer: A small beaker, a piece of magnesium strip, dilute hydrochloric acid, and a thermometer.

Question: What are autoimmune diseases?  
Answer: Autoimmune diseases occur when the immune system mistakenly attacks the body's own cells, causing inflammation and damage.

Question: What are the methods of releasing hydrocarbons into the environment?  
Answer: Methods of releasing hydrocarbons into the environment include bacterial activity on organic matter, the use of liquid petroleum and other fossil fuels, and the use of lubrication oil and grease.

Question: What adaptations do fruits dispersed by animals have?  
Answer: Fruits dispersed by animals have succulent edible parts, attractive colors, hooks or hairs for attachment, and shapes that attract animals.

Question: What is the significance of the direction of force?  
Answer: The direction of force is significant because it determines the direction of the resulting motion. Force has both magnitude and direction, making it a vector quantity.

Question: What is the function of a step-up transformer?  
Answer: A step-up transformer increases the output voltage, making it higher than the input voltage.

Question: What is an ecological footprint?  
Answer: An ecological footprint is a measure of the impact of human activities on the environment, expressed as the amount of land and water required to sustain those activities.

Question: What does a graph of voltage (V) against current (I) look like according to Ohm's Law?  
Answer: According to Ohm's Law, a graph of voltage (V) against current (I) is a straight line passing through the origin, indicating a linear relationship.

Question: How do plants store excess glucose produced during photosynthesis?  
Answer: Excess glucose is stored as starch in various plant parts, including leaves, stems, roots, and seeds.

Question: How does the induced current direction change during coil rotation in a dynamo?  
Answer: The induced current direction changes periodically, resulting in an alternating current as the coil rotates within the magnetic field.

Question: What is the trend in acidity and basicity of oxides in Period 3?

Answer: In Period 3, the acidity of oxides increases from left to right, while the basicity decreases. Sodium oxide is strongly basic, magnesium oxide is weakly basic, and the acidity increases from silicon dioxide to chlorine heptoxide.

Question: What measures can be taken to reduce the environmental impact of agrochemicals?

Answer: Measures include using organic fertilizers, practicing integrated pest management, adopting sustainable farming techniques, reducing chemical inputs, and promoting the use of natural alternatives.

Question: How do convex mirrors provide a wider field of view compared to plane mirrors?

Answer: Convex mirrors diverge light rays, allowing them to reflect a larger area than plane mirrors.

Question: What is the relationship between force and acceleration in Newton's second law?

Answer: The relationship is direct proportionality. If the force is increased or decreased by a certain ratio, the acceleration also increases or decreases by the same ratio.

Question: How do you calculate the mole fraction of water in a solution containing 10 mol of water and 1 mol of NaOH?

Answer: Mole fraction of water =  $10/11$ .

Question: How is mean speed calculated for a child walking from point A to point C via point B in 5 seconds?

Answer: Mean speed = Total distance / Total time.

Question: How do you investigate the effect of perpendicular distance on the moment of force using a stick and Newton balance?

Answer: Investigate the effect by attaching a loop and Newton balance to different points on the stick, applying a constant force, and measuring the distance required to initiate rotation.

Question: How do you prepare 500 cm<sup>3</sup> of a 1 mol/dm<sup>3</sup> glucose solution?

Answer: Weigh 90g of glucose and dissolve it in water to make the final volume 500 cm<sup>3</sup>.

Question: How is hydrogen gas used in the production of ammonia?

Answer: Hydrogen gas reacts with nitrogen in the Haber process to produce ammonia, which is used to manufacture fertilizers.

Question: What is the formula for calculating the moment due to a force in a given scenario?

Answer: The formula for calculating the moment due to a force is Moment = Force × Perpendicular distance from the rotational axis to the line of action of the force.

Question: Explain the operation of a voltage regulator.

Answer: A voltage regulator maintains a constant output voltage despite variations in input voltage or load conditions, ensuring stable power supply for electronic circuits.

Question: Calculate the amount of sulfuric acid ( $\text{H}_2\text{SO}_4$ ) in moles in 49 grams.

Answer: The amount of sulfuric acid in 49 grams is 0.5 moles, calculated as  $49/98 = 0.5$  moles.

Question: What is an endoscope and how does it work?

Answer: An endoscope is a medical instrument that uses optical fibers to observe internal organs by transmitting light and images through flexible fibers.

Question: How do sound waves propagate?

Answer: Sound waves propagate through air, liquids, or solids by causing particles in the medium to vibrate parallel to the direction of wave travel.

Question: What is the specific heat capacity of water, and why is it significant?

Answer: The specific heat capacity of water is  $4200 \text{ J kg}^{-1} \text{ K}^{-1}$ . It is significant because it allows water to absorb and store large amounts of heat, moderating temperature changes and making it useful in various applications.

Question: How do you determine the center of gravity of an object using the method described in the document?

Answer: Hang the object from different points and mark the vertical lines along the string. The point where these lines intersect is the center of gravity, where the weight of the object acts.

Question: How do lenses in cameras focus light?

Answer: Camera lenses adjust their curvature and position to focus light on the film or sensor, capturing clear images.

Question: How does a photovoltaic cell convert sunlight into electrical energy?

Answer: A photovoltaic cell converts sunlight into electrical energy by absorbing photons, which generate electron-hole pairs in the semiconductor material. The built-in electric field separates the charge carriers, creating a current flow and producing electricity.

Question: How do you calculate the total voltage in a series circuit?

Answer: The total voltage in a series circuit is the sum of the voltages across each component:  $V_{\text{total}} = V_1 + V_2 + V_3 + \dots$

Question: What changes occur in the fetus during the ninth month of development?

Answer: During the ninth month, the nails of the fingers are fully grown, testes descend into the scrotum, and the body shows a full-grown nature, weighing about 2-3 kg.

Question: What are the stages of the cell cycle?

Answer: The cell cycle consists of interphase (G1, S, G2 phases), where the cell grows and replicates its DNA, and mitotic phase (mitosis and cytokinesis), where the cell divides to form two daughter cells.

Question: How does a dry cell generate an electric current in a conductor?

Answer: A dry cell generates an electric current in a conductor by providing a potential difference between its positive and negative terminals, causing electrons to flow through the conductor.

Question: What are the three stages of respiration in humans?

Answer: The three stages are gas exchange between the external environment and lungs, gas exchange in alveoli, and cellular respiration.

Question: What is the equivalent resistance of three resistors with values  $20\ \Omega$ ,  $6\ \Omega$ , and  $12\ \Omega$  connected in parallel?

Answer: The equivalent resistance is  $\frac{1}{R} = \frac{1}{20\ \Omega} + \frac{1}{6\ \Omega} + \frac{1}{12\ \Omega}$ , so  $R \approx 3.04\ \Omega$ .

Question: How does the specific heat capacity of lead affect its use in shielding?

Answer: The low specific heat capacity of lead allows it to absorb and dissipate large amounts of heat, making it effective for use in radiation shielding and other high-temperature applications.

Question: What is coordination in the context of living organisms?

Answer: Coordination refers to the adaptation of body functions according to changes in the environment, facilitated by the nervous system, muscles, and hormones.

Question: How does tightening a screw affect the force required to initiate the turning effect on a stick?

Answer: Tightening the screw increases the force required to initiate the turning effect on the stick, confirming that the moment depends on the magnitude of the force.

Question: What happens when a p-n junction is forward biased?

Answer: When a p-n junction is forward biased, the positive potential is applied to the p-type and the negative potential to the n-type, reducing the depletion region and allowing current to flow across the junction.

Question: Explain the significance of using three-pin plugs for electric appliances.

Answer: Three-pin plugs provide an earth connection, enhancing safety by preventing electric shocks from faulty appliances.

Question: What is the significance of DNA in living organisms?

Answer: DNA contains the genetic information that determines the characteristics of living organisms, guiding their growth, development, and functioning.

Question: How do you calculate the pressure at a depth in a liquid?

Answer: Pressure ( $P$ ) at a depth is calculated using the formula:  $P = h\rho g$ , where  $h$  is the height of the liquid column,  $\rho$  is the density of the liquid, and

$g$  is gravitational acceleration.

Question: How does the frequency of a sound wave affect its wavelength?

Answer: Higher frequency sound waves have shorter wavelengths, while lower frequency waves have longer wavelengths.

Question: What is the principle behind the operation of a bicycle dynamo?

Answer: The principle behind a bicycle dynamo is electromagnetic induction, where mechanical rotation induces an electromotive force in the coil.

Question: What are the key features of reptiles (Reptilia)?

Answer: Reptiles have dry skin with scales, pentadactyle limbs, a heart with two atria and an incompletely divided ventricle, lungs for respiration, and are cold-blooded with internal fertilization.

Question: What is the importance of chlorophyll in plants?

Answer: Chlorophyll allows plants to absorb light energy and produce food through photosynthesis.

Question: How do inhibitors influence chemical reactions?

Answer: Inhibitors decrease the rate of chemical reactions by interfering with the reactant collisions, making reactions slower.

Question: How does an LED produce light?

Answer: An LED produces light through electroluminescence, where electrons recombine with holes in the semiconductor material, releasing energy as photons.

Question: What is the venation pattern in dicot leaves?

Answer: Dicot leaves possess reticulate venation.

Question: How do you determine the center of gravity of an object using a thin rectangular lamina and a string?

Answer: Hang the object from different points and mark the vertical lines along the string. The point where these lines intersect is the center of gravity, where the weight of the object acts.

Question: How do bats use ultrasound waves to avoid obstacles while flying?

Answer: Bats emit ultrasound waves that reflect back from obstacles, allowing them to judge the position of the obstacles and navigate safely.

Question: What is the role of the lymphatic system in the body?

Answer: The lymphatic system returns excess tissue fluid to the bloodstream, filters lymph through lymph nodes, and aids in immune defense.

Question: How do geneticists use pedigrees to study inheritance?

Answer: Geneticists use pedigrees to trace the inheritance of traits through families, helping to identify patterns of inheritance and predict the likelihood of genetic disorders in future generations.

Question: How are organisms classified into groups?

Answer: Organisms are classified into groups to make it easier to study them, identify specific characteristics, understand the biosphere, reveal relationships between groups, and identify organisms with economic uses.

Question: How does a U-magnet create a uniform magnetic field for experiments?

Answer: The U-shape focuses the magnetic field between the poles, providing a strong, uniform field for studying electromagnetic effects.

Question: How does the density of an object affect its buoyancy in a fluid?

Answer: An object will float if its density is less than the density of the fluid it is submerged in, as the buoyant force will be greater than the object's weight.

Question: What factors affect the force acting on a current-carrying conductor in a magnetic field?

Answer: The force is directly proportional to the current flowing through the conductor, the length of the conductor, and the strength of the magnetic field.

Question: What is the purpose of an energy meter in households?

Answer: An energy meter measures the amount of electrical energy consumed by household appliances, providing data for billing and energy management.

Question: Where are electrons found in an atom?

Answer: Electrons are found rotating around the nucleus of an atom.

Question: What is the role of the armature in a DC motor?

Answer: The armature generates rotational motion by interacting with the magnetic field when current flows through its coils.

Question: What energy transformation occurs in a loudspeaker?

Answer: In a loudspeaker, electrical energy is transformed into sound energy.

Question: What is the significance of chromosomes?

Answer: Chromosomes store genetic material and transfer inherited characters from generation to generation. The number of chromosomes is specific to a species.

Question: What are the three major stages of a cardiac cycle?

Answer: Diastole, systole, and the intervening phase.

Question: What is the significance of solubility in the development of nanomaterials?

Answer: Solubility is significant in the development of nanomaterials for controlling particle size, dispersion, and stability in various solvents, enabling applications in medicine, electronics, and materials science.

Question: What are the characteristics of liquid pressure?



Answer: Liquid pressure depends on the height of the liquid column, is the same at the same level, acts in all directions, and does not depend on the shape of the liquid column.

Question: What is the significance of genetic drift in small populations?

Answer: Genetic drift is a random process that can lead to significant changes in allele frequencies in small populations, potentially reducing genetic diversity and increasing the risk of inbreeding and genetic disorders.

Question: What is the relative molecular mass of ammonia (NH<sub>3</sub>)?

Answer: The relative molecular mass of ammonia is 17, calculated as 14 for nitrogen plus 3 x 1 for hydrogen.

Question: How do you achieve equilibrium in an object under the action of two equal and opposite forces?

Answer: Achieve equilibrium by ensuring that the forces have equal magnitudes, act in opposite directions, and lie along the same line of action, resulting in no net force.

Question: What are amphoteric oxides?

Answer: Amphoteric oxides are oxides that show both acidic and basic properties, such as aluminium oxide.

Question: What is a heteroatomic molecule?

Answer: A heteroatomic molecule is a molecule consisting of atoms of different elements, such as H<sub>2</sub>O, CH<sub>4</sub>, and NH<sub>3</sub>.

Question: What is the function of a rectifier diode in power supplies?

Answer: A rectifier diode converts AC to DC by allowing current to flow in only one direction, providing the necessary DC voltage for electronic devices.

Question: How does the electronic configuration of an atom influence its chemical behavior?

Answer: The electronic configuration of an atom influences its chemical behavior by determining the stability of its valence shell and its tendency to gain, lose, or share electrons to achieve a stable configuration.

Question: What is the significance of the direction of rotation in determining the moment of force?

Answer: The direction of rotation determines whether the moment of force is classified as clockwise or anti-clockwise, influencing the net rotational effect on the object.

Question: What are the signs and symptoms of renal cysts?

Answer: Symptoms of renal cysts include pain in the back or side, high blood pressure, blood in urine, and frequent urination.

Question: What is the chemical formula for copper sulfate?

Answer: The chemical formula for copper sulfate is CuSO<sub>4</sub>.

Question: What is a homoatomic molecule?

Answer: A homoatomic molecule is a molecule consisting of atoms of the same element, such as H<sub>2</sub>, O<sub>2</sub>, and N<sub>2</sub>.

Question: How does the use of renewable energy sources enhance the sustainability of electrochemical processes?

Answer: The use of renewable energy sources enhances the sustainability of electrochemical processes by providing clean and abundant energy, reducing reliance on fossil fuels, lowering carbon emissions, and enabling the development of environmentally friendly technologies.

Question: Explain how energy is conserved in a closed system.

Answer: In a closed system, energy is conserved as it transforms from one form to another, with the total energy remaining constant.

Question: Explain the formation and characteristics of a p-n junction, including the depletion region and potential barrier.

Answer: A p-n junction is formed by joining p-type and n-type semiconductors, creating a unique electrical interface with distinct properties.

Formation:

- p-type Semiconductor: Contains an abundance of holes (positive charge carriers) due to doping with group III elements.
- n-type Semiconductor: Contains an abundance of free electrons (negative charge carriers) due to doping with group V elements.

Junction Creation: When a p-type and n-type semiconductor are brought together, a p-n junction is formed at the interface.

Characteristics:

- Depletion Region: Formation: At the junction, free electrons from the n-type region diffuse into the p-type region and recombine with holes, leaving behind positively charged donor ions in the n-region and negatively charged acceptor ions in the p-region. Depletion Zone: This creates a region around the junction where no free charge carriers exist, known as the depletion region. Charge Distribution: The depletion region has immobile ions, creating an electric field that opposes further diffusion of charge carriers. Potential Barrier: Formation: The electric field in the depletion region creates a potential difference across the junction, known as the potential barrier. Magnitude: The potential barrier for silicon p-n junctions is typically about 0.7 V, while for germanium it is about 0.3 V. Function: The potential barrier prevents further movement of electrons and holes across the junction, maintaining equilibrium.
- Electrical Behavior: Forward Bias: When a forward voltage (positive to p-type, negative to n-type) is applied across the junction, the potential barrier is reduced, allowing current to flow as electrons and holes move towards the junction and recombine. Reverse Bias: When a reverse voltage (negative to p-type, positive to n-type) is applied, the potential barrier increases, widening the depletion region and preventing current flow except for a small leakage current.

Question: What is the electronic configuration of chlorine?

Answer: The electronic configuration of chlorine is 2, 8, 7.

Question: How does air pollution impact climate change?

Answer: Air pollution contributes to climate change by releasing greenhouse gases such as carbon dioxide, methane, and nitrous oxide into the atmosphere. These gases trap heat and increase global temperatures.

Question: How is velocity different from speed?

Answer: Velocity is a vector quantity that includes both magnitude and direction, whereas speed is a scalar quantity with only magnitude.

Question: How is the chemical formula of calcium chloride written?

Answer: The chemical formula of calcium chloride is  $\text{CaCl}_2$ , indicating one calcium ion and two chloride ions.

Question: How do you calculate the pressure exerted by a liquid column?

Answer: The pressure exerted by a liquid column is calculated using the formula:  $P = h\rho g$ , where  $h$  is the height of the column,  $\rho$  is the density of the liquid, and  $g$  is gravitational acceleration.

Question: How do you balance a uniform rod with different weights suspended at varying distances from the pivot?

Answer: Balance the rod by ensuring that the clockwise moments due to the weights on one side equal the anti-clockwise moments due to the weights on the other side, achieving equilibrium.

Question: What is the equivalent resistance of a circuit with a  $10\ \Omega$  resistor and a  $5\ \Omega$  resistor connected in parallel, followed by a  $15\ \Omega$  resistor in series?

Answer: The equivalent resistance of the parallel combination is  $1/\frac{1}{10} + \frac{1}{5} = 1/10 + 1/5\ \Omega$ , so  $\frac{1}{R} = 3.33\ \Omega$ . The total equivalent resistance is  $3.33\ \Omega + 15\ \Omega = 18.33\ \Omega$ .

Question: Explain the working principle and components of a bicycle dynamo, and describe the energy transformation that takes place.

Answer: A bicycle dynamo is a device that converts mechanical energy into electrical energy using the principles of electromagnetic induction. The main components of a bicycle dynamo include a cylindrical magnet, a coil of wire wound around a soft iron core, and a rough head that contacts the bicycle tire. Working Principle: Rotation: As the bicycle wheel rotates, the rough head of the dynamo, which is in contact with the tire, also rotates. Magnetic Field: This rotation causes the cylindrical magnet attached to the rough head to spin, creating a changing magnetic field. Electromagnetic Induction: The changing magnetic field induces an electromotive force (emf) in the coil wound around the soft iron core. Current Generation: The induced emf generates an alternating current (AC) in the coil, which is used to power the bicycle lamp. Energy Transformation: The dynamo converts the mechanical energy of the rotating bicycle wheel into electrical energy through electromagnetic induction. The brightness of the bicycle lamp increases with the speed of the bicycle because a faster rotation of the magnet results in a higher rate of change of the magnetic field, thus inducing a larger emf and generating a greater current.

Question: What are the potential health risks of untreated urinary tract infections (UTIs)?

Answer: Untreated UTIs can lead to kidney infections, sepsis, and long-term kidney damage.

Question: How do you apply a couple of forces to rotate an object without a pivot point?

Answer: To rotate an object without a pivot point, apply two equal and opposite forces along lines of action that are spaced apart. The object will rotate around a point between the forces.

Question: How does the reaction between iron and steam demonstrate the reactivity of metals?

Answer: Iron reacts with steam to form iron oxide and hydrogen gas, indicating its reactivity with water vapor:  $3\text{Fe} + 4\text{H}_2\text{O} \rightarrow \text{Fe}_3\text{O}_4 + 4\text{H}_2$ .

Question: How does changing the direction of current affect the magnetic field?

Answer: Changing the current direction reverses the direction of the magnetic field around the conductor.

Question: What are the key features of Annelids?

Answer: Annelids are triploblastic, live in damp soil, marine, and freshwater habitats, have segmented bodies, bilateral symmetry, a coelom, and reproduce both asexually and sexually.

Question: What is the displacement during the first 6 seconds of motion for an object that acquires a velocity of 15 m/s?

Answer: Displacement =  $\frac{1}{2} \times 15 \text{ m/s} \times 6 \text{ s} = 45 \text{ meters}$ .

Question: What happens to gases dissolved in water when the water is heated?

Answer: When water is heated, dissolved gases are released, indicating that the solubility of gases in water decreases with an increase in temperature.

Question: How does the concentration of the electrolyte affect electrolysis?

Answer: The concentration of the electrolyte affects the rate of electrolysis. Higher concentrations generally increase the rate of ion migration and reaction rates, while very low concentrations can limit ion availability and reduce efficiency.

Question: How does a solar inverter convert energy from solar panels?

Answer: A solar inverter converts the DC electricity generated by solar panels into AC electricity, making it compatible with the power grid and household appliances.

Question: What is the relationship between force magnitude and the moment of force in rotational motion?

Answer: The moment of force in rotational motion is directly proportional to the magnitude of the applied force. An increase in force results in a larger moment, making it easier to rotate the object.

Question: How does the electronic configuration of carbon influence its ability to form multiple covalent bonds?

Answer: The electronic configuration of carbon (2, 4) allows it to form multiple covalent bonds by sharing its four valence electrons with other atoms, enabling the formation of a wide variety of organic compounds.

Question: What is the unit used to measure potential difference?

Answer: The unit used to measure potential difference is the Volt (V).

Question: What is the resultant force of two parallel forces of 8 N and 16 N?

Answer: The resultant force is 24 N.

Question: How does the process of osmosis facilitate water absorption in plants?

Answer: Osmosis allows water to move from areas of higher concentration in the soil to areas of lower concentration in the root hairs, enabling water absorption.

Question: How does the use of renewable energy sources support energy security?

Answer: Renewable energy sources diversify the energy supply, reduce dependence on fossil fuels, and increase resilience to energy price fluctuations. They support energy security and sustainability.

Question: What is the structural unit of the nervous system?

Answer: The neuron.

Question: What is static electricity?

Answer: Static electricity consists of charges that are deposited on the surfaces of insulators and do not flow.

Question: What is the direction of the magnetic field around a conductor with an upward current flow?

Answer: The magnetic field around a conductor with an upward current flow is in an anti-clockwise direction.

Question: What are conductors?

Answer: Conductors are materials that allow a current of electrons to pass easily through them.

Question: What are anemophilous flowers?

Answer: Anemophilous flowers are pollinated by wind and produce large amounts of small, light pollen with branched stigmas to facilitate wind pollination.

Question: What is pressure in the context of physical forces?

Answer: Pressure is the force acting on a unit area. It is calculated as the perpendicular force applied (F) divided by the area (A).

Question: What type of image is formed by a convex lens when the object distance is greater than twice the focal length?

Answer: A real, inverted, and smaller image is formed between the focal length and twice the focal length on the opposite side.

Question: What are some useful effects of protists to humans?

Answer: Useful effects of protists include acting as primary producers in aquatic food chains, forming mutualistic associations with fungi, and extracting agar for culture media and alginic acid for making ice cream.

Question: How do geneticists study the genetic basis of aging?

Answer: Geneticists study the genetic basis of aging by identifying genes associated with longevity and age-related diseases, investigating the molecular pathways involved in aging, and exploring the interactions between genetics and environmental factors that influence aging.

Question: What are the advantages of using solid-state electrolytes in batteries?

Answer: Solid-state electrolytes in batteries offer advantages like improved safety, higher energy density, longer cycle life, and the potential for flexible and lightweight designs, making them suitable for advanced energy storage applications.

Question: How does Newton's second law apply to pushing a car?

Answer: When pushing a car, the force applied by the person determines the car's acceleration. The mass of the car and the applied force determine the car's motion according to Newton's second law.

Question: What factors determine the magnitude of induced voltage in a coil?

Answer: Factors determining the magnitude of induced voltage include the number of coil turns, magnetic field strength, and speed of motion.

Question: What are the features of vertebrates in the class Pisces?

Answer: Vertebrates in the class Pisces have a bony or cartilaginous endoskeleton, streamlined bodies, scales, fins for swimming, a lateral line system for detecting vibrations, a two-chambered heart, gills for respiration, and are cold-blooded.

Question: What occurs at the anode and cathode of an electrochemical cell?

Answer: At the anode, oxidation occurs where electrons are lost by a species. At the cathode, reduction occurs where electrons are gained by a species.

Question: How does the structure of ionic compounds affect their melting and boiling points?

Answer: The structure of ionic compounds, with strong electrostatic forces between oppositely charged ions, results in high melting and boiling points due to the large amount of energy required to break these forces.

Question: What is the role of environmental policies in mitigating climate change?

Answer: Environmental policies play a role in mitigating climate change by regulating greenhouse gas emissions, promoting renewable energy, encouraging energy efficiency, and supporting conservation efforts.

Question: What are the potential risks and benefits of genetically modified organisms (GMOs)?

Answer: Potential benefits of GMOs include increased crop yields, improved nutritional content, and resistance to pests and diseases. Potential risks include environmental impacts, the development of resistance in pests, and ethical concerns about altering the genetic makeup of organisms.

Question: What is a physical change?

Answer: A physical change involves changes in the physical state or arrangement of particles without forming new substances, such as melting ice or boiling water.

Question: How does the specific heat capacity of a substance influence its thermal properties?

Answer: The specific heat capacity of a substance influences its thermal properties by determining how much heat it can absorb or release for a given temperature change, affecting its suitability for various applications.

Question: How does temperature affect the resistance of a nichrome wire coil?

Answer: The resistance of a nichrome wire coil increases with temperature. It is essential to maintain a constant temperature to accurately measure resistance.

Question: What is the importance of understanding electromagnetism in technology?

Answer: Understanding electromagnetism is crucial for designing and operating various devices, including motors, generators, transformers, and medical imaging equipment.

Question: How does the epiglottis function during swallowing?

Answer: The epiglottis closes the trachea during swallowing, preventing food from entering the respiratory tract and directing it into the esophagus.

Question: What is the carbon cycle?

Answer: The carbon cycle is the process by which carbon is exchanged between the atmosphere, land, water, and living organisms.

Question: What are the uses of Acetic acid?

Answer: Acetic acid is used in food processing (vinegar), coagulating rubber latex, producing photographic films, and in the paper and textile industries.

Question: How do calcium and carbonate ions combine to form calcium carbonate?

Answer: Calcium ions ( $\text{Ca}^{2+}$ ) and carbonate ions ( $\text{CO}_3^{2-}$ ) combine through electrostatic attraction to form calcium carbonate ( $\text{CaCO}_3$ ) with ionic bonds.

Question: What is a bridge type rectifier circuit used for?

Answer: A bridge type rectifier circuit is used to supply voltage correctly to an electronic appliance regardless of how the battery is connected to the circuit.

Question: What elements are present in lipids?

Answer: Lipids contain Carbon, Hydrogen, and Oxygen.

Question: Describe the role and functioning of a commutator in a DC motor, including its importance for motor operation.

Answer: The commutator is a crucial component in a DC motor that ensures the continuous rotation of the armature by periodically reversing the direction of current flow through the armature windings. Structure: The commutator consists of two split rings connected to the ends of the armature coil. It rotates with the armature and maintains contact with stationary brushes that supply current. Functioning: When the armature rotates, the commutator segments come into contact with the brushes, which are connected to the external power supply. As the armature rotates through 180 degrees, the split rings switch contacts with the brushes, reversing the current direction in the coil. This switching ensures that the forces on opposite sides of the armature continue to push in the same rotational direction, maintaining continuous rotation. Importance: The commutator converts the supplied DC into alternating current within the armature windings, aligning the magnetic forces to produce continuous torque. Without the commutator, the armature would oscillate back and forth rather than rotate continuously, making it essential for the smooth operation of the motor. The commutator's role in reversing current direction ensures the effective conversion of electrical energy into mechanical energy, enabling the DC motor to perform useful work.

Question: What are the features of invertebrates in the phylum Arthropoda?

Answer: Invertebrates in the phylum Arthropoda are triploblastic, coelomic, have jointed limbs, segmented bodies forming functional segments called Tagma, a chitinous cuticle acting as an exoskeleton, bilateral symmetry, and show sexual dimorphism.

Question: What is the stationary phase of population growth?

Answer: The stationary phase is when the number of organisms in a population stabilizes at the carrying capacity, balancing birth and death rates.

Question: What is the role of carbon brushes in an alternating current dynamo?

Answer: Carbon brushes maintain contact with the rotating brushing rings, allowing current to flow to the external circuit without wearing out quickly.

Question: What is the momentum of a 750 g object moving at 8 m/s?

Answer: The momentum is  $p = m \times v = 0.75 \times 8 = 6 \text{ kg m/s}$ .

Question: What is the structure of cartilage tissue?

Answer: Cartilage tissue consists of chondrocytes embedded in a flexible matrix of collagen and elastic fibers, providing support and flexibility to various parts of the body.

Question: What is the role of hydrogen gas in the production of margarine?

Answer: Hydrogen gas is used in the hydrogenation of vegetable oils to produce margarine, converting unsaturated fats to saturated fats.

Question: What is the effect of two equal and opposite forces acting on an object in terms of rotation?

Answer: Two equal and opposite forces acting on an object create a couple of forces, causing the object to rotate around a point between the two



forces without causing linear motion.

Question: What is the significance of the periodic classification of elements?

Answer: The periodic classification helps in organizing the vast information about elements and their compounds, making it easier to study and understand their properties.

Question: How does the magnetic field around a solenoid differ from that around a straight conductor?

Answer: The magnetic field inside a solenoid is uniform and parallel, while the field around a straight conductor forms concentric circles.

Question: What are the deficiency symptoms of vitamin E?

Answer: Deficiency symptoms of vitamin E include premature births, increased rate of breaking down of red blood cells, and weaknesses in cell division and reproduction.

Question: How much heat is required to increase the temperature of 0.8 kg of aluminium from 30°C to 50°C?

Answer: The heat required is 14,400 J, calculated using the formula  $Q = mc\Delta T = 0.8 \times 900 \times (50 - 30)$ .

Question: How is carbon dioxide gas prepared in the laboratory?

Answer: Carbon dioxide gas is prepared by reacting calcium carbonate with dilute hydrochloric acid and collecting the gas by downward displacement of water or upward displacement of air.

Question: What is the trend in atomic radius down a group?

Answer: The atomic radius increases down a group.

Question: What is the effect of coil windings on the magnetic field in a DC motor?

Answer: More coil windings increase the magnetic field strength, enhancing the motor's torque and overall performance.

Question: What are the uses of oxygen gas in medicine?

Answer: Oxygen gas is used to support respiration in critically ill patients, during surgery, and in oxygen therapy for various medical conditions.

Question: How does water function as a coolant?

Answer: Water functions as a coolant due to its high specific heat capacity, preventing rapid fluctuations in body temperature with changes in the environment.

Question: What is the power output if 600 J of work is done in 10 seconds?

Answer: The power output is 60 Watts (W).

Question: How is the chemical formula of calcium oxide written?

Answer: The chemical formula of calcium oxide is CaO, indicating one calcium ion and one oxide ion.

Question: What is the Nernst equation, and how is it used in electrochemistry?

Answer: The Nernst equation relates the cell potential to the concentrations of reactants and products, allowing the calculation of cell potential under non-standard conditions. It is given by  $E = E^\circ - (RT/nF) \ln(Q)$ , where  $E$  is the cell potential,  $E^\circ$  is the standard cell potential,  $R$  is the gas constant,  $T$  is the temperature,  $n$  is the number of electrons,  $F$  is the Faraday constant, and  $Q$  is the reaction quotient.

Question: What is the significance of the latent heat of vaporization in phase change processes?

Answer: The latent heat of vaporization is significant in phase change processes because it quantifies the energy required to convert a liquid into a gas at its boiling point, providing insight into the energy dynamics of phase transitions.

Question: What is the work done in lifting a 3 kg object to a height of 4 m?

Answer: The work done is 120 Joules (J).

Question: How does a photodiode convert light into electrical current?

Answer: A photodiode generates electron-hole pairs when exposed to light, creating a current proportional to the light intensity, used in light detection and solar energy applications.

Question: Why is the zinc electrode considered the negative terminal in a zinc-copper electrochemical cell?

Answer: The zinc electrode is considered the negative terminal because zinc atoms lose electrons (oxidation) and these electrons accumulate on the zinc strip, making it negatively charged.

Question: How does the curvature of a lens affect its image formation?

Answer: The curvature determines the focal length and the degree to which light rays are converged or diverged, affecting image size and clarity.

Question: What are the different types of consumers in an ecosystem?

Answer: Consumers in an ecosystem are classified into primary consumers (herbivores), secondary consumers (carnivores and omnivores), and tertiary consumers (carnivores).

Question: What does a straight line with a positive slope on a velocity-time graph represent?

Answer: It represents uniform acceleration.

Question: What is colour blindness, and how is it inherited?

Answer: Colour blindness, particularly red-green colour blindness, is a sex-linked inherited disorder caused by a recessive gene on the X chromosome. Affected individuals cannot distinguish between red and green colours.

Question: How is the chemical formula of calcium chloride represented?

Answer: The chemical formula of calcium chloride is  $\text{CaCl}_2$ , indicating one calcium ion and two chloride ions.

Question: How do viruses evade the immune system?

Answer: Viruses evade the immune system by rapidly mutating, hiding within host cells, and disrupting immune responses, making it challenging for the body to detect and eliminate them.

Question: What is the function of DNA?

Answer: DNA transfers genetic characteristics from generation to generation.

Question: How does the direction of the applied force affect the velocity of an object?

Answer: The direction of the applied force determines the change in velocity. A force applied in the direction of motion increases velocity, while a force applied opposite to the direction of motion decreases velocity.

Question: What is the function of the corpus luteum in the menstrual cycle?

Answer: The corpus luteum forms from the remains of the graafian follicle after ovulation and secretes progesterone to maintain the uterine lining for potential pregnancy.

Question: Why is it important to disconnect appliances during lightning strikes?

Answer: Disconnecting appliances during lightning strikes prevents potential damage from power surges and reduces the risk of electrical fires.

Question: Explain how velocity is a vector quantity.

Answer: Velocity is a vector quantity because it has both magnitude and direction, indicating the rate of change of displacement in a specific direction.

Question: How does solubility affect the distribution of chemicals in the environment?

Answer: Solubility affects the distribution, transport, and bioavailability of chemicals in the environment, influencing their ecological impact and persistence.

Question: What is the importance of understanding electromagnetism in technology development?

Answer: Understanding electromagnetism is crucial for designing and operating various devices, including motors, generators, transformers, and medical equipment.

Question: What is the importance of dispersal of fruits and seeds?

Answer: Dispersal minimizes competition for resources, finds new habitats, increases diversity, and provides protection from pests and diseases.

Question: What are essential oils?

Answer: Essential oils are volatile compounds obtained from plant materials, responsible for their characteristic aroma.

Question: How does the concept of heat capacity relate to the heat change in a reaction?

Answer: Heat capacity determines the amount of heat needed to change the temperature of a substance, affecting the overall heat change in the reaction.

Question: How is the compound sodium chloride (NaCl) formed?

Answer: Sodium chloride (NaCl) is formed by the electrostatic attraction between positively charged sodium ions (Na<sup>+</sup>) and negatively charged chloride ions (Cl<sup>-</sup>).

Question: What measures can be taken to avoid CKD?

Answer: Measures to avoid CKD include refraining from using agrochemicals, maintaining a wholesome lifestyle to control diabetes and high blood pressure, minimizing frequent urine infections, drinking 3.5-4.5 liters of clean water daily, receiving medical treatment for skin allergies promptly, avoiding improper use of painkillers, and abstaining from liquor and smoking.

Question: How do you determine the equilibrium of an object under the action of two forces using a ring and spring balances?

Answer: Attach the spring balances to the ring and pull in opposite directions with varying forces. The object remains in equilibrium when the forces are equal in magnitude and opposite in direction, resulting in no net movement.

Question: What are the three widely used temperature scales?

Answer: The three widely used temperature scales are Celsius, Fahrenheit, and Kelvin.

Question: What is the balanced chemical equation for the reaction between sodium and chlorine?

Answer: The balanced chemical equation for sodium reacting with chlorine is:  $2\text{Na} + \text{Cl}_2 \rightarrow 2\text{NaCl}$ .

Question: What is the formula for calculating average speed?

Answer: Average speed = Total Distance / Total Time

Question: How does the induced voltage waveform in an alternating current dynamo look?

Answer: The induced voltage waveform in an alternating current dynamo is sinusoidal, alternating between positive and negative values.

Question: How does Newton's third law apply to swimming?

Answer: In swimming, the swimmer pushes water backwards with their hands (action), and the water pushes the swimmer forward with an equal and opposite force (reaction).

Question: Describe the reactivity of magnesium with hot water.

Answer: Magnesium reacts with hot water to form magnesium hydroxide and hydrogen gas:  $\text{Mg} + 2\text{H}_2\text{O} \rightarrow \text{Mg(OH)}_2 + \text{H}_2$ .

Question: How is iron extracted from its ore?

Answer: Iron is extracted from haematite (Fe<sub>2</sub>O<sub>3</sub>) in a blast furnace by reducing the ore with carbon monoxide, producing molten iron and slag.

Question: What changes occur in the fetus during the eighth month of development?

Answer: During the eighth month, subcutaneous fat begins to deposit and the fetus weighs about 2 kg.

Question: How does the curvature of a concave mirror affect its ability to focus light?

Answer: The curvature determines the focal length, with greater curvature resulting in a shorter focal length and stronger focusing ability.

Question: What are the properties of strong bases?

Answer: Strong bases completely ionize in water, releasing a high concentration of hydroxyl ions (OH<sup>-</sup>).

Question: How do geneticists study the function of non-coding DNA?

Answer: Geneticists study the function of non-coding DNA by analyzing its role in regulating gene expression, investigating its involvement in chromatin structure, and identifying non-coding RNAs that play crucial roles in cellular processes.

Question: What is chloroethene, and what is its structure?

Answer: Chloroethene is a derivative of ethene where one hydrogen atom is replaced by a chlorine atom, with the formula C<sub>2</sub>H<sub>3</sub>Cl and a structure where the double bond remains between the carbon atoms.

Question: How does the electrolysis of acidulated water demonstrate the decomposition of water?

Answer: The electrolysis decomposes water into hydrogen and oxygen gases, demonstrating the breakdown of water molecules.

Question: How does the reactivity of metals with hydrochloric acid vary among magnesium, zinc, and iron?

Answer: Magnesium reacts vigorously, zinc reacts moderately, and iron reacts slowly with hydrochloric acid, forming their respective chlorides and hydrogen gas:  $\text{Mg} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$ ;  $\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$ ;  $\text{Fe} + 2\text{HCl} \rightarrow \text{FeCl}_2 + \text{H}_2$ .

Question: What is a single displacement reaction? Provide an example.

Answer: A single displacement reaction involves an element displacing another element in a compound, forming a new compound. An example is zinc displacing copper from copper sulfate:  $\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$ .

Question: What is the role of Newton's third law in the formation of a force couple?

Answer: Newton's third law states that for every action force, there is an equal and opposite reaction force. This principle is applied in the formation of a force couple, where the reaction force at the pivot creates the couple.

Question: Describe the role of smooth muscle tissue in the digestive system.

Answer: Smooth muscle tissue in the digestive system contracts rhythmically, moving food through the digestive tract and aiding in

digestion and absorption.

Question: What is the function of a voltage comparator in electronic circuits?

Answer: A voltage comparator compares two input voltages and outputs a signal indicating which input is higher, used in applications like zero-crossing detectors and level shifters.

Question: What does an energy level diagram for an exothermic reaction show?

Answer: It shows that the energy contained in the products is less than the energy content of the reactants, indicating energy is released.

Question: How does the first ionisation energy vary within a group?

Answer: The first ionisation energy generally decreases down a group.

Question: Explain the significance of impedance matching in RF circuits.

Answer: Impedance matching ensures maximum power transfer and minimizes signal reflection in RF circuits by matching the impedance of the source and load, optimizing performance.

Question: What is herpes?

Answer: Herpes is a viral STD caused by Herpes simplex, characterized by painful blisters on sex organs and nervous system inactivation. It has no permanent cure but is not fatal.

Question: How do vibrations in the air produce sound waves?

Answer: Vibrations in the air cause particles to oscillate, creating compressions and rarefactions that propagate as sound waves.

Question: Describe the process of electrochemical reduction of carbon dioxide to useful chemicals.

Answer: The electrochemical reduction of carbon dioxide involves converting CO<sub>2</sub> into valuable chemicals like methane, ethylene, or formic acid using an electrochemical cell with suitable catalysts. This process offers a sustainable approach to utilizing CO<sub>2</sub> as a feedstock.

Question: How does the wavelength of light influence photosynthetic activity?

Answer: Different wavelengths of light affect photosynthetic activity, with red and blue light being most effective for chlorophyll absorption and photosynthesis.

Question: What are some international conventions for environmental management?

Answer: International conventions for environmental management include the Montreal Protocol to control ozone-depleting gases and the Kyoto Protocol to minimize greenhouse gas emissions. These agreements aim to protect the environment and mitigate climate change.

Question: How is pure gold obtained from a gold amalgam?

Answer: By heating the gold amalgam, which causes mercury to evaporate, leaving behind pure gold.

Question: How does the length of a conductor affect the magnetic force on it?

Answer: A longer conductor experiences a greater magnetic force, as the force is directly proportional to the conductor's length.

Question: What changes occur in the fetus during the fifth month of development?

Answer: During the fifth month, the fetus is completely covered with hair, the mother can feel fetal movements, and the fetal heartbeat can be observed.

Question: If an object travels at  $3 \text{ m/s}^2$  acceleration for 4 seconds, what is the final velocity?

Answer: Final velocity =  $3 \text{ m/s}^2 \times 4 \text{ s} = 12 \text{ m/s}$ .

Question: How is concentration expressed in terms of moles/volume (n/v)?

Answer: Concentration is given as the amount of moles of solute per cubic decimeter of the solution.

Question: What is the significance of the vertical line passing through the center of gravity in maintaining equilibrium?

Answer: The vertical line passing through the center of gravity indicates the line of action of the weight. For equilibrium, the lines of action of other forces must intersect this vertical line and lie in the same plane.

Question: What components are essential for the operation of a bicycle dynamo?

Answer: Essential components of a bicycle dynamo include the rotating coil, magnetic field, mechanical connection to the tire, and electrical circuit.

Question: What is the role of thermal radiation in heat transfer from the sun?

Answer: Thermal radiation is the primary method of heat transfer from the sun, allowing heat to travel through the vacuum of space as electromagnetic waves and warm the earth's surface.

Question: How do concave lenses form images?

Answer: Concave lenses diverge light rays, creating virtual, upright, and smaller images of objects.

Question: How does the boiling point of water compare to the boiling points of most essential oils?

Answer: Most essential oils have boiling points higher than that of water.

Question: How does the diaphragm in a moving coil microphone respond to sound?

Answer: The diaphragm vibrates in response to sound waves, moving the attached coil within a magnetic field and generating an alternating current.

Question: What is the role of a catalyst in a fuel cell?

Answer: A catalyst in a fuel cell accelerates the electrochemical reactions at the electrodes, improving the efficiency and power output by lowering

the activation energy required for the reactions.

Question: What is a couple of forces?

Answer: A couple of forces consists of two equal and opposite forces acting parallel to each other on an object, causing it to rotate without causing linear motion.

Question: How does mass affect the difficulty of stopping a moving object?

Answer: The greater the mass of a moving object, the more difficult it is to stop, as momentum is the product of mass and velocity.

Question: How does the electrolysis of sodium chloride solution demonstrate the production of sodium hydroxide?

Answer: The electrolysis of sodium chloride solution produces hydrogen and chlorine gases, leaving behind  $\text{Na}^+$  and  $\text{OH}^-$  ions in the solution, which combine to form sodium hydroxide ( $\text{NaOH}$ ).

Question: How does a DC current circuit with a battery, resistor, and center-zero galvanometer behave?

Answer: In a DC current circuit, the galvanometer shows a constant deflection, indicating a constant current. When plotted against time, the current forms a straight line.

Question: What is the test for identifying oxygen gas?

Answer: Oxygen gas is identified by introducing a glowing splint into a test tube containing the gas, which relights with a flame, confirming the presence of oxygen.

Question: What is the period number of potassium?

Answer: Potassium is in Period 4.

Question: What is the function of a phase-locked loop (PLL) in communication systems?

Answer: A phase-locked loop (PLL) synchronizes an output signal's phase and frequency with a reference signal, providing stable frequency synthesis and signal demodulation in communication systems.

Question: How do you calculate the acceleration of an object that changes its velocity from 5 m/s to 25 m/s in 4 seconds?

Answer:  $\text{Acceleration} = (25 \text{ m/s} - 5 \text{ m/s}) / 4 \text{ s} = 5 \text{ m/s}^2$ .

Question: What is the purpose of a rheostat in a circuit?

Answer: A rheostat is used to vary the current and potential difference across a conductor in a circuit.

Question: How does urbanization impact biodiversity?

Answer: Urbanization leads to habitat loss, fragmentation, and degradation, reducing biodiversity. It affects the abundance and distribution of species and alters ecosystem dynamics.

Question: How does a moving coil microphone convert sound into electrical signals?



Answer: The microphone converts sound into electrical signals by vibrating a coil within a magnetic field, inducing an alternating current that corresponds to the sound waves.

Question: What is the role of amplitude in wave motion?

Answer: Amplitude determines the maximum displacement of particles in a wave, affecting the wave's energy and intensity.

Question: How do you determine the sum of moments of multiple forces acting on an object?

Answer: Determine the sum of moments by adding the moments of all forces acting on the object, considering their directions (clockwise or anti-clockwise) and using the appropriate sign convention.

Question: What is the significance of the five-kingdom classification system?

Answer: The five-kingdom classification system, introduced by Robert Whittaker, helps categorize organisms into more specific groups based on their characteristics.

Question: What is the role of iron in plants?

Answer: Iron is important for the synthesis of chlorophyll and respiratory enzymes.

Question: Name different forms of energy.

Answer: Heat energy, electric energy, magnetic energy, mechanical energy, light energy, and sound energy.

Question: What is the chemical formula for potassium carbonate?

Answer: The chemical formula for potassium carbonate is  $K_2CO_3$ , indicating two potassium ions and one carbonate ion.

Question: How is equilibrium achieved in the case of a sphere suspended by a string?

Answer: Equilibrium is achieved when the tension in the string, which acts upwards, balances the weight of the sphere, which acts downwards. This results in no net force acting on the sphere, keeping it at rest.

Question: What are isotopes?

Answer: Isotopes are atoms of the same element with different numbers of neutrons but the same number of protons.

Question: Describe the use of symbols in representing genetic traits.

Answer: Genetic traits are represented using symbols, with capital letters for dominant alleles and lowercase letters for recessive alleles, to simplify the notation of genotypes.

Question: What is the significance of the stationary phase in paper chromatography?

Answer: The stationary phase (paper) provides a surface for the components to interact with and separate based on their different affinities.

Question: Explain the significance of power factor correction in electrical systems.

Answer: Power factor correction improves the efficiency of electrical systems by reducing reactive power, minimizing energy losses, and lowering utility bills.

Question: What is the reaction between calcium carbonate and hydrochloric acid?

Answer: Calcium carbonate reacts with hydrochloric acid to form calcium chloride, water, and carbon dioxide:  $\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$ .

Question: How does the use of synthetic chemicals in cleaning agents affect the environment?

Answer: The use of synthetic chemicals in cleaning agents affects the environment by causing water pollution, harming aquatic organisms, and contributing to the formation of detergent swans on water surfaces.

Question: What is the role of a pivot point in the formation of a force couple in practical applications?

Answer: The pivot point provides a fixed point around which the object can rotate due to the action and reaction forces according to Newton's third law, facilitating the formation of a force couple.

Question: What are the uses of oxygen gas in respiration?

Answer: Oxygen gas is essential for the respiration of all organisms, supporting cellular respiration and energy production.

Question: What is the displacement of an object moving at 7 m/s for 9 seconds?

Answer: Displacement =  $7 \text{ m/s} \times 9 \text{ s} = 63 \text{ meters}$ .

Question: What is the rate of doing work if a child of 35 kg climbs a staircase to a height of 4 m in 1 minute?

Answer: The rate of doing work is 23.33 Watts (W).

Question: How do you express the composition of a solution in parts per million (ppm)?

Answer:  $\text{ppm} = (\text{Mass of solute} / \text{Mass of solution}) \times 1,000,000$ .

Question: How do bacteria benefit the environment?

Answer: Bacteria decompose dead bodies and structures, fix atmospheric nitrogen, and aid in the production of curd, yoghurt, and cheese.

Question: How do C4 and CAM plants adapt to arid environments for photosynthesis?

Answer: C4 plants fix  $\text{CO}_2$  into four-carbon compounds to minimize photorespiration, while CAM plants open stomata at night to reduce water loss, both adapting to arid conditions.

Question: What components are essential for the operation of a bicycle dynamo?

Answer: Essential components of a bicycle dynamo include the rotating coil, magnetic field, mechanical connection to the tire, and electrical circuit.

Question: What happens to the induced current when the coil in a dynamo is vertical?

Answer: When the coil is vertical, the induced current becomes zero as the conductors do not intersect the magnetic field lines.

Question: How is the chemical formula of ammonium phosphate represented?

Answer: The chemical formula of ammonium phosphate is  $(\text{NH}_4)_3\text{PO}_4$ , indicating three ammonium ions and one phosphate ion.

Question: Describe the function of fuses in protecting electric circuits.

Answer: Fuses protect electric circuits by breaking the circuit when the current exceeds a safe level, preventing overheating and potential fires.

Question: What is the role of electrodes in an electrochemical cell?

Answer: Electrodes in an electrochemical cell serve as the sites for oxidation and reduction reactions. The anode is where oxidation occurs, and the cathode is where reduction occurs.

Question: How does an aneroid barometer measure atmospheric pressure?

Answer: An aneroid barometer measures atmospheric pressure using a sealed, air-evacuated cavity with flexible walls. Changes in pressure cause the walls to flex, moving an indicator to show the pressure on a scale.

Question: What is the significance of the discovery of the double helix structure of DNA?

Answer: The discovery of the double helix structure of DNA by Watson and Crick provided insights into the molecular basis of inheritance, revealing how genetic information is stored, replicated, and transmitted from one generation to the next.

Question: What is the specific heat capacity of aluminium?

Answer: The specific heat capacity of aluminium is  $900 \text{ J kg}^{-1} \text{ K}^{-1}$ .

Question: What is the function of chloroplasts in photosynthesis?

Answer: Chloroplasts capture light energy with chlorophyll, converting carbon dioxide and water into glucose and oxygen, providing energy for the plant through photosynthesis.

Question: How does the efficiency of electric appliances impact energy consumption?

Answer: Efficient electric appliances convert more of the supplied energy into useful work, reducing overall energy consumption and lowering electricity bills.

Question: How do snakes detect vibrations in the ground?

Answer: Snakes detect ground vibrations through their lower jaw bone, which transmits vibrations to their sensory system.

Question: What is the significance of photosynthesis in maintaining life on Earth?

Answer: Photosynthesis provides the primary source of food and oxygen for most living organisms, supporting life and maintaining ecological balance.

Question: Explain with an example the concept of displacement.

Answer: If a child travels from home to school along a path AB + BC + CD, the total distance is 700 m, but the displacement is the straight-line distance AD, which is 500 m.

Question: How do you determine the direction of the moment of force in a given scenario?

Answer: Determine the direction of the moment of force by observing whether the applied force causes clockwise or anti-clockwise rotation and classifying the moment accordingly.

Question: How is the heat of reaction for sodium and chlorine calculated?

Answer: By determining the quantity of heat evolved for the given moles of reactants and scaling up to 1 mol to find the heat of reaction per mole.

Question: Why is it important to use appropriate fuses in domestic circuits?

Answer: Appropriate fuses protect domestic circuits from overcurrent, preventing potential damage to appliances and reducing the risk of electrical fires.

Question: How much heat is required to increase the temperature of 6 kg of copper by 20 K?

Answer: The heat required is 48,000 J, calculated using the formula  $Q = mc\Delta T = 6 \times 400 \times 20$ .

Question: What is the role of vitamins in the human body?

Answer: Vitamins are organic compounds important in bio-chemical reactions and are needed for various bodily functions.

Question: How does the structure of covalent compounds influence their physical state at room temperature?

Answer: The structure of covalent compounds, with weaker intermolecular forces compared to ionic compounds, results in many being liquids or gases at room temperature.

Question: What is the significance of Michael Faraday's contribution to electromagnetism?

Answer: Michael Faraday's discovery of electromagnetic induction revolutionized the generation of electricity and led to the development of various electrical devices.

Question: Describe the process of protein synthesis on the rough endoplasmic reticulum.

Answer: Protein synthesis on the rough endoplasmic reticulum involves ribosomes translating mRNA into polypeptides, which are then folded and modified within the ER lumen.

Question: How does the RCCB protect against electric shocks?

Answer: The RCCB detects current leaks to the ground and automatically disconnects the power supply, preventing electric shocks and potential

injuries.

Question: What happens when the forces acting on an object are not coplanar?

Answer: When the forces acting on an object are not coplanar, the object will not be in equilibrium and will move or rotate due to the unbalanced forces and moments.

Question: How does the direction of induced current change with coil rotation?

Answer: The direction of induced current changes periodically with coil rotation, resulting in an alternating current output.

Question: How is the chemical formula of sulphuric acid written?

Answer: The chemical formula of sulphuric acid is  $\text{H}_2\text{SO}_4$ , indicating two hydrogen atoms, one sulphur atom, and four oxygen atoms.

Question: What is Archimedes' principle and its significance?

Answer: Archimedes' principle states that when an object is partially or completely submerged in a fluid, the upthrust acting on it is equal to the weight of the fluid displaced by the object. It explains why objects float or sink.

Question: How is potassium permanganate used to prepare oxygen gas in the laboratory?

Answer: Potassium permanganate is heated to decompose it into potassium manganate, manganese dioxide, and oxygen gas, collected by downward displacement of water.

Question: How does the body regulate blood volume through kidney function?

Answer: The kidneys regulate blood volume by adjusting urine production, influenced by hormones like ADH and aldosterone, which control water and sodium reabsorption.

Question: What are the differences between monocots and dicots in terms of stem structure?

Answer: Monocots have unbranched stems, while dicots have branched stems.

Question: What is the role of the placenta in fetal development?

Answer: The placenta facilitates the exchange of nutrients, oxygen, and waste products between the mother and fetus through the umbilical cord.

Question: What parts of the body belong to the central nervous system?

Answer: The brain and spinal cord.

Question: Describe the role of the pancreas in digestion.

Answer: The pancreas secretes digestive enzymes into the duodenum through the pancreatic duct, aiding in the breakdown of proteins, starch, and lipids.

Question: What determines the properties of a salt?

Answer: The properties of a salt depend on the strength of the acid and base from which it is formed.

Question: What is the significance of the resultant force in practical applications?

Answer: The resultant force allows the effective use of multiple small forces to achieve the effect of a single large force.

Question: How do the stems of monocots and dicots differ in diameter?

Answer: Monocot stems have an even diameter, while dicot stems are broad at the base and thin at the tip.

Question: What is the purpose of the galvanometer in demonstrating electromagnetic induction?

Answer: The galvanometer measures the induced current, indicating the presence and magnitude of electromagnetic induction in a circuit.

Question: What is the structure of a DNA molecule?

Answer: A DNA molecule is a clockwise twined double helical structure of two strands that run anti-parallel to each other. The two strands are joined by nitrogenous base pairs: Adenine (A) pairs with Thymine (T) and Cytosine (C) pairs with Guanine (G).

Question: How does the diaphragm in a moving coil microphone respond to sound?

Answer: The diaphragm vibrates in response to sound waves, moving the attached coil within a magnetic field and generating an alternating current.

Question: What are the properties of hydrogen gas?

Answer: Hydrogen gas is colorless, odorless, less dense than air, combustible, and slightly soluble in water.

Question: How do lithium and oxygen atoms achieve a stable electronic configuration in lithium oxide?

Answer: Lithium atoms lose electrons to form  $\text{Li}^+$  ions, and oxygen atoms gain electrons to form  $\text{O}^{2-}$  ions. The electrostatic attraction between these ions forms lithium oxide ( $\text{Li}_2\text{O}$ ).

Question: What is the significance of the magnetic field strength in a solenoid?

Answer: The magnetic field strength determines the solenoid's effectiveness in generating a magnetic force and performing work.

Question: How do you investigate the equilibrium of an object under the action of two forces using a block of wood and Newton balances?

Answer: Attach the Newton balances to the block of wood and pull in opposite directions with varying forces. The object remains in equilibrium when the forces are equal in magnitude and opposite in direction, resulting in no net movement.

Question: How does the amplitude of a wave affect its energy?

Answer: Higher amplitude waves carry more energy, as amplitude is directly related to the wave's intensity.

Question: How does urbanization impact air quality?

Answer: Urbanization impacts air quality by increasing emissions from vehicles, industrial activities, and construction, leading to higher levels of air pollutants such as particulate matter, nitrogen oxides, and volatile organic compounds.

Question: What is the highest proportion of the body mass of living organisms composed of?

Answer: The highest proportion of the body mass of living organisms is composed of water.

Question: How does a glass-mercury thermometer work?

Answer: A glass-mercury thermometer works by connecting a narrow glass tube to a bulb containing mercury. When the temperature rises, the mercury expands and moves up along the tube, and the temperature can be read from the scale marked on the tube according to the length of the mercury column.

Question: What is the role of a capacitor in an electric motor?

Answer: A capacitor in an electric motor provides the necessary phase shift to create a rotating magnetic field, enabling the motor to start and run efficiently.

Question: What is the relationship between the number of valence electrons and the group number?

Answer: The number of valence electrons in the outermost shell of an atom determines the group number of the element.

Question: How do ultrasound waves assist blind people in navigation?

Answer: Ultrasound spectacles worn by blind people emit ultrasound waves that reflect back from obstacles, helping them navigate their surroundings.

Question: What are the causes of diabetes?

Answer: Causes of diabetes include a busy lifestyle, consumption of food items made of wheat flour and polished rice, lack of exercise, and mental stress. Diabetes results from the failure of insulin secretion due to the dysfunction or inborn absence of beta cells in the pancreas.

Question: How is the chemical formula of magnesium nitrate written?

Answer: The chemical formula of magnesium nitrate is  $\text{Mg}(\text{NO}_3)_2$ , indicating one magnesium ion and two nitrate ions.

Question: What are some useful effects of fungi?

Answer: Fungi can be used as a protein supplement (e.g., mushrooms), aid in bread and alcohol fermentation (e.g., yeast), and produce antibiotics (e.g., Penicillium).

Question: How do concave lenses affect light rays coming from a distant object?

Answer: Concave lenses diverge light rays, making them appear to originate from a focal point on the same side as the object.

Question: What are the changes that occur in the male reproductive system during puberty?

Answer: Changes in the male reproductive system during puberty include the growth of pubertal hair, widened shoulders, deepened voice, accelerated growth of bones and muscles, production of sperms, and growth of genitals.

Question: How does electroplating enhance the properties of metal objects?

Answer: Electroplating enhances properties like corrosion resistance, appearance, and durability by applying a thin layer of a less reactive metal, such as gold, silver, or chromium, onto the surface of the object.

Question: What is the first ionisation energy of aluminium?

Answer: The first ionisation energy of aluminium is 578 kJ/mol.

Question: Why is it important to measure the rate of reaction under different conditions?

Answer: Measuring the rate of reaction under different conditions helps understand the factors influencing reaction kinetics and optimize industrial processes.

Question: How does the induced electromotive force vary with the magnetic field?

Answer: The induced electromotive force is directly proportional to the strength of the magnetic field and the rate of change of the field.

Question: What is the principle of differential expansion in bimetallic strips?

Answer: Differential expansion in bimetallic strips occurs because two metals with different expansion rates bend when heated, allowing the strip to make or break electrical contacts, regulating temperature in devices like thermostats.

Question: How does friction affect the motion of a rolling object on a rough surface?

Answer: Friction opposes the motion of a rolling object on a rough surface, causing it to slow down and eventually stop. A rougher surface increases friction, reducing the distance traveled.

Question: What is the role of the umbilical cord in fetal development?

Answer: The umbilical cord connects the fetus to the placenta, allowing the exchange of nutrients, oxygen, and waste products between the mother and fetus.

Question: What is the resultant force if two forces of 10 N and 6 N act in the same direction?

Answer: The resultant force is 16 N in the same direction.

Question: What is the role of specific heat capacity in calculating heat change?

Answer: It determines how much heat is required to raise the temperature of a given mass of substance by  $1^{\circ}\text{C}$ .



Question: Why is fecal matter not considered an excretory substance?

Answer: Fecal matter consists of undigested food, which is not a product of cellular biochemical reactions and thus not considered an excretory material.

Question: Explain the concept of temperature and its significance in daily life, including the various methods and devices used to measure temperature.

Answer: Temperature is a fundamental physical quantity that describes the degree of hotness or coldness of an object. It is directly related to the mean kinetic energy of the particles that make up the object. Various phenomena and activities in daily life are influenced by temperature, making it a crucial aspect of our environment. Significance in Daily Life: Weather Reports: Daily weather reports provide information about the highest and lowest temperatures recorded in different locations, influencing decisions related to clothing, outdoor activities, and travel. Drying Clothes: Washed clothes dry faster on warm sunny days compared to rainy or cold days due to the higher temperature, which increases the rate of evaporation. Food and Beverages: The coolness of ice cream and the warmth of a hot cup of tea are directly related to their temperatures, affecting our sensory experiences. Measuring Temperature: Touch Method: Although touching various objects gives a rough idea about their temperature, it is not accurate and cannot provide a numerical value. Hence, it is unsuitable for precise measurements. Thermometers: Glass-Mercury Thermometer: Invented by Galileo Galilei, this thermometer consists of a narrow glass tube connected to a bulb containing mercury. As the temperature rises, the mercury expands and moves up the tube, allowing the temperature to be read from the scale on the tube. Mercury is chosen for its uniform expansion, good thermal conductivity, and liquid state over a broad temperature range. Glass-Alcohol Thermometer: Similar in construction to the mercury thermometer but uses ethyl alcohol (ethanol), which is suitable for measuring lower temperatures due to its melting point of  $-115^{\circ}\text{C}$ . Ethanol is colored to make the column visible. Digital Thermometer: Uses an electrical property, such as resistance, which varies with temperature. The temperature is read directly from a digital display.

Question: What is the significance of the speed of electromagnetic waves being constant in a vacuum?

Answer: The constant speed of electromagnetic waves in a vacuum allows for the calculation of distances and times for light and other electromagnetic radiation to travel across space.

Question: What is the effect of friction on a moving object?

Answer: Friction opposes the motion of a moving object, causing it to slow down and eventually stop unless an external force is applied to maintain motion.

Question: What is the formula for calculating the moment of a force applied to a pivoted rod?

Answer: The formula for calculating the moment of a force applied to a pivoted rod is  $\text{Moment} = \text{Force} \times \text{Perpendicular distance from the pivot point to the line of action of the force}$ .

Question: What is a Punnett square, and how is it used?

Answer: A Punnett square is a diagram used to predict the outcome of a particular genetic cross, showing the possible genotypes of offspring based on the parents' genes.

Question: How does the specific heat capacity of ethanol make it useful in laboratory thermometers?

Answer: Ethanol's specific heat capacity and high expansion rate with temperature changes make it useful in laboratory thermometers, providing accurate temperature measurements.

Question: What is the boiling point of oxygen during fractional distillation of atmospheric air?

Answer: Oxygen boils at  $-183^{\circ}\text{C}$ .

Question: What are the factors that affect the rate of chemical reactions?

Answer: Factors include surface area of reactants, concentration of reactants, pressure of gaseous reactants, temperature, and the presence of catalysts or inhibitors.

Question: What is the function of mucus in the digestive tract?

Answer: Mucus lubricates food, eases its passage, and protects the inner lining of the digestive tract from digestive enzymes.

Question: How is the chemical formula of carbon dioxide written?

Answer: The chemical formula of carbon dioxide is  $\text{CO}_2$ , indicating one carbon atom and two oxygen atoms.

Question: How does the use of efficient electric appliances impact electricity bills?

Answer: Using efficient electric appliances reduces electricity consumption, leading to lower utility bills and cost savings for households.

Question: What are the effects of acid rain on the environment?

Answer: Effects of acid rain on the environment include damage to forests, lakes, and streams, soil degradation, and harm to aquatic life.

Question: What are the subatomic particles in an atom?

Answer: The subatomic particles in an atom are electrons, protons, and neutrons.

Question: What are the environmental concerns associated with artificial polymers?

Answer: Artificial polymers are not biodegradable, leading to environmental pollution. They release poisonous gases when burned, creating disposal problems.

Question: Describe the difference between a bipolar junction transistor (BJT) and a field-effect transistor (FET).

Answer: A BJT controls current using both electron and hole charge carriers, while a FET controls current using only one type of charge carrier (electrons or holes) and relies on an electric field to modulate the conductivity of a channel.

Question: How do you adjust the resistance of a variable resistor?

Answer: The resistance of a variable resistor is adjusted by turning a knob or screw to change the position of the wiper on the resistive element, altering the resistance value.

Question: What is visible light?

Answer: Visible light is the range of the electromagnetic spectrum to which our eyes are sensitive, with frequencies from  $4.28 \times 10^{14}$  Hz to  $7.69 \times 10^{14}$  Hz and wavelengths from 690 nm to 400 nm.

Question: What is the effect of temperature on the rate of reaction?

Answer: Increasing temperature generally increases the rate of reaction by providing more kinetic energy for reactant collisions.

Question: What are some effects of ultraviolet radiation on humans?

Answer: Ultraviolet radiation can produce vitamin D but can also cause cataracts and skin cancer with excessive exposure.

Question: What is the acceleration of an object that goes from rest to 24 m/s in 8 seconds?

Answer: Acceleration =  $24 \text{ m/s} / 8 \text{ s} = 3 \text{ m/s}^2$ .

Question: How do you balance a uniform rod with weights at different points?

Answer: To balance a uniform rod with weights at different points, adjust the positions of the weights such that the moments due to the weights on either side of the pivot are equal.

Question: How do protected areas contribute to biodiversity conservation?

Answer: Protected areas contribute to biodiversity conservation by preserving habitats, preventing exploitation, and providing safe havens for endangered species.

Question: What is the typical forward voltage for silicon and germanium diodes?

Answer: The typical forward voltage for silicon diodes is about 0.7 V, while for germanium diodes, it is about 0.3 V.

Question: Why is classification of organisms significant?

Answer: Classification is significant because it makes it easier to study organisms, identify specific characteristics, understand the biosphere, reveal relationships between groups, and identify organisms with economic uses.

Question: How is the resultant force of two parallel forces acting along the same direction demonstrated?

Answer: It is demonstrated by using Newton balances and a strip of wood to show that the sum of the forces from two balances is equal to the force measured by a third balance.

Question: How does the respiratory system facilitate gas exchange?

Answer: The respiratory system allows oxygen to enter the lungs and carbon dioxide to be expelled, occurring in the alveoli of the lungs.

Question: What are the components of blood tissue?

Answer: Blood tissue consists of plasma (fluid matrix), red blood cells (erythrocytes), white blood cells (leucocytes), and platelets (cellular fragments).

Question: How does an electricity meter function in a household?

Answer: An electricity meter records the amount of electric energy consumed by the household in kilowatt hours (kWh), which is used for billing purposes.

Question: Why is it difficult to catch a bullet fired from a gun?

Answer: It is difficult to catch a bullet fired from a gun because, despite its small mass, it has a very high velocity, resulting in a large momentum.

Question: How does the electrolysis of sodium chloride solution produce chlorine gas?

Answer: Chlorine gas is produced at the anode by the oxidation of  $\text{Cl}^-$  ions:  
 $2\text{Cl}^- (\text{aq}) \rightarrow \text{Cl}_2 (\text{g}) + 2\text{e}^-$ .

Question: How do kidney transplants restore kidney function in patients with end-stage renal disease?

Answer: Kidney transplants replace the damaged kidney with a healthy donor kidney, restoring filtration ability and overall kidney function.

Question: How do you measure the current flowing through a bulb in a circuit with two dry cells?

Answer: Connect an ammeter in series with the bulb and the dry cells to measure the current flowing through the bulb.

Question: What is the resultant force if two forces of 10 N and 6 N act in opposite directions?

Answer: The resultant force is 4 N in the direction of the 10 N force.

Question: How does the speed of electromagnetic waves change in different media?

Answer: The speed of electromagnetic waves is slower in material media compared to a vacuum, affecting their wavelength.

Question: What are the potential benefits of gene therapy?

Answer: Gene therapy has the potential to treat or cure genetic disorders by replacing faulty genes with healthy ones, correcting genetic defects at their source, and providing long-lasting or permanent therapeutic effects.

Question: What is the principle behind the operation of a hydraulic press?

Answer: The principle behind a hydraulic press is that pressure applied to a confined fluid is transmitted undiminished in all directions, allowing a small force applied to a small piston to generate a larger force on a larger piston.

Question: How does kidney function influence the body's acid-base balance?

Answer: The kidneys help maintain acid-base balance by excreting hydrogen ions and reabsorbing bicarbonate, regulating blood pH levels.

Question: How does the size of an image in a plane mirror compare to the size of the object?

Answer: The size of the image in a plane mirror is the same as the size of the object.

Question: What is the effect of applying a force on a very smooth surface like ice?

Answer: On a very smooth surface like ice, even a very small force can start the motion of an object because there is little to no resistive force.

Question: What are the potential health effects of exposure to ultraviolet (UV) radiation?

Answer: Exposure to UV radiation increases the risk of skin cancer, cataracts, and immune system suppression. It can cause long-term health issues and is particularly harmful with the depletion of the ozone layer.

Question: What happens when two forces of equal magnitude act on an object in opposite directions?

Answer: The object remains in equilibrium and does not move.

Question: What are the components of a nucleotide?

Answer: Each nucleotide is made up of a nitrogenous base, a pentose sugar group, and a phosphate group.

Question: How are permanent tissues classified?

Answer: Permanent tissues are classified into simple permanent tissues and complex permanent tissues based on the nature of their cells.

Question: What is the role of bacteria in the nitrogen cycle?

Answer: Bacteria fix atmospheric nitrogen to increase soil nitrate levels, which is essential for plant growth.

Question: What is the function of white blood cells in the immune system?

Answer: White blood cells protect the body by destroying pathogens, producing antibodies, and regulating immune responses.

Question: What are the potential impacts of global warming on polar regions?

Answer: Global warming leads to the melting of ice caps and glaciers, rising sea levels, loss of habitat for polar species, and changes in ocean circulation patterns. These impacts threaten the stability of polar ecosystems and coastal communities.

Question: What is the chemical formula for potassium chloride?

Answer: The chemical formula for potassium chloride is KCl.

Question: What method is used to examine if water is essential for rusting?

Answer: Fix two cleaned iron nails to each of the rubber stoppers, place one stopper with nails in an empty boiling tube, and the other in a boiling tube with anhydrous calcium chloride or silica gel. Observe after a few days.

Question: How is carbon dioxide prepared in the laboratory?

Answer: Carbon dioxide is prepared by reacting calcium carbonate with dilute hydrochloric acid and collecting the gas by downward displacement of water.

Question: What is the specific latent heat of fusion of ice?

Answer: The specific latent heat of fusion of ice is  $3.36 \times 10^5$  J/kg.

Question: How does Newton's first law explain the need for seat belts in vehicles?

Answer: Newton's first law explains that a body in motion stays in motion unless acted upon by an external force. Seat belts provide the external force needed to stop the motion of passengers when a vehicle suddenly stops, preventing them from being thrown forward.

Question: What is the valency of phosphorus?

Answer: The valency of phosphorus is 5 and 3.

Question: What happens to the induced current when the coil in a dynamo is vertical?

Answer: When the coil is vertical, the induced current becomes zero as the conductors do not intersect the magnetic field lines.

Question: Describe the equilibrium of a sphere suspended by a string in terms of forces.

Answer: The sphere is in equilibrium because the tension in the string balances the weight of the sphere. The forces are equal in magnitude, opposite in direction, and their lines of action are along the same line, resulting in no net force.

Question: Materials required: - Hydrated copper sulphate, naphthalene (moth balls), mortar and pestle Method: - Take some copper sulphate and naphthalene (moth balls) into a mortar, grind them together with the pestle into a powder and mix well. Transfer the powder onto a piece of paper and observe. What is the method for Activity to observe a mixture?

Answer: The method involves grinding copper sulphate and naphthalene together into a powder, mixing them well, and observing the mixture on a piece of paper.

Question: How do you calculate the moment of a force applied to a stick with a loop and Newton balance?

Answer: Calculate the moment by multiplying the applied force by the perpendicular distance from the axis of rotation to the line of action of the force, measured using the loop and Newton balance.

Question: How is the chemical formula of ammonia written?

Answer: The chemical formula of ammonia is  $\text{NH}_3$ , indicating one nitrogen atom and three hydrogen atoms.

Question: How do lenses aid in the function of optical instruments like binoculars?

Answer: Lenses in binoculars magnify distant objects by converging light rays to create clear, enlarged images.

Question: Describe the organizational levels and interactions within the biosphere, providing examples for each level.

Answer: The biosphere is organized from the simplest to the most complex levels, forming a hierarchy that showcases the interdependence and interactions among organisms and their environment. The levels are as follows: Individual: An individual is a single organism belonging to a particular species. For instance, a coconut plant or an elephant represents an individual in the biosphere. A species is a group of similar organisms capable of interbreeding naturally to produce fertile offspring. Population: This level comprises a group of individuals of the same species living in a specific geographical area at a given time. For example, the population of elephants in Yala National Park in 2011 was 5,879, and the human population in Sri Lanka in 2014 was 21,899,445. Community: A community includes different populations interacting in a particular area. For example, the animal community in Yala National Park or the mangrove plant community in the Negombo lagoon area illustrates community interactions. Ecosystem: An ecosystem encompasses all communities and their non-living environmental components in a specific area. Examples include a pond, a decaying log, a forest, or a beach with rocks and cliffs. Figure 15.2 in the document shows the interactions of living organisms with non-living components in a pond ecosystem, emphasizing the interconnectedness of flora, fauna, air, water, and soil. Biosphere: The biosphere is the part of the Earth and its atmosphere inhabited by living organisms. It consists of three main components: Lithosphere: The Earth's crust and upper mantle. Hydrosphere: All oceans and freshwater bodies, covering 70% of the Earth's surface. Atmosphere: The layer of air surrounding the Earth.

Question: What are the potential health risks of untreated glomerulonephritis?

Answer: Untreated glomerulonephritis can lead to chronic kidney disease, kidney failure, high blood pressure, and increased risk of cardiovascular disease.

Question: What observation is made in the area of a leaf covered with colorless polythene during the light energy experiment?

Answer: The area covered with colorless polythene turns dark purple or blue with iodine solution, indicating photosynthesis and starch production.

Question: What are the repeating units in Teflon?

Answer: The repeating units in Teflon are  $\text{-CF}_2\text{-CF}_2\text{-}$ .

Question: How does a rubber sucker adhere to a surface?

Answer: A rubber sucker adheres to a surface by removing most of the air between the sucker and the surface, creating lower pressure inside the sucker than the atmospheric pressure outside, which presses the sucker onto the surface.

Question: What is the effect of molecular size on solubility?

Answer: Larger molecules typically have lower solubility due to increased molecular mass and surface area, making it harder for the solvent to dissolve them.

Question: Describe the process of balancing the chemical equation for the reaction between aluminum and hydrochloric acid.

Answer: The chemical equation for aluminum reacting with hydrochloric acid is balanced by ensuring equal numbers of atoms on both sides:  $2\text{Al} + 6\text{HCl} \rightarrow 2\text{AlCl}_3 + 3\text{H}_2$ .

Question: What is the magnitude of the resultant force if two collinear forces of 10 N and 6 N act in the same direction?

Answer: The magnitude of the resultant force is 16 N.

Question: How does the length of a conductor affect the force in a magnetic field?

Answer: A longer conductor experiences a greater force, as the force is directly proportional to the conductor's length.

Question: How does the power rating of an appliance affect its energy consumption?

Answer: The power rating of an appliance determines the rate at which it consumes energy. Higher power ratings result in higher energy consumption over a given period.

Question: What are dioecious plants?

Answer: Dioecious plants have staminate and pistillate flowers on separate plants, requiring cross-pollination between different plants.

Question: What are the benefits of using energy-efficient lighting?

Answer: Energy-efficient lighting reduces energy consumption, lowers greenhouse gas emissions, and decreases electricity costs. It supports sustainable energy use and environmental protection.

Question: What is the significance of the high specific heat capacity of water in regulating climate?

Answer: Water's high specific heat capacity moderates temperature fluctuations, contributing to stable and mild climates by absorbing and releasing heat with minimal temperature change.

Question: How does gravitational acceleration affect potential energy?

Answer: Gravitational acceleration affects potential energy by determining the force with which an object is attracted to the Earth, influencing the amount of work required to lift the object.

Question: What is the molar mass of ammonium chloride ( $\text{NH}_4\text{Cl}$ )?

Answer: The molar mass of  $\text{NH}_4\text{Cl}$  is 53.5 g/mol.

Question: What is the chemical formula for calcium oxide?

Answer: The chemical formula for calcium oxide is  $\text{CaO}$ .

Question: What observations can be made from Activity involving a cubic-shaped block of wood?



Answer: In Activity , it is observed that the block of wood moves when there is a nonzero resultant force and remains stationary when the resultant force is zero. This demonstrates that equilibrium occurs when the forces acting on the block have equal magnitudes and opposite directions.

Question: What is the significance of the normal line in reflection?

Answer: The normal line is an imaginary line perpendicular to the surface at the point of incidence, used to measure the angles of incidence and reflection.

Question: How does the structure of ionic compounds affect their solubility in water?

Answer: The structure of ionic compounds, with positive and negative ions, makes them soluble in water because water molecules can surround and separate the ions, dissolving the compound.

Question: What is the role of the culture medium in tissue culture?

Answer: The culture medium provides essential nutrients, including sucrose, mineral salts, vitamins, and growth substances, and is solidified with agar.

Question: What is the role of crests and troughs in a transverse wave?

Answer: Crests are points of maximum positive displacement, and troughs are points of maximum negative displacement in a transverse wave.

Question: How does a transformer work?

Answer: An alternating current in the primary coil generates an alternating magnetic field, which is linked to the secondary coil through the soft iron core. This varying magnetic field induces an alternating voltage in the secondary coil.

Question: How does the solubility of salts in water vary with temperature?

Answer: The solubility of salts in water generally increases with temperature, allowing more salt to dissolve as the temperature rises.

Question: What is the role of the perpendicular distance in determining the moment of a force?

Answer: The perpendicular distance from the axis of rotation to the line of action of the force determines the magnitude of the moment. A greater distance results in a larger moment for the same force.

Question: What are the components of a nucleotide?

Answer: Each nucleotide is made up of a nitrogenous base, a pentose sugar group, and a phosphate group.

Question: What is the role of decomposers in nutrient cycling?

Answer: Decomposers break down dead organic matter, recycling nutrients back into the ecosystem.

Question: How is the human reproductive process regulated?

Answer: The human reproductive process is regulated by hormones such as FSH, LH, testosterone, estrogen, and progesterone, secreted by various endocrine glands.

Question: What is the significance of meiosis in sexual reproduction?

Answer: Meiosis is significant because it reduces the chromosome number by half, ensuring genetic diversity and producing gametes (sperm and egg) for sexual reproduction.

Question: Describe the operation of a relay in an electrical circuit.

Answer: A relay is an electrically operated switch that uses a small control current to open or close a larger load circuit, providing isolation and control in various applications.

Question: What is the role of vegetative propagation in plant reproduction?

Answer: Vegetative propagation allows for the reproduction of plants using vegetative parts such as stems, roots, and leaves, rather than seeds.

Question: What is the formula for calculating the moment due to a force?

Answer: The moment due to a force is calculated as the product of the force and the perpendicular distance from the rotational axis to the line of action of the force (Moment = Force  $\times$  Perpendicular distance).

Question: How do sound waves interact with different materials?

Answer: Sound waves can be absorbed, reflected, or transmitted depending on the material's properties and the frequency of the waves.

Question: What is the reaction between calcium and hydrochloric acid?

Answer: Calcium reacts with hydrochloric acid to form calcium chloride and hydrogen gas:  $\text{Ca} + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2$ .

Question: What is the relationship between the speed of coil rotation and the output voltage of a dynamo?

Answer: The output voltage of a dynamo increases with the speed of coil rotation, as a higher speed induces a greater electromotive force.

Question: What is the resistance of a nichrome wire coil if a current of 0.5 A flows through it with a potential difference of 3 V?

Answer: Using Ohm's Law,  $R = V/I$ , the resistance is  $R = 3 \text{ V} / 0.5 \text{ A} = 6 \Omega$ .

Question: What are some examples of gymnosperms?

Answer: Examples of gymnosperms include Cycas and Pinus.

Question: How can the presence of carbon and hydrogen in candle wax be confirmed?

Answer: The presence of carbon and hydrogen in candle wax can be confirmed by burning the candle and observing the color change in copper sulfate and the milky appearance of limewater, indicating the production of water and carbon dioxide.

Question: What is the atomic number of oxygen?

Answer: The atomic number of oxygen is 8.

Question: What is the explosive mechanism of seed dispersal?

Answer: The explosive mechanism involves the pericarp of the fruit exploding and dispersing seeds far away due to touch, moisture, or dry

weather conditions.

Question: How do the stems of monocots and dicots differ?

Answer: Monocot stems have an even diameter, while dicot stems are broad at the base and thin at the tip.

Question: What is the principle behind the operation of a thermos flask?

Answer: A thermos flask operates on the principle of insulation and reflection. It has a vacuum layer to prevent heat transfer by conduction and convection, and reflective surfaces to reduce heat transfer by radiation, maintaining the temperature of its contents.

Question: What is the significance of polar covalent bonds in biological molecules?

Answer: Polar covalent bonds are significant in biological molecules because they create partial charges that allow for interactions with other molecules, facilitating processes like hydrogen bonding and enzyme-substrate binding.

Question: What is the role of tension in determining the sound produced by string instruments?

Answer: The tension of the string affects its frequency of vibration, with higher tension resulting in higher-pitched sounds.

Question: What is the atomic number and mass number of protium?

Answer: The atomic number is 1 and the mass number is 1 for protium.

Question: What is a salt according to the document?

Answer: A salt is formed by the reaction of an acid with a base, resulting in a compound composed of positive and negative ions.

Question: What is the specific heat capacity of aluminium, and how is it measured?

Answer: The specific heat capacity of aluminium is  $900 \text{ J kg}^{-1} \text{ K}^{-1}$ . It is measured by supplying a known amount of heat to a known mass of aluminium and recording the resulting temperature change.

Question: What is the role of a thermistor in temperature control circuits?

Answer: A thermistor is a temperature-sensitive resistor whose resistance changes significantly with temperature, used in temperature control and sensing applications.

Question: What is the electronic configuration of a nitrogen atom?

Answer: The electronic configuration of a nitrogen atom is 2, 5.

Question: What is the principle behind the operation of a bicycle dynamo?

Answer: The principle behind a bicycle dynamo is electromagnetic induction, where mechanical rotation induces an electromotive force in the coil.

Question: Why should a plant be kept in the dark for 48 hours before conducting photosynthesis experiments?

Answer: Keeping a plant in the dark for 48 hours ensures that stored starch is removed from the leaves, making it easier to observe the effects of light energy on photosynthesis.

Question: What is the calyx?

Answer: The calyx is the outermost part of a flower, comprised of sepals, which protect the flower parts when the flower is in the bud stage.

Question: How is the chemical formula of phosphine written?

Answer: The chemical formula of phosphine is  $\text{PH}_3$ , indicating one phosphorus atom and three hydrogen atoms.

Question: What does a horizontal line on a displacement-time graph indicate?

Answer: It indicates that the object is at rest or not changing its position over time.

Question: Describe the process of electrochemical machining.

Answer: Electrochemical machining (ECM) removes material from a workpiece using controlled anodic dissolution, where the workpiece is the anode and a tool is the cathode in an electrolyte solution. It is used for precise machining of hard-to-machine materials.

Question: What is the relationship between liquid pressure and the depth of the liquid?

Answer: The pressure exerted by a liquid increases with the depth of the liquid because the weight of the liquid above that point increases.

Question: What is the significance of the human circulatory system?

Answer: The human circulatory system is significant as it transports oxygen, nutrients, and waste products throughout the body, maintaining homeostasis and supporting cellular functions.

Question: What is a transverse wave?

Answer: A transverse wave is a type of mechanical wave where particles of the medium move perpendicular to the direction of wave propagation.

Question: What are zoophilous flowers?

Answer: Zoophilous flowers are pollinated by animals and have adaptations like fragrance, large size, and colorful appearance to attract animals for pollination.

Question: What are the characteristics of gymnosperms?

Answer: Gymnosperms have true tissue differentiation, possess vascular tissues, reproduce sexually by seeds, and are autotrophic and photosynthetic.

Question: How is atmospheric pressure measured using a mercury barometer?

Answer: Atmospheric pressure is measured using a mercury barometer by the height of the mercury column in a glass tube. The height of the column represents the atmospheric pressure exerted on the mercury in the container.

Question: Why is it important to use appropriate cable sizes for electrical wiring?

Answer: Using appropriate cable sizes ensures the wires can safely carry the required current without overheating, reducing the risk of electrical fires and ensuring efficient power delivery.

Question: Describe the role of the pancreas in digestion.

Answer: The pancreas secretes digestive enzymes into the duodenum through the pancreatic duct, aiding in the breakdown of proteins, starch, and lipids.

Question: What organs are responsible for excreting different waste materials?

Answer: The lungs exhale CO<sub>2</sub> and water vapor, the kidneys excrete urea, uric acid, salts, and water in urine, and the skin excretes urea, uric acid, NaCl, and water in sweat.

Question: How does the induced current in a dynamo vary during one complete rotation?

Answer: The induced current alternates direction during one complete rotation, producing a sinusoidal wave of alternating current.

Question: What is the importance of the central lumen in sclerenchyma cells?

Answer: The central lumen in sclerenchyma cells allows for the accumulation of structural materials like lignin, enhancing the cell's mechanical strength and support capabilities.

Question: What is the function of brushing rings in an alternating current dynamo?

Answer: Brushing rings connect the rotating coil to the external circuit, allowing current to flow continuously despite the coil's rotation.

Question: How does the power output of an electric appliance relate to its energy consumption?

Answer: The power output of an electric appliance determines the rate at which it consumes energy. Higher power output results in higher energy consumption over time.

Question: How does an electrochemical gradient drive the production of ATP in chloroplasts?

Answer: In chloroplasts, an electrochemical gradient created by the transport of protons across the thylakoid membrane during photosynthesis drives the production of ATP through chemiosmosis, where protons flow back into the stroma through ATP synthase, generating ATP.

Question: How does climate change affect the distribution of species?

Answer: Climate change alters habitat conditions, forcing species to migrate, adapt, or face extinction. It affects the distribution and abundance of species, leading to changes in ecosystem dynamics.

Question: What is the role of carbon brushes in an alternating current dynamo?

Answer: Carbon brushes maintain contact with the rotating brushing rings, allowing current to flow to the external circuit without wearing out quickly.

Question: What is the role of the large intestine in water absorption?

Answer: The large intestine absorbs water from the remaining indigestible food matter, forming semi-solid fecal matter for excretion.

Question: How does a geyser work to heat water?

Answer: A geyser heats water by using an electric heating element immersed in the water tank, converting electrical energy into heat to raise the water temperature.

Question: What is the role of genetic counseling in managing inherited disorders?

Answer: Genetic counseling provides individuals and families with information about the risks, inheritance patterns, and implications of genetic disorders, helping them make informed decisions about their health and reproduction.

Question: What is the function of the lens in a human eye?

Answer: The lens in the human eye refracts light to focus images on the retina, enabling clear vision.

Question: What is the formula to calculate the pressure exerted by a liquid column?

Answer: The formula to calculate the pressure exerted by a liquid column is  $P = h\rho g$ , where  $h$  is the height of the column,  $\rho$  is the density of the liquid, and  $g$  is gravitational acceleration.

Question: What are the effects of light pollution on ecosystems?

Answer: Light pollution disrupts the natural behavior of wildlife, affects reproductive cycles, and alters predator-prey relationships. It impacts ecosystem health and biodiversity.

Question: Describe the function of a distribution box in a domestic electric circuit.

Answer: A distribution box distributes electricity to various circuits in the household, protecting each circuit with MCBs or fuses to prevent overloading and short circuits.

Question: What are some common examples of mixtures?

Answer: Common examples of mixtures include air, soil, sea water, river water, and various food items such as cool drinks, tea, coffee, and fruit salads.

Question: What is acid rain, and how is it formed?

Answer: Acid rain is precipitation that is more acidic than normal rain due to the presence of sulfur dioxide ( $\text{SO}_2$ ) and nitrogen dioxide ( $\text{NO}_2$ ) in the atmosphere. These gases dissolve in rainwater to form sulfurous acid, sulfuric acid, and nitric acid.

Question: What causes the depletion of the ozone layer?

Answer: The depletion of the ozone layer is primarily caused by human-made chemicals such as chlorofluorocarbons (CFCs) and halons.

Question: What is the relationship between mass and weight?

Answer: Mass is the amount of matter in an object, while weight is the force exerted on the object due to gravity. Weight is calculated as  $\text{Weight} = mg$ .

Question: What is the simplest amino acid?

Answer: The simplest amino acid is glycine.

Question: What happens during the menstrual phase of the uterine cycle?

Answer: During the menstrual phase, the uterine lining degrades and is expelled from the body as menstrual flow, typically lasting about four days.

Question: What is the formula for calculating kinetic energy?

Answer: Kinetic energy ( $E_k$ ) =  $\frac{1}{2} mv^2$ , where  $m$  is mass and  $v$  is velocity.

Question: Describe the working principle of a crystal oscillator.

Answer: A crystal oscillator uses the mechanical resonance of a vibrating crystal to generate a precise and stable frequency signal, essential for timing and frequency control in electronic circuits.

Question: How do solar cells generate electricity?

Answer: Solar cells generate electricity by allowing sunlight to fall on silicon p-n junctions, which generates a small electromotive force (voltage) across the junction.

Question: What is the significance of the Kyoto Protocol?

Answer: The Kyoto Protocol is an international treaty that commits participating countries to reduce greenhouse gas emissions to combat climate change.

Question: How does the distal convoluted tubule regulate ion balance?

Answer: The distal convoluted tubule reabsorbs sodium and calcium while secreting potassium and hydrogen ions, maintaining electrolyte balance.

Question: What is the concentration of a solution made by dissolving 17g of sodium nitrate in 200 cm<sup>3</sup> of water?

Answer: The concentration is 1 mol/dm<sup>3</sup>.

Question: What is rust, and how does it form on iron objects?

Answer: Rust is a reddish-brown compound that forms on iron objects when they are exposed to air and moisture. It is primarily composed of iron oxides formed through the oxidation of iron in the presence of water or air moisture.

Question: What is the significance of a double bond in an oxygen (O<sub>2</sub>) molecule?

Answer: A double bond in an oxygen (O<sub>2</sub>) molecule involves the sharing of two pairs of electrons between two oxygen atoms, resulting in a strong and stable bond.

Question: How do geneticists use CRISPR technology in genetic research?

Answer: CRISPR technology allows geneticists to precisely edit genes by targeting specific DNA sequences, enabling the study of gene function and the development of gene therapies for genetic disorders.

Question: What is the voltage drop across a  $10\ \Omega$  resistor with a current of  $1.5\text{ A}$  flowing through it?

Answer: Using Ohm's Law,  $V = IR$  the voltage drop is  $V = 1.5\text{ A} \times 10\ \Omega = 15\text{ V}$ .

Question: How do we perceive different sound qualities?

Answer: Different sound qualities are perceived based on the unique waveforms of sounds produced by various sources, such as musical instruments.

Question: What is the method to observe fungi on a slice of bread?

Answer: Add a few drops of water onto a slice of bread, leave it for 2 days, obtain a small amount of the mycelium, place it on a glass slide, cover it with a coverslip, and observe it through a microscope.

Question: What is the purpose of using rubber slippers or mats when operating electric appliances?

Answer: Rubber slippers or mats insulate the user from the ground, reducing the risk of electric shocks when operating electric appliances.

Question: What is the significance of Newton's laws of motion?

Answer: Newton's laws of motion provide a fundamental framework for understanding the relationship between forces and the motion of objects. They explain how forces affect the motion of objects and the interaction between objects.

Question: What is the density of water used in the calculation for the reaction between vinegar and lime water?

Answer:  $1000\text{ kg m}^{-3}$ .

Question: How is hydrogen gas collected by downward displacement of air?

Answer: Hydrogen gas, less dense than air, is collected by displacing air downwards in an inverted gas jar, a method known as downward displacement of air.

Question: How is the concentration of a solution affected by dilution?

Answer: Dilution decreases the concentration of a solution by adding more solvent.

Question: How do magnesium and chlorine atoms achieve stability in magnesium chloride?

Answer: Magnesium atoms lose two electrons to form  $\text{Mg}^{2+}$  ions, and chlorine atoms gain one electron each to form  $\text{Cl}^{-}$  ions. The electrostatic attraction between these ions forms magnesium chloride ( $\text{MgCl}_2$ ).

Question: How are chromosomes involved in cell division?

Answer: During cell division, chromosomes condense and become visible, ensuring the accurate distribution of genetic material to daughter cells.



Question: What is the volume fraction of a component in a gas mixture?  
Answer:  $\text{Volume fraction} = \frac{\text{Volume of the component}}{\text{Total volume of the gas mixture}}$

Question: A man sighting a barking and lunging dog, starts to run fast. Which of the following hormone secreted in the human body is related to this incident? (1) growth hormone (2) thyroxine (3) oestrogen (4) adrenaline  
Answer: (4) adrenaline

Question: How are water waves classified?  
Answer: Water waves are classified as transverse waves because the water particles move up and down while the wave propagates horizontally.

Question: What is the protective function of blood tissue?  
Answer: Blood tissue protects the body by using white blood cells to destroy foreign bodies through phagocytosis and antibody production.

Question: How does the rate of change of the magnetic field affect the induced voltage?  
Answer: A faster rate of change of the magnetic field induces a higher voltage, as the induced electromotive force is directly proportional to the rate of change.

Question: How does electronegativity influence the polarity of a molecule?  
Answer: Electronegativity influences the polarity of a molecule by determining how strongly an atom attracts shared electrons. Atoms with higher electronegativity attract electrons more strongly, leading to partial charges and polar bonds.

Question: Describe the working principle of a cathode ray tube (CRT) in old televisions.  
Answer: A cathode ray tube (CRT) uses an electron gun to emit electrons that strike a phosphorescent screen, creating images by modulating the electron beam intensity and deflecting it across the screen.

Question: How do lenses correct vision in eyeglasses?  
Answer: Eyeglasses use convex or concave lenses to adjust the focal point of light entering the eye, aiding in clear vision for various refractive errors.

Question: What is the significance of Michael Faraday's contribution to electromagnetism?  
Answer: Michael Faraday's discovery of electromagnetic induction revolutionized the generation of electricity and led to the development of various electrical devices.

Question: What is the relationship between current and potential difference in a conductor?  
Answer: According to Ohm's Law, the current (I) passing through a conductor is directly proportional to the potential difference (V) across it, provided the temperature remains constant.

Question: What is the role of the armature in generating rotational motion in a DC motor?

Answer: The armature interacts with the magnetic field, producing rotational motion when current flows through its coils.

Question: What factors contribute to the efficiency of modern electric cookers?

Answer: Factors contributing to the efficiency of modern electric cookers include better heat transfer, reduced heat loss, and advanced technologies like induction heating.

Question: How do you calculate the resistance of a bulb connected to a 12 V power supply with a current of 0.5 A?

Answer: Using Ohm's Law,  $R = V/I$ , the resistance is  $R = 12 \text{ V} / 0.5 \text{ A} = 24 \Omega$ .

Question: Why is it important to use appropriate fuses in domestic circuits?

Answer: Appropriate fuses protect domestic circuits from overcurrent, preventing potential damage to appliances and reducing the risk of electrical fires.

Question: What are secondary sexual characteristics in males?

Answer: Secondary sexual characteristics in males, influenced by the hormone testosterone, include pubertal hair growth on the face, chest, under armpits, and in genital areas, widened shoulders, deepened voice, accelerated growth of bones and muscles, production of sperms by testes, and growth of genitals.

Question: What is the relative molecular mass of carbon dioxide (CO<sub>2</sub>)?

Answer: The relative molecular mass of carbon dioxide (CO<sub>2</sub>) is 44, calculated as 12 for carbon plus 2 x 16 for oxygen.

Question: What are the safety measures when using strong acids and bases?

Answer: Strong acids and bases should be handled with protective equipment, avoiding direct contact and inhalation, and following proper disposal methods.

Question: What happens to frictional force when the contact surfaces are polished?

Answer: When the contact surfaces are polished, the frictional force decreases because the surfaces become smoother and have less resistance to motion.

Question: What are the three types of tanks used in salterns for salt production?

Answer: Large shallow tanks, medium tanks, and small tanks.

Question: How does the coil's position affect the electromotive force in an alternating current dynamo?

Answer: The electromotive force varies with the coil's position, reaching maximum values when the coil intersects the magnetic field lines perpendicularly.

Question: What is the role of sulphur in plants?

Answer: Sulphur is a constituent of amino acids and proteins.

Question: Describe the physical properties of nitrogen.

Answer: Nitrogen is a colorless, odorless gas that is lighter than air and slightly soluble in water.

Question: How are the surfaces of a concave lens described?

Answer: The surfaces of a concave lens are parts of spheres with centers C1 and C2, joined by the principal axis.

Question: How does the polarity of a molecule affect its boiling point?

Answer: The polarity of a molecule affects its boiling point by creating dipole-dipole interactions that require more energy to overcome, resulting in a higher boiling point compared to non-polar molecules.

Question: How do chemo-autotrophs obtain energy?

Answer: Chemo-autotrophs obtain energy by oxidizing inorganic compounds, such as hydrogen sulfide or ammonia.

Question: How do viruses infect plants?

Answer: Viruses infect plants by entering through wounds or being transmitted by vectors such as insects, then replicating within plant cells and causing symptoms such as mosaic patterns, stunted growth, and wilting.

Question: What causes appendicitis, and what are its symptoms?

Answer: Appendicitis is caused by infection and swelling of the appendix, leading to symptoms such as abdominal pain, fever, and digestive disturbances.

Question: What is the mass of  $100\text{ cm}^3$  of water assumed in the calculation?

Answer: 100 g.

Question: How does the conductivity of an electrolyte influence the performance of an electrochemical cell?

Answer: The conductivity of an electrolyte influences the performance of an electrochemical cell by affecting ion transport and reaction rates. High conductivity ensures efficient ion migration, reducing internal resistance and improving cell efficiency and power output.

Question: What is the method to observe fungi on a slice of bread as described in the document?

Answer: Add a few drops of water onto a slice of bread, leave it for 2 days, obtain a small amount of the mycelium, place it on a glass slide, cover it with a coverslip, and observe it through a microscope.

Question: What factors does kinetic energy depend on?

Answer: Kinetic energy depends on the mass and velocity of the object.

Question: What occurs when zinc reacts with dilute sulfuric acid?

Answer: Zinc reacts with dilute sulfuric acid, producing zinc sulfate and hydrogen gas:  $\text{Zn} + \text{H}_2\text{SO}_4 \rightarrow \text{ZnSO}_4 + \text{H}_2$ .

Question: If a force of 2 N moves an object by 1 m, what is the work done?

Answer: The work done is 2 Joules (J).

Question: What are the two forms of mechanical energy?

Answer: Potential energy and kinetic energy.

Question: What is the significance of waveforms in determining the quality of sound?

Answer: The waveform of a sound determines its quality or timbre, allowing us to differentiate between sounds produced by different sources.

Question: What are the features of invertebrates in the phylum Cnidaria?

Answer: Invertebrates in the phylum Cnidaria are aquatic, mostly marine, diploblastic with a coelenteron, have radial symmetry, and are predators with nematocysts.

Question: What is the concentration of a solution containing 1 mol of NaCl in 500 cm<sup>3</sup> of water?

Answer: The concentration is 2 mol/dm<sup>3</sup>.

Question: Describe the role of the pancreas in digestion.

Answer: The pancreas secretes digestive enzymes into the duodenum through the pancreatic duct, aiding in the breakdown of proteins, starch, and lipids.

Question: What is the first ionisation energy of boron?

Answer: The first ionisation energy of boron is 801 kJ/mol.

Question: What conclusion can be drawn about the surface area when a large cube is divided into small cubes?

Answer: The surface area increases when a large cube is divided into smaller cubes, enhancing the rate of reaction.

Question: What are the features of vertebrates in the class Mammalia?

Answer: Vertebrates in the class Mammalia have skin covered by hair, mammary glands, sweat and sebaceous glands, ear lobes, a four-chambered heart, complete double circulation, biconcave red blood cells lacking a nucleus, and are warm-blooded with internal fertilization.

Question: What is the relationship between genes and chromosomes?

Answer: Genes are specific segments of DNA located on chromosomes, each gene occupying a particular position on a chromosome.

Question: Explain the significance of impedance matching in RF circuits.

Answer: Impedance matching ensures maximum power transfer and minimizes signal reflection in RF circuits by matching the impedance of the source and load, optimizing performance.

Question: What are fixed value resistors?

Answer: Fixed value resistors are resistors with a constant resistance value that cannot be changed. They are made by depositing thin films of carbon or winding materials like nichrome.

Question: What is the acceleration of a 2 kg object when a force of 10 N is applied?

Answer: The acceleration is  $a = F/m = 5 \text{ m/s}^2$ .

Question: What is the role of the cytoskeleton in cells?

Answer: The cytoskeleton provides structural support, facilitates cell movement, and aids in intracellular transport by maintaining the cell's shape and organizing its components.

Question: How does climate change impact the frequency of natural disasters?

Answer: Climate change increases the frequency and intensity of natural disasters such as hurricanes, floods, droughts, and wildfires. It poses significant risks to human safety, infrastructure, and ecosystems.

Question: What is the role of catalysts in biological systems?

Answer: Catalysts, often enzymes, accelerate biochemical reactions, ensuring efficient metabolic processes in living organisms.

Question: How does the number of coil turns affect the dynamo's performance?

Answer: More coil turns increase the induced electromotive force, enhancing the dynamo's efficiency and electricity generation.

Question: How do you measure the resistance of a nichrome wire coil in a circuit?

Answer: Connect the nichrome wire coil in series with an ammeter and a power supply, measure the current, and use a voltmeter to measure the voltage across the coil. Calculate the resistance using Ohm's Law.

Question: How has genetic engineering been applied in agriculture?

Answer: Genetic engineering has been used to produce crops resistant to pests, diseases, and environmental conditions. Examples include weedicide-resistant crops and vitamin A-enriched rice (Golden Rice).

Question: What is the role of carbon monoxide in the blast furnace?

Answer: Carbon monoxide acts as a reducing agent, reducing iron ore to liquid iron by reacting with iron(III) oxide to form carbon dioxide.

Question: How is the focal length of a convex lens defined?

Answer: The focal length is the distance from the optical center of the lens to the focal point.

Question: How is potassium permanganate used to prepare oxygen gas in the laboratory?

Answer: Potassium permanganate is heated to decompose it into potassium manganate, manganese dioxide, and oxygen gas, collected by downward displacement of water.

Question: What are electrostatic charges?

Answer: Electrostatic charges are charges that remain stationary on the surface of an object.

Question: How are highly reactive metals like sodium and potassium stored, and why?

Answer: Highly reactive metals like sodium and potassium are stored in liquids like kerosene or liquid paraffin to prevent them from reacting with air and moisture, which could cause dangerous reactions.

Question: How does the type of electrode material affect the performance of an electrochemical cell?

Answer: The type of electrode material affects the performance of an electrochemical cell by influencing reaction kinetics, conductivity, stability, and compatibility with the electrolyte. Optimal electrode materials ensure efficient and durable cell operation.

Question: What is the specific heat capacity of zinc?

Answer: The specific heat capacity of zinc is  $380 \text{ J kg}^{-1} \text{ K}^{-1}$ .

Question: What is a double displacement reaction? Provide an example.

Answer: A double displacement reaction involves the exchange of elements or radicals between two compounds, forming new compounds. An example is the reaction between barium chloride and sodium sulfate:  $\text{BaCl}_2 + \text{Na}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + 2\text{NaCl}$ .

Question: What is the significance of polar and non-polar covalent bonds in chemical reactions?

Answer: Polar and non-polar covalent bonds influence chemical reactions by determining the reactivity, solubility, and interaction of molecules with other substances, affecting the course and outcome of reactions.

Question: How does the surface area of a reactant influence the rate of a chemical reaction?

Answer: A larger surface area provides more collision sites for reactants, increasing the rate of reaction.

Question: What is the molar mass of calcium carbonate ( $\text{CaCO}_3$ )?

Answer: The molar mass of calcium carbonate is 100 grams per mole, calculated as 40 for calcium, 12 for carbon, and  $3 \times 16$  for oxygen.

Question: What is the relationship between dominant and recessive alleles?

Answer: Dominant alleles determine the trait expressed when present, while recessive alleles are expressed only when both alleles are recessive.

Question: What are the key features of the Domain Archaea?

Answer: The Domain Archaea includes prokaryotes that can live in extreme environments and are not sensitive to most antibiotics.

Question: How does the polarity of water molecules contribute to its properties as a solvent?

Answer: The polarity of water molecules allows them to surround and interact with various solutes, breaking ionic and molecular bonds, making

water an excellent solvent for many substances.

Question: What is velocity?

Answer: Velocity is the rate of change of displacement.

Question: How is the human reproductive process regulated?

Answer: The human reproductive process is regulated by hormones such as FSH, LH, testosterone, estrogen, and progesterone, secreted by various endocrine glands.

Question: Explain the term 'half reactions' in the context of electrochemical cells.

Answer: Half reactions' refer to the separate oxidation and reduction reactions that occur in an electrochemical cell. Each half reaction shows the conversion of one chemical species to another by losing or gaining electrons.

Question: Describe the reaction of aluminum with sodium hydroxide solution.

Answer: Aluminum reacts with sodium hydroxide solution to form sodium aluminate and hydrogen gas:  $2\text{Al} + 2\text{NaOH} + 2\text{H}_2\text{O} \rightarrow 2\text{NaAlO}_2 + 3\text{H}_2$ .

Question: What are the factors that affect the rate of chemical reactions?

Answer: Factors include surface area of reactants, concentration of reactants, pressure of gaseous reactants, temperature, and the presence of catalysts or inhibitors.

Question: What occurs when potassium bromide reacts with chlorine gas?

Answer: Potassium bromide reacts with chlorine gas to form potassium chloride and bromine:  $2\text{KBr} + \text{Cl}_2 \rightarrow 2\text{KCl} + \text{Br}_2$ .

Question: Explain the concept of mean velocity with an example.

Answer: Mean velocity is the average velocity over a time interval, calculated by dividing total displacement by total time.

Question: Describe the reaction of potassium permanganate when heated.

Answer: When potassium permanganate is heated, it decomposes to form potassium manganate, manganese dioxide, and oxygen:  $2\text{KMnO}_4 \rightarrow \text{K}_2\text{MnO}_4 + \text{MnO}_2 + \text{O}_2$ .

Question: What are the three methods of heat transfer, and how do they operate?

Answer: The three methods of heat transfer are conduction, convection, and radiation. Conduction transfers heat through direct contact, convection transfers heat through fluid motion, and radiation transfers heat through electromagnetic waves.

Question: How does the electronic configuration of sulfur influence its bonding behavior?

Answer: The electronic configuration of sulfur (2, 8, 6) allows it to form covalent bonds by sharing its valence electrons with other atoms to achieve a stable configuration.

Question: What is the molar mass of sodium (Na)?

Answer: The molar mass of sodium (Na) is 23 grams per mole.

Question: How does the induced voltage waveform in an alternating current dynamo look?

Answer: The induced voltage waveform in an alternating current dynamo is sinusoidal, alternating between positive and negative values.

Question: What is the composition of a 5 g/dm<sup>3</sup> solution in terms of m/v?

Answer: The composition is 5 g/dm<sup>3</sup>.

Question: What is the molar mass of potassium hydroxide (KOH)?

Answer: The molar mass of KOH is 56 g/mol.

Question: How is the chemical formula of potassium hydroxide represented?

Answer: The chemical formula of potassium hydroxide is KOH, indicating one potassium ion and one hydroxide ion.

Question: What is the significance of the water-energy-food nexus?

Answer: The water-energy-food nexus is significant because it highlights the interdependence of these resources and the need for integrated management to ensure sustainability and security.

Question: What is the relationship between velocity and time in a velocity-time graph with a straight line?

Answer: It indicates constant acceleration or deceleration.

Question: How does the expansion of solids play a role in the design of bimetallic strips in electrical appliances?

Answer: Bimetallic strips in electrical appliances consist of two metals with different expansion rates. When heated, the strip bends due to the differential expansion, which can be used to regulate the temperature in devices like electric irons and rice cookers.

Question: What is the role of water in maintaining osmotic pressure in cells?

Answer: Water helps maintain constant osmotic pressure in cells.

Question: What is the principle behind ultrasound imaging?

Answer: Ultrasound imaging uses high-frequency sound waves to create images of internal body structures based on the reflection of sound waves.

Question: What is the molar mass of sodium carbonate (Na<sub>2</sub>CO<sub>3</sub>)?

Answer: The molar mass of Na<sub>2</sub>CO<sub>3</sub> is 106 g/mol.

Question: Describe the process of electrochemical synthesis of ammonia and its importance.

Answer: The electrochemical synthesis of ammonia involves the reduction of nitrogen gas and hydrogen gas using an electrochemical cell, providing a sustainable and energy-efficient alternative to the traditional Haber-Bosch process. It is important for producing ammonia, a key ingredient in fertilizers, with lower energy consumption and reduced carbon footprint.



Question: How does the release of greenhouse gases contribute to the greenhouse effect?

Answer: The release of greenhouse gases contributes to the greenhouse effect by trapping heat in the Earth's atmosphere, leading to an increase in global temperatures and climate change.

Question: How is the heat of reaction for sodium and chlorine calculated?

Answer: By determining the quantity of heat evolved for the given moles of reactants and scaling up to 1 mol to find the heat of reaction per mole.

Question: What is hercogamy?

Answer: Hercogamy is an adaptation in flowers where the stamens and stigma are positioned at a distance to avoid self-pollination. Examples include orchid and catharanthus.

Question: How does the height of a water column affect the pressure?

Answer: The pressure in a liquid increases with the height of the water column.

Question: What are the characteristics of the Kingdom Fungi?

Answer: The Kingdom Fungi includes organisms with chitinous cell walls, eukaryotic cellular organization, and the ability to decompose organic matter.

Question: How do geneticists study the genetic basis of complex diseases?

Answer: Geneticists study the genetic basis of complex diseases by identifying genetic variants associated with disease risk, conducting genome-wide association studies, and investigating gene-environment interactions that contribute to disease development.

Question: What is the significance of the angular shape of the water molecule?

Answer: The angular shape of the water molecule, caused by the two lone pairs on the oxygen atom, creates a dipole moment, making water a polar molecule with unique properties such as high surface tension and solubility.

Question: What is the importance of catalysts in everyday life?

Answer: Catalysts play a crucial role in various processes, such as food digestion, pollution control, and manufacturing of chemicals.

Question: What is the function of a low-dropout regulator (LDO) in voltage regulation?

Answer: A low-dropout regulator (LDO) provides efficient and stable voltage regulation with a small difference between the input and output voltages, making it suitable for sensitive electronic circuits.

Question: Describe the process of endocytosis.

Answer: Endocytosis is the process by which cells engulf external substances, forming vesicles that bring these substances into the cell for processing or digestion.

Question: Explain the role of ATP in cellular activities.

Answer: ATP (adenosine triphosphate) is the primary energy carrier in cells, providing energy for various metabolic processes, including muscle contraction, protein synthesis, and active transport.

Question: What are the potential health risks of high calcium levels (hypercalcemia) for kidney function?

Answer: Hypercalcemia can lead to kidney stones, impaired kidney function, and potential kidney damage.

Question: How can the focal length of a concave mirror be determined experimentally?

Answer: The focal length can be determined by focusing a distant object's image on a screen using the concave mirror and measuring the distance between the mirror and the screen.

Question: What is the chemical formula for sulfur dioxide?

Answer: The chemical formula for sulfur dioxide is  $\text{SO}_2$ .

Question: How does the direction of induced current change with coil rotation?

Answer: The direction of induced current changes periodically with coil rotation, resulting in an alternating current output.

Question: How does the structure of a virus differ from a cell?

Answer: A virus does not have cellular structures such as organelles or a plasma membrane. It consists of nucleic acid (DNA or RNA) enclosed in a protein capsid.

Question: How are electrons arranged in Rutherford's model?

Answer: Electrons revolve around the nucleus, similar to how planets revolve around the sun.

Question: Who introduced the cell theory?

Answer: Schleiden, Schwann, and Rudolf Virchow introduced the cell theory based on observations of live tissues through a microscope.

Question: How does the Liebig condenser assist in distillation?

Answer: It cools and condenses the vapor produced during distillation, converting it back into liquid form.

Question: What is the role of the renal cortex in kidney function?

Answer: The renal cortex contains nephrons and blood vessels, playing a crucial role in filtering blood and forming urine.

Question: Calculate the energy consumption of a 200W television used for 4 hours daily over a month.

Answer: The energy consumption is  $(200\text{W} \times 4 \text{ hours} \times 30 \text{ days}) / 1000 = 24 \text{ kWh}$ .

Question: What is the role of the center of curvature in determining the properties of spherical mirrors?

Answer: The center of curvature is the point from which the mirror's curvature is derived, helping to define the focal length and reflective

properties.

Question: What is the significance of a double bond in an oxygen (O<sub>2</sub>) molecule?

Answer: A double bond in an oxygen (O<sub>2</sub>) molecule involves the sharing of two pairs of electrons between two oxygen atoms, resulting in a strong and stable bond.

Question: How do you find the total resistance of a circuit with a combination of series and parallel resistors?

Answer: Calculate the equivalent resistance of parallel groups first, then add the series resistances to find the total resistance.

Question: What is the momentum of a 3 kg object moving at 2 m/s?

Answer: The momentum is  $p = m \times v = 3 \times 2 = 6$  kg m/s.

Question: How does electromagnetic induction enable the operation of a moving coil microphone?

Answer: Electromagnetic induction enables the microphone to convert sound waves into electrical signals by inducing a current in the vibrating coil.

Question: How do you find the velocity from a velocity-time graph?

Answer: The velocity is given by the value on the y-axis.

Question: What is the significance of finding new characteristics in a family member?

Answer: Finding new characteristics suggests that inherited traits can skip generations, reappearing in descendants after being absent in previous generations.

Question: What is the significance of the human genome project?

Answer: The human genome project aims to map the base sequences of all genes in human chromosomes, providing insights into genetic disorders and the potential for gene therapy and personalized medicine.

Question: How does the frequency of a wave affect its energy?

Answer: The energy of a wave is directly proportional to its frequency; higher frequency waves carry more energy.

Question: What are compressions and rarefactions in a sound wave?

Answer: Compressions are regions of high pressure where particles are close together, and rarefactions are regions of low pressure where particles are spread apart.

Question: What is the kinetic energy of a 2 kg object moving at 3 m/s?

Answer: The kinetic energy is 9 Joules (J).

Question: What is the significance of the electromagnetic spectrum in remote sensing?

Answer: The electromagnetic spectrum allows remote sensing technologies to detect and measure various environmental and atmospheric conditions from a distance.

Question: How does the weight of an object in water compare to its weight in air?

Answer: The weight of an object in water is less than its weight in air because the upthrust exerted by the water reduces the apparent weight of the object.

Question: What are some medical applications of gene technology?

Answer: Gene technology is used in medicine to produce insulin, growth hormones, antibiotics, and for gene therapy to replace diseased genes with healthy ones.

Question: What is the resultant force if two forces of 10 N and 6 N act in the same direction?

Answer: The resultant force is 16 N in the same direction.

Question: How does the thermal decomposition of limestone illustrate an endothermic reaction?

Answer: The reaction absorbs heat to produce quicklime and carbon dioxide:  $\text{CaCO}_3 (\text{s}) \rightarrow \text{CaO} (\text{s}) + \text{CO}_2 (\text{g})$ .

Question: How does a photovoltaic cell convert sunlight into electrical energy?

Answer: A photovoltaic cell converts sunlight into electrical energy by absorbing photons, which generate electron-hole pairs in the semiconductor material. The built-in electric field separates the charge carriers, creating a current flow and producing electricity.

Question: What is the role of a galvanic cell in generating electrical energy?

Answer: A galvanic cell generates electrical energy from spontaneous redox reactions occurring between the electrodes, with chemical energy being converted into electrical energy that can be used to power devices.

Question: What are the features of invertebrates in the phylum Arthropoda?

Answer: Invertebrates in the phylum Arthropoda are triploblastic, coelomic, have jointed limbs, segmented bodies forming functional segments called Tagma, a chitinous cuticle acting as an exoskeleton, bilateral symmetry, and show sexual dimorphism.

Question: How do you measure the force required to initiate the turning effect on a stick using a Newton balance?

Answer: Attach a Newton balance to the stick and apply a perpendicular force. Measure the minimum force required to slightly move the stick, keeping the balance perpendicular to the stick.

Question: How do you determine the weight required to balance a rod when a weight is suspended from one end?

Answer: To determine the weight required to balance a rod, use the principle of moments: the clockwise moment due to the weight at one end should equal the anti-clockwise moment due to the weight at the other end.

Question: What happens when carbon monoxide (CO) from cigarette smoke is absorbed into the blood?

Answer: Carbon monoxide binds with hemoglobin, reducing the blood's oxygen-carrying capacity.

Question: What is the valency of nitrogen?

Answer: The valency of nitrogen is 3.

Question: How is the chemical formula of magnesium hydroxide written?

Answer: The chemical formula of magnesium hydroxide is  $\text{Mg}(\text{OH})_2$ , indicating one magnesium ion and two hydroxide ions.

Question: What are some examples of disaccharides?

Answer: Examples of disaccharides include maltose, sucrose, and lactose.

Question: What is one factor on which friction does not depend?

Answer: Friction does not depend on the surface area of the contact surfaces.

Question: What are the potential effects of climate change on freshwater resources?

Answer: Climate change affects freshwater resources by altering precipitation patterns, increasing evaporation rates, and reducing snowpack and glacier melt. It leads to water scarcity and impacts water availability and quality.

Question: What is one of the reasons for the increasing use of white light LEDs?

Answer: White light LEDs are increasingly used because of their very low power consumption and long lifetimes of about 50,000 hours.

Question: What is the significance of Mendel's choice of the garden pea plant for his experiments?

Answer: The garden pea plant's ease of cultivation, short generation time, and clear contrasting traits made it an ideal choice for Mendel's genetic experiments, allowing for accurate observations of inheritance patterns.

Question: What is the displacement of an athlete running a 200 m track from A to B and finishing at the starting point?

Answer: The displacement is zero (0).

Question: What processes are involved in the water cycle?

Answer: Processes involved in the water cycle include evaporation, condensation, precipitation, infiltration, and runoff.

Question: How does a lithium-ion battery differ from a nickel-metal hydride battery?

Answer: A lithium-ion battery offers higher energy density, lower self-discharge, and longer cycle life compared to a nickel-metal hydride battery. Lithium-ion batteries are lighter and provide higher voltage, making them suitable for portable electronics and electric vehicles.

Question: Why is it important to use energy-efficient lighting in households?

Answer: Using energy-efficient lighting reduces electricity consumption, lowers utility bills, and decreases the environmental impact of energy production.

Question: How do ionic compounds behave in solid state compared to their behavior in aqueous solutions?

Answer: In the solid state, ionic compounds do not conduct electricity because the ions are fixed in place within the lattice structure. In aqueous solutions, the ions are free to move and conduct electricity.

Question: Describe the setup for Activity in investigating the equilibrium of an object under two forces.

Answer: In Activity , a ring is placed horizontally on a table and pulled with two spring balances in opposite directions. By varying the force applied, the ring is kept at rest to observe that the forces required to maintain equilibrium are equal in magnitude.

Question: How do you investigate the equilibrium of an object under the action of two forces using a block of wood and Newton balances?

Answer: Attach the Newton balances to the block of wood and pull in opposite directions with varying forces. The object remains in equilibrium when the forces are equal in magnitude and opposite in direction, resulting in no net movement.

Question: What are the adverse effects of food additives?

Answer: Adverse effects of food additives include allergies, diabetes, obesity, cancer, and disorders of the nervous system and digestive tract.

Question: How does the expansion of liquids demonstrate thermal expansion principles?

Answer: The expansion of liquids demonstrates thermal expansion principles by showing how liquid volume increases with temperature, as seen in experiments with colored water and test tubes.

Question: What is the effect of reversing current direction on the magnetic field around a conductor?

Answer: Reversing the current direction reverses the field direction, changing the magnetic field's orientation around the conductor.

Question: What observations indicate that copper is deposited at the cathode during the electrolysis of copper sulfate?

Answer: The cathode becomes coated with copper, and the blue color of the solution fades as  $\text{Cu}^{2+}$  ions are reduced.

Question: What are zoophilous flowers?

Answer: Zoophilous flowers are pollinated by animals and have adaptations like fragrance, large size, and colorful appearance to attract animals for pollination.

Question: What is the significance of solubility in geochemistry?

Answer: Solubility is important in geochemistry for understanding mineral formation, weathering processes, and the mobility of elements in the Earth's crust and hydrosphere.

Question: How do sound waves propagate through different media?

Answer: Sound waves propagate through compressions and rarefactions in the medium, whether it is air, water, or solid material.

Question: What is the acceleration of a 3 kg object when a force of 9 N is applied?

Answer: The acceleration is  $F/m = 3 \text{ m/s}^2$ .

Question: What are the main functions of the respiratory system?

Answer: The respiratory system facilitates the intake of oxygen and the expulsion of carbon dioxide and other gaseous waste products.

Question: How do animals perform thermoregulation?

Answer: Animals perform thermoregulation by adjusting their behavior, physiology, and morphology to maintain a stable internal temperature, including sweating, shivering, and altering blood flow.

Question: How does Newton's second law apply to throwing a ball?

Answer: When throwing a ball, the force applied by the hand determines the ball's acceleration. The mass of the ball and the applied force determine the ball's velocity and motion according to Newton's second law.

Question: How does the direction of current change in an alternating current dynamo?

Answer: The direction of current changes periodically in an alternating current dynamo as the coil rotates, resulting in alternating current.

Question: What is the importance of using distilled water in the electrolysis of acidulated water?

Answer: Distilled water is free of impurities that could interfere with the electrolysis process and produce unwanted reactions, ensuring accurate and efficient electrolysis.

Question: What is the principle behind detecting fractures in airplane components using ultrasound?

Answer: High-frequency ultrasound waves do not penetrate air gaps, indicating potential fractures or structural issues in solid components.

Question: What is the relationship between magnetic field strength and induced voltage?

Answer: The induced voltage is directly proportional to the magnetic field strength, with stronger fields generating higher voltage.

Question: What is the principle behind ultrasound scanning of internal organs?

Answer: Ultrasound waves are emitted by a transmitter placed on the patient's body, and the reflected waves from internal structures are used to create images for medical examination.

Question: What is the effect of a convex lens on parallel light rays?

Answer: A convex lens converges parallel light rays to a focal point on the opposite side of the lens.

Question: What is the significance of chlorophyll in plants?

Answer: Chlorophyll allows plants to absorb light energy and produce food through photosynthesis.

Question: How do you adjust the final volume of a solution in a volumetric flask?

Answer: Add water carefully until the meniscus is at the volume mark of the flask.

Question: Explain the concept of galvanic corrosion and how it can be prevented.

Answer: Galvanic corrosion occurs when two dissimilar metals are in electrical contact in the presence of an electrolyte, causing the more reactive metal (anode) to corrode. It can be prevented by using compatible metals, insulating the metals, or applying protective coatings.

Question: How does the coil's position affect the electromotive force in an alternating current dynamo?

Answer: The electromotive force varies with the coil's position, reaching maximum values when the coil intersects the magnetic field lines perpendicularly.

Question: How is the total energy consumed by an electric appliance calculated?

Answer: The total energy consumed ( $E$ ) is calculated by multiplying the power ( $P$ ) by the time ( $t$ ) the appliance operates, expressed as  $E = Pt$ .

Question: How does dialysis help patients with renal failure?

Answer: Dialysis is a medical procedure that filters blood using a machine when kidneys fail, removing waste products and excess fluid from the body.

Question: How do you investigate the dependence of the moment on the perpendicular distance to the force from the point of suspension?

Answer: To investigate the dependence of the moment on the perpendicular distance, apply the same force at different distances from the axis of rotation and measure the resulting moments.

Question: What is urine, and where is it produced?

Answer: Urine is the excretory material produced in the nephrons of the kidneys.

Question: How is the purity of crystals ensured during recrystallization?

Answer: By dissolving the impure solid in a hot solvent and filtering out impurities before cooling the solution to form pure crystals.

Question: What is the role of nitrogen in plants?

Answer: Nitrogen is a constituent of amino acids, proteins, nucleic acids, and chlorophyll.



Question: What are metalloids?

Answer: Metalloids are elements that have properties intermediate between metals and non-metals.

Question: What percentage of the mature human body is composed of proteins?

Answer: 17% of the mature human body is composed of proteins.

Question: What is the significance of the coelom in Annelids?

Answer: The coelom provides an independent movement for the gut wall irrespective of the body movements.

Question: How does the use of efficient electric appliances impact electricity bills?

Answer: Using efficient electric appliances reduces electricity consumption, leading to lower utility bills and cost savings for households.

Question: What is the unit for measuring acceleration?

Answer: The unit for measuring acceleration is meters per second squared ( $\text{m/s}^2$ ).

Question: Why is it important to use a non-conductive plastic cup in the electrolysis of acidulated water?

Answer: A non-conductive plastic cup prevents short circuits, ensuring that the electric current flows through the water and facilitates the electrolysis process.

Question: How are elements arranged in the modern Periodic Table?

Answer: Elements are arranged in the modern Periodic Table in ascending order of their atomic numbers.

Question: What occurs during the secretory phase of the uterine cycle?

Answer: During the secretory phase, the uterine lining thickens and blood supply increases, becoming secretory under the influence of progesterone, typically lasting about 14 days.

Question: What is the principle behind the operation of a bicycle dynamo?

Answer: The principle behind a bicycle dynamo is electromagnetic induction, where mechanical rotation induces an electromotive force in the coil.

Question: Where can smooth muscle tissue be found in the body?

Answer: Smooth muscle tissue is found in the walls of organs with cavities, such as the digestive tract, uterus, blood vessels, and bladder.

Question: How does friction affect the motion of a sliding object on an inclined plane?

Answer: Friction opposes the motion of a sliding object on an inclined plane, causing it to slow down and eventually stop unless an external force is applied to maintain motion.

Question: How do you determine the velocity from a displacement-time graph?

Answer: Velocity is determined by the slope of the displacement-time graph.

Question: How are the angle of incidence and the angle of reflection defined?

Answer: The angle of incidence is the angle between the incident ray and the normal at the point of incidence, while the angle of reflection is the angle between the reflected ray and the normal.

Question: What are the conditions for maintaining equilibrium in a system of forces acting on an object?

Answer: The conditions for maintaining equilibrium are that the forces must be coplanar, their lines of action must intersect at a common point, and the resultant of any two forces must be equal in magnitude and opposite in direction to the third force.

Question: What are some useful effects of fungi?

Answer: Fungi can be used as a protein supplement (e.g., mushrooms), aid in bread and alcohol fermentation (e.g., yeast), and produce antibiotics (e.g., Penicillium).

Question: How does magnesium react with hot water compared to cold water?

Answer: Magnesium reacts slowly with cold water but reacts more readily with hot water, producing magnesium hydroxide and hydrogen gas:  $\text{Mg} + 2\text{H}_2\text{O} \rightarrow \text{Mg}(\text{OH})_2 + \text{H}_2$ .

Question: How is the crystal lattice structure of sodium chloride formed?

Answer: The crystal lattice structure of sodium chloride is formed by the regular arrangement of  $\text{Na}^+$  and  $\text{Cl}^-$  ions in a three-dimensional array, where each ion is surrounded by six oppositely charged ions.

Question: How does the electrolysis of acidulated water produce oxygen gas?

Answer: Oxygen gas is produced at the anode by the oxidation of  $\text{OH}^-$  ions:  $4\text{OH}^- (\text{aq}) \rightarrow \text{O}_2 (\text{g}) + 2\text{H}_2\text{O} (\text{l}) + 4\text{e}^-$ .

Question: What is the relationship between the number of turns in the primary and secondary coils of a transformer?

Answer: The voltage ratio between the primary and secondary coils is equal to the ratio of the number of turns in the primary coil to the number of turns in the secondary coil ( $V_p/V_s = N_p/N_s$ ).

Question: How do ionic compounds conduct electricity?

Answer: Ionic compounds conduct electricity in aqueous solutions and in the fused (molten) state because the ions are free to move and carry an electric charge.

Question: Describe the equilibrium of a plank of wood suspended by four strings in terms of forces.

Answer: The plank of wood is in equilibrium because the forces of tension in the four strings balance the weight of the plank. The tensions act vertically upwards and are equal in magnitude to the weight, resulting in no net force.

Question: What are the properties of water that result from hydrogen bonding?

Answer: Properties of water that result from hydrogen bonding include high boiling point, high specific heat capacity, surface tension, solvent capabilities, and the unique behavior of ice floating on liquid water.

Question: What are the key points summarized about heat changes in chemical reactions?

Answer: Every chemical reaction involves a heat change, exothermic reactions release heat, endothermic reactions absorb heat, and the amount of heat can be calculated using  $Q = mc\theta$ .

Question: What is the role of testosterone in male reproduction?

Answer: Testosterone promotes the development of male secondary sexual characteristics, supports sperm production, and influences libido.

Question: How does the speed of sound compare to the speed of light?

Answer: The speed of sound is much slower than the speed of light; sound travels at approximately 343 m/s in air, while light travels at about  $3 \times 10^8$  m/s in a vacuum.

Question: What is the relative molecular mass of sulfuric acid ( $\text{H}_2\text{SO}_4$ )?

Answer: The relative molecular mass of sulfuric acid is 98, calculated as  $2 \times 1$  for hydrogen, 32 for sulfur, and  $4 \times 16$  for oxygen.

Question: How can typhoid fever be prevented?

Answer: Typhoid fever can be prevented by consuming boiled water, avoiding contaminated food, maintaining hygiene, and getting vaccinated.

Question: What is the periodic law?

Answer: The periodic law states that the properties of elements are periodic functions of their atomic number.

Question: What is the result of the measurements in Activity when the meter ruler is in equilibrium?

Answer: When the meter ruler is in equilibrium, the sum of the forces measured by the two spring balances equals the weight of the meter ruler, indicating that the ruler is balanced under the action of three parallel, coplanar forces.

Question: What is haemophilia, and how is it inherited?

Answer: Haemophilia is an inherited disorder where blood does not clot properly due to the absence of specific clotting factors. It is caused by a recessive gene on the X chromosome and primarily affects males.

Question: What is the effect of amplitude on the perception of sound?

Answer: Higher amplitude waves are perceived as louder sounds, while lower amplitude waves are perceived as softer sounds.

Question: What is the importance of dispersal of fruits and seeds?

Answer: Dispersal minimizes competition for resources, finds new habitats, increases diversity, and provides protection from pests and diseases.

Question: What is the difference between ionic and covalent compounds in terms of electrical conductivity?

Answer: Ionic compounds conduct electricity in aqueous solutions and in the fused state, while covalent compounds generally do not conduct electricity in any state.

Question: What are the features of gymnosperms?

Answer: Gymnosperms have true tissue differentiation, possess vascular tissues, reproduce sexually by seeds, and are autotrophic and photosynthetic.

Question: What is the optical center of a concave lens?

Answer: The midpoint between the two surfaces of the lens, where any light ray traveling through it passes straight without bending.

Question: How is the chemical formula of silicon dioxide written?

Answer: The chemical formula of silicon dioxide is  $\text{SiO}_2$ , indicating one silicon atom and two oxygen atoms.

Question: What are the deficiency symptoms of magnesium?

Answer: Deficiency symptoms of magnesium include high heart beat and nerve irritability.

Question: What is the displacement of an object moving at a uniform velocity of 15 m/s for 20 seconds?

Answer: Displacement =  $15 \text{ m/s} \times 20 \text{ s} = 300 \text{ meters}$ .

Question: Describe the significance of understanding work, energy, and power in engineering.

Answer: Understanding these concepts is crucial in engineering to design efficient systems and machines that optimize energy use and perform work effectively.

Question: How do you measure the voltage across a component in a series circuit?

Answer: Use a voltmeter connected in parallel with the component to measure the voltage across it.

Question: How are polymers formed, and what are monomers?

Answer: Polymers are formed by the joining of a large number of small molecules called monomers through a process called polymerization.

Question: What is artificial vegetative propagation?

Answer: Artificial vegetative propagation is the production of plants vegetatively by humans. Methods include rooting of stem cuttings, layering, grafting, and tissue culture.

Question: What are the applications of electrochemical cells in medical devices?

Answer: Electrochemical cells are used in medical devices for applications like powering pacemakers, drug delivery systems, biosensors for glucose monitoring, and diagnostic equipment, providing reliable and efficient energy solutions for healthcare.

Question: How do plants regulate water loss?

Answer: Plants regulate water loss through stomatal control, producing waxy cuticles, and adjusting leaf orientation and surface area to minimize transpiration.

Question: How do you measure the force required to initiate the turning effect using a Newton balance and a stick?

Answer: Measure the force by attaching the Newton balance to the stick, applying a perpendicular force, and recording the minimum force required to slightly move the stick.

Question: What is the relative molecular mass of sulfuric acid ( $\text{H}_2\text{SO}_4$ )?

Answer: The relative molecular mass of sulfuric acid is 98, calculated as  $2 \times 1$  for hydrogen, 32 for sulfur, and  $4 \times 16$  for oxygen.

Question: What types of cells make up sclerenchyma tissue?

Answer: Sclerenchyma tissue is made up of sclereids and sclerenchyma fibers.

Question: How does electromagnetic induction apply to credit and debit cards?

Answer: Electromagnetic induction is used in magnetic stripes on credit and debit cards, storing data that is read by inducing a current in a reader device.

Question: How is the resultant force of two collinear forces acting in opposite directions calculated?

Answer: The resultant force is calculated by subtracting the smaller force from the larger force, in the direction of the larger force.

Question: What is a mercury barometer and how is it used to measure atmospheric pressure?

Answer: A mercury barometer measures atmospheric pressure using a glass tube filled with mercury inverted in a container. The height of the mercury column in the tube represents the atmospheric pressure.

Question: What is the function of the calyx?

Answer: The calyx, comprised of sepals, protects the flower parts when the flower is in the bud stage.

Question: What is the significance of using dilute solutions in heat change experiments?

Answer: Dilute solutions ensure that the specific heat capacity and density are close to those of water, simplifying calculations.

Question: What are the steps involved in tissue culture?

Answer: The steps include introducing vegetative tissue into the culture medium, developing callus, separating plantlets, and adapting them to natural conditions.

Question: How do mutations in DNA contribute to evolution?

Answer: Variations that occur in DNA due to mutations are important in evolution.

Question: What is the chemical formula for calcium chloride?

Answer: The chemical formula for calcium chloride is  $\text{CaCl}_2$ .

Question: What is the relationship between atomic radius and atomic number within a group?

Answer: Within a group, the atomic radius increases as the atomic number increases.

Question: What is the importance of energy level diagrams in understanding chemical reactions?

Answer: They visually represent the energy changes, helping to understand whether a reaction is exothermic or endothermic.

Question: What are some examples of organisms in the phylum Arthropoda?

Answer: Examples of organisms in the phylum Arthropoda include Butterfly, Spider, Scorpion, and Centipede.

Question: What are cleaning agents, and what are their basic raw materials?

Answer: Cleaning agents, such as soaps and detergents, are used to cleanse skin, hair, clothes, and surfaces. Their basic raw materials are plant oil or animal fat and a strong base like sodium hydroxide or potassium hydroxide.

Question: How do the properties of elements in a group compare?

Answer: Elements in the same group have similar properties because they have the same number of valence electrons.

Question: How is the chemical formula of magnesium nitrate written?

Answer: The chemical formula of magnesium nitrate is  $\text{Mg}(\text{NO}_3)_2$ , indicating one magnesium ion and two nitrate ions.

Question: What are the uses of sodium hydroxide in the soap-making industry?

Answer: Sodium hydroxide is used in the saponification process to convert fats and oils into soap.

Question: What is excretion?

Answer: Excretion is the removal of excretory products produced during metabolism.

Question: How do geneticists use population genetics to study evolution?

Answer: Geneticists use population genetics to study the distribution of genetic variation within and between populations, examining how

evolutionary forces such as natural selection, genetic drift, and gene flow shape genetic diversity over time.

Question: What is the electronic configuration of a sodium ion (Na<sup>+</sup>)?

Answer: The electronic configuration of a sodium ion (Na<sup>+</sup>) is 2, 8.

Question: What is the purpose of a thermistor in temperature sensing?

Answer: A thermistor is a type of resistor whose resistance changes significantly with temperature, making it useful for temperature sensing and control applications.

Question: What is the environmental equilibrium?

Answer: Environmental equilibrium is the balanced relationship among living organisms, physical components, and environmental conditions in the biosphere. It is essential for maintaining the stability and health of ecosystems.

Question: What is the balanced ionic equation for the reaction between zinc and hydrogen ions?

Answer: The balanced ionic equation is  $\text{Zn(s)} + 2\text{H}^+(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{H}_2(\text{g})$ .

Question: What is the principle behind the use of lenses in microscopes?

Answer: Microscopes use lenses to achieve high magnification of small objects by converging light rays through several focal points.

Question: What is the role of crests and troughs in describing transverse waves?

Answer: Crests and troughs represent the maximum and minimum displacements of particles in a transverse wave, indicating the wave's amplitude.

Question: What are bio-geochemical cycles?

Answer: Bio-geochemical cycles are natural processes that recycle nutrients and elements through the biosphere, involving the movement of substances between living organisms and the physical environment. Examples include the carbon, nitrogen, and water cycles.

Question: What are some examples of disaccharides?

Answer: Examples of disaccharides include maltose, sucrose, and lactose.

Question: How does the accumulation of heavy metals in the environment affect wildlife?

Answer: Heavy metals cause toxicity, bioaccumulation in the food chain, and harmful effects on reproduction, growth, and survival of wildlife. They pose a significant threat to ecosystem health.

Question: How can environmental equilibrium be affected?

Answer: Environmental equilibrium can be affected by changes in the environment, often due to complicated human activities.

Question: How do plants respond to gravity?

Answer: Plants respond to gravity through gravitropism, where roots grow towards the gravitational pull (positive gravitropism) and shoots grow away

from it (negative gravitropism).

Question: Describe the operation of a servo motor in control systems.

Answer: A servo motor uses feedback control to adjust its position or speed precisely, driven by a control signal that determines its movement based on the desired position or speed.

Question: What is the significance of the physical state of reactants and products in expressing heat change?

Answer: The physical state (solid, liquid, gas, aqueous) affects the heat change and should be indicated for accurate representation.

Question: What is the role of the armature in generating rotational motion in a DC motor?

Answer: The armature interacts with the field, producing rotational motion when current flows through its coils.

Question: Describe the reactivity of magnesium with hot water.

Answer: Magnesium reacts with hot water to form magnesium hydroxide and hydrogen gas:  $\text{Mg} + 2\text{H}_2\text{O} \rightarrow \text{Mg}(\text{OH})_2 + \text{H}_2$ .

Question: How does the reduction of  $\text{Cu}^{2+}$  ions at the cathode affect the copper sulfate solution?

Answer: The reduction of  $\text{Cu}^{2+}$  ions at the cathode removes these ions from the solution, decreasing the intensity of the blue color and resulting in the deposition of copper metal on the cathode.

Question: How does the diaphragm in a moving coil microphone respond to sound?

Answer: The diaphragm vibrates in response to sound waves, moving the attached coil within a magnetic field and generating an alternating current.

Question: What is the function of the nucleolus?

Answer: The nucleolus produces and assembles ribosomal RNA and ribosomal subunits, essential for protein synthesis in the cell.

Question: How does a compressed gas exert pressure?

Answer: A compressed gas exerts pressure due to the force of the gas molecules colliding with the walls of the container. The more the gas is compressed, the higher the pressure.

Question: What is polythene, and how is it produced?

Answer: Polythene is a polymer produced by the polymerization of ethene molecules, resulting in long chains of repeating units of  $-\text{CH}_2-\text{CH}_2-$ .

Question: What is the greenhouse effect?

Answer: The greenhouse effect is the trapping of heat in the Earth's atmosphere by greenhouse gases, leading to an increase in global temperatures.

Question: What is the function of bile in digestion?

Answer: Bile emulsifies fats, breaking them into small droplets to increase the surface area for enzyme action, aiding in lipid digestion.



Question: What role does the magnetic field play in the operation of a bicycle dynamo?

Answer: The magnetic field interacts with the rotating coil, inducing an electromotive force that generates electrical power for the bicycle's lights.

Question: What are some examples of foods rich in proteins?

Answer: Examples include meat, fish, egg white, and cereals.

Question: What factors determine the magnitude of induced voltage in a coil?

Answer: Factors determining the magnitude of induced voltage include the number of coil turns, magnetic field strength, and speed of motion.

Question: Describe an experiment to demonstrate electromagnetic induction using a bar magnet and a coil, including the setup, procedure, and observations.

Answer: To demonstrate electromagnetic induction, an experiment can be conducted using a bar magnet, a coil of wire, and a center-zero galvanometer. Setup: Form a coil by winding a meter-length of copper wire around a cardboard tube. Connect the ends of the coil to a center-zero galvanometer. Procedure: Move the north pole of the bar magnet towards the coil rapidly and observe the deflection in the galvanometer. Move the north pole of the bar magnet away from the coil and observe the deflection in the galvanometer. Repeat the experiment using the south pole of the bar magnet and observe the galvanometer's deflection. Observations: When the north pole of the bar magnet is moved towards the coil, the galvanometer deflects to the right, indicating a current flow from A to B. When the north pole is moved away from the coil, the galvanometer deflects in the opposite direction, indicating a reverse current flow. When the south pole is moved towards the coil, the deflection pattern is reversed, showing that the direction of the induced current depends on the polarity of the magnet and the direction of motion. This experiment demonstrates that an electromotive force is induced in a conductor when there is a change in the magnetic field around it, consistent with Faraday's law of electromagnetic induction.

Question: What is the primary function of water?

Answer: Water provides a medium for bio-chemical reactions in the cells of organisms.

Question: How does the use of efficient electric appliances impact electricity bills?

Answer: Using efficient electric appliances reduces electricity consumption, leading to lower utility bills and cost savings for households.

Question: How do different musical instruments produce distinct sound qualities?

Answer: Distinct sound qualities, or timbres, are produced by the unique waveforms and harmonics generated by each instrument.

Question: What are the features of vertebrates in the class Pisces?

Answer: Vertebrates in the class Pisces have a bony or cartilaginous endoskeleton, streamlined bodies, scales, fins for swimming, a lateral line system for detecting vibrations, a two-chambered heart, gills for respiration, and are cold-blooded.

Question: What is the resistance of a nichrome wire coil with a potential difference of 2 V and a current of 0.4 A?

Answer: Using Ohm's Law,  $R = V/I$ , the resistance is  $R = 2 \text{ V} / 0.4 \text{ A} = 5 \Omega$ .

Question: Explain the function of a magnetic contactor in industrial control systems.

Answer: A magnetic contactor is an electrically operated switch that controls high-power circuits, providing reliable switching and protection for industrial control systems.

Question: What is the chemical formula of sodium oxide?

Answer: The chemical formula of sodium oxide is  $\text{Na}_2\text{O}$ , indicating two sodium ions and one oxide ion.

Question: What is the specific latent heat of fusion?

Answer: The specific latent heat of fusion is the amount of heat required to change the state of a unit mass of a solid substance at its melting point into the liquid state without changing its temperature.

Question: What are the symptoms and treatment of tuberculosis?

Answer: Symptoms of tuberculosis include coughing blood, fever, tiredness, weight loss, and loss of appetite. It can be treated with proper medical intervention and prevented with vaccines.

Question: How does chromatography help in identifying active chemical compounds in plants?

Answer: Chromatography separates the components of plant extracts, allowing for the identification and analysis of individual chemical compounds.

Question: What is the purpose of tissue culture in plant propagation?

Answer: Tissue culture produces a large number of genetically identical plants quickly and efficiently, using vegetative tissues in a controlled culture medium.

Question: How do different animals perceive sound frequencies differently?

Answer: Animals like elephants hear low frequencies (infra-sound), while bats and dolphins hear high frequencies (ultrasound), each adapted to their specific environmental needs.

Question: How are essential oils used in the production of medicinal ointments and toothpaste?

Answer: Essential oils have medicinal properties and are used for their therapeutic effects and aromatic qualities.

Question: What are food chains and food webs?

Answer: Food chains are linear sequences of organisms where each is eaten by the next in the chain, transferring energy and nutrients. Food

webs are interconnected food chains that show the complex feeding relationships among organisms in an ecosystem.

Question: How is the acceleration of a body affected by its mass for a given force?

Answer: For a given force, the acceleration of a body is inversely proportional to its mass. A larger mass results in a smaller acceleration.

Question: Why is an experiment to test the need for water in photosynthesis difficult to design in a laboratory?

Answer: Without water, the plant in the control experiment will die, making it challenging to observe the effects of water on photosynthesis.

Question: What happens to the mass of manganese dioxide after the reaction?

Answer: The mass of manganese dioxide remains the same, indicating it has not been consumed in the reaction.

Question: What is the role of an operational amplifier (op-amp) in electronic circuits?

Answer: An operational amplifier (op-amp) amplifies the difference between two input voltages, providing high gain and stability for various analog signal processing applications.

Question: How does a scuba diver's depth affect the pressure they experience?

Answer: A scuba diver experiences increased pressure with depth due to the weight of the water above them, following the formula  $P = h\rho g$ .

Question: What is the relationship between surface area and reaction rate?

Answer: A larger surface area increases the rate of reaction by providing more sites for reactant collisions.

Question: What is the function of sensory neurons?

Answer: Sensory neurons transmit impulses from sensory organs to the central nervous system, allowing the body to perceive and respond to stimuli.

Question: How is carbon dioxide used in the production of fizzy drinks?

Answer: Carbon dioxide dissolves in water to form carbonic acid, giving fizzy drinks their characteristic effervescence and taste.

Question: How does the use of a straw demonstrate the application of atmospheric pressure?

Answer: When sucking air from a straw, the pressure inside the straw decreases, and the atmospheric pressure outside pushes the liquid up the straw into the mouth.

Question: How do inherited traits vary within a species?

Answer: Inherited traits vary within a species due to the combination of different alleles, leading to a wide range of phenotypic variations among individuals.

Question: How does the electronic configuration of chlorine influence its ability to form ionic and covalent bonds?

Answer: The electronic configuration of chlorine (2, 8, 7) makes it highly reactive, allowing it to gain an electron to form ionic bonds or share electrons to form covalent bonds, achieving a stable configuration.

Question: How does a thermocouple measure temperature?

Answer: A thermocouple measures temperature by generating a voltage proportional to the temperature difference between its two junctions, allowing temperature monitoring.

Question: What is the role of ATP in cellular respiration?

Answer: ATP stores and releases energy needed for various biological processes, including muscle contraction, active transport, and synthesis of complex molecules.

Question: How does the mobile phase in chromatography affect the separation of components?

Answer: The mobile phase (solvent) carries the components through the stationary phase, allowing them to separate based on their movement rates.

Question: How do smooth muscle cells differ from skeletal muscle cells?

Answer: Smooth muscle cells are spindle-shaped, unbranched, and have a single nucleus, while skeletal muscle cells are long, cylindrical, multinucleate, and striated.

Question: Describe the equilibrium of a rod resting on two supports.

Answer: The rod is in equilibrium because the weight of the rod is balanced by the perpendicular reaction forces exerted by the supports. The forces are coplanar and parallel, and their magnitudes add up to equal the weight of the rod.

Question: How does the induced current direction change during coil rotation in a dynamo?

Answer: The induced current direction changes periodically, resulting in an alternating current as the coil rotates within the magnetic field.

Question: Describe the process of electroless plating and its applications.

Answer: Electroless plating is a chemical process that deposits a metal coating on a substrate without using an external electric current. It relies on a chemical reducing agent in the plating solution. Applications include corrosion protection, wear resistance, and improved conductivity in electronics.

Question: What is the potential energy of a 3.5 kg object at a height of 4.5 m?

Answer: The potential energy is 157.5 Joules (J).

Question: What is the common feature found in the materials used in our day-to-day life, such as plastic goods, clothes, and paints?

Answer: The common feature found in these materials is the presence of carbon as a component element.

Question: What do bats use ultrasound waves for?

Answer: Bats use ultrasound waves to avoid obstacles while flying at night by emitting ultrasound waves that reflect back from obstacles, helping them navigate.

Question: How do you calculate the mole fraction of a solute in a solution?

Answer: Mole fraction = Amount of moles of solute / Total amount of moles in the solution.

Question: What is upthrust and how is it experienced by objects in a liquid?

Answer: Upthrust is the upward force exerted by a liquid on an object immersed in it. It is experienced as a reduction in the apparent weight of the object due to the liquid's buoyant force.

Question: How does an aneroid barometer measure atmospheric pressure?

Answer: An aneroid barometer measures atmospheric pressure using a sealed, air-evacuated cavity with flexible walls. Changes in pressure cause the walls to flex, moving an indicator to show the pressure on a scale.

Question: What is sexual reproduction?

Answer: Sexual reproduction occurs due to the fusion of two gametes produced in the sexual structures of male and female organisms, resulting in offspring with mixed characteristics of parents.

Question: How does the moment of force depend on the perpendicular distance to the force from the point of suspension?

Answer: The moment of force increases as the perpendicular distance to the force from the point of suspension increases, assuming the force magnitude remains constant.

Question: What are some conservation strategies?

Answer: Conservation strategies include habitat restoration, protected areas, wildlife corridors, captive breeding, and legal protection of endangered species.

Question: What substances can be absorbed directly into the blood without digestion?

Answer: Medicines, vitamins, alcohol, and glucose.

Question: How do you achieve equilibrium in a system of forces acting on an object suspended by multiple strings?

Answer: Achieve equilibrium by ensuring that the forces exerted by the strings balance the weight of the object. The tensions in the strings must be equal and opposite to the weight, and their lines of action must intersect at a common point.

Question: What is the equivalent resistance of a  $10\ \Omega$  resistor and a  $2\ \Omega$  resistor connected in series?

Answer: The equivalent resistance is  $R = 10\ \Omega + 2\ \Omega = 12\ \Omega$

Question: What is the impact of obesity on kidney function?

Answer: Obesity increases the risk of developing kidney disease by contributing to hypertension, diabetes, and increased workload on the kidneys.

Question: How do you investigate the effect of tightening a screw on the moment of force required to rotate a stick?

Answer: Investigate the effect by tightening the screw at different levels and measuring the force required to initiate rotation using a Newton balance, observing the relationship between screw tightness and required force.

Question: How is the composition of a mixture expressed in terms of mass/volume (m/v)?

Answer: It expresses the mass of solute contained in a unit volume of the mixture.

Question: What is the effect of placing an object at the focal point of a convex lens?

Answer: The image is formed at infinity and is larger than the object.

Question: How does the orientation of the coil affect the induced voltage in a dynamo?

Answer: The orientation of the coil affects the induced voltage, with maximum values generated when the coil is perpendicular to the magnetic field lines.

Question: How does the coil's position affect the electromotive force in an alternating current dynamo?

Answer: The electromotive force varies with the coil's position, reaching maximum values when the coil intersects the magnetic field lines perpendicularly.

Question: How does the use of fossil fuels contribute to air pollution?

Answer: Fossil fuel combustion releases pollutants such as carbon dioxide, sulfur dioxide, nitrogen oxides, and particulate matter. These pollutants degrade air quality and contribute to climate change.

Question: What is the secretory phase in the uterus?

Answer: The secretory phase is when the uterine lining thickens and blood supply increases, becoming secretory under the influence of progesterone, typically lasting about 14 days.

Question: How does the body remove excess potassium through the kidneys?

Answer: The kidneys filter and excrete excess potassium in urine, maintaining electrolyte balance and preventing hyperkalemia.

Question: What are some examples of genetically modified crops?

Answer: Examples include pest-resistant cotton, herbicide-resistant soybeans, and vitamin A-enriched Golden Rice. These crops have been engineered for improved yield, resistance to pests and diseases, and enhanced nutritional content.

Question: What percentage of the mature human body is composed of proteins?

Answer: 17% of the mature human body is composed of proteins.

Question: What is the significance of the cell cycle in living organisms?

Answer: The cell cycle is significant because it ensures the accurate replication and distribution of genetic material during cell division, supporting growth, development, and tissue repair.

Question: What factors influence the efficiency of electromagnetic induction?

Answer: Factors influencing efficiency include the number of coil turns, the strength of the magnetic field, and the speed of relative motion between the coil and magnet.

Question: What is the pressure exerted by a 1-meter-high column of mercury with a density of  $13,600 \text{ kg/m}^3$ ?

Answer: The pressure exerted is calculated using  $P = h\rho g$ . For a height of 1 m, the pressure is  $P = 1 \text{ m} * 13,600 \text{ kg/m}^3 * 10 \text{ m/s}^2 = 136,000 \text{ Pa}$ .

Question: How does the efficiency of an electric iron affect energy consumption?

Answer: The efficiency of an electric iron affects energy consumption by determining how much of the supplied electric energy is converted into useful heat for ironing clothes.

Question: What is the role of DNA in inheritance?

Answer: DNA carries genetic information in the form of genes, which determine inherited traits. It is the material that transmits features from one generation to the next.

Question: How does a voltaic cell differ from an electrolytic cell?

Answer: A voltaic cell generates electrical energy from spontaneous chemical reactions, while an electrolytic cell uses electrical energy to drive non-spontaneous chemical reactions.

Question: How do viruses infect host cells?

Answer: Viruses infect host cells by attaching to the cell membrane, injecting their nucleic acid into the host, and hijacking the host's cellular machinery to replicate and produce new viral particles.

Question: What happens when the forces acting on an object are not coplanar?

Answer: When the forces acting on an object are not coplanar, the object will not be in equilibrium and will move or rotate due to the unbalanced forces and moments.

Question: What is the role of potassium in plants?

Answer: Potassium is important for the opening and closing of stomata and protein synthesis.

Question: What is the significance of meiosis in sexual reproduction?

Answer: Meiosis is significant because it reduces the chromosome number by half, ensuring genetic diversity and producing gametes (sperm and egg) for sexual reproduction.

Question: What is the chemical formula for sodium nitrate?

Answer: The chemical formula for sodium nitrate is  $\text{NaNO}_3$ , indicating one sodium ion and one nitrate ion.

Question: How did Mendel's experiments demonstrate the concept of dominant and recessive traits?

Answer: Mendel's experiments demonstrated that dominant traits mask recessive traits in the F1 generation, but recessive traits reappear in the F2 generation, showing the principles of dominance and recessiveness.

Question: How do radio waves transmit information over long distances?

Answer: Radio waves carry modulated signals that can be transmitted over long distances and decoded by receivers for communication.

Question: Explain the concept of heat, its measurement, and the difference between heat and temperature, including an experimental setup to demonstrate heat transfer.

Answer: Heat is a form of energy that transfers from one object to another due to a temperature difference. It flows from a body at a higher temperature to a body at a lower temperature until thermal equilibrium is reached.

Difference Between Heat and Temperature: Heat: A form of energy measured in joules (J) or calories (cal). It is the energy transferred between objects due to temperature differences. Temperature: A measure of the mean kinetic energy of the particles in a substance, measured in degrees Celsius ( $^{\circ}\text{C}$ ), Fahrenheit ( $^{\circ}\text{F}$ ), or Kelvin (K). Measurement of Heat: Heat is measured in joules (J) in the International System of Units (SI). One calorie is defined as the amount of heat required to raise the temperature of 1 gram of water by  $1^{\circ}\text{C}$ , and it equals approximately 4.184 joules.

Experimental Setup to Demonstrate Heat Transfer: Materials Required: A heated block of iron, a vessel of cold water, a thermometer, and a stirrer.

Procedure: Heat the block of iron and place it into the vessel of cold water. Observe the temperature of the water using the thermometer. Stir the water to ensure uniform temperature distribution.

Observations: The temperature of the water rises as heat flows from the hot iron block to the cold water. The temperature of the iron block decreases until both the water and the iron reach thermal equilibrium, where no more heat transfer occurs.

Conclusion: This experiment demonstrates that heat flows from a higher temperature object (iron block) to a lower temperature object (water) until thermal equilibrium is reached.

Question: How do genetic factors influence the risk of developing kidney disease?

Answer: Genetic factors can predispose individuals to conditions like PKD, Alport syndrome, and other inherited kidney diseases.

Question: How is solvent extraction used to obtain essential oils?

Answer: By dissolving plant parts in an organic solvent, which extracts the essential oils that can then be separated by evaporating the solvent.



Question: What is the purpose of brushing rings in an alternating current dynamo?

Answer: Brushing rings in an alternating current dynamo maintain contact with the rotating coil, allowing current to flow to the external circuit.

Question: Explain the concept of load shedding in electricity supply.

Answer: Load shedding involves temporarily cutting off electricity supply to certain areas to balance the demand and supply, preventing overloading of the power grid.

Question: How are kidney and bladder stones formed, and how are they treated?

Answer: Stones form from crystallized calcium oxalate, causing pain when blocking ureters. They can be treated with drugs, surgery, or crushed using lithotripsy technology.

Question: What are the functions of the immune system?

Answer: The immune system defends against infections, identifies and destroys pathogens, and provides immunity through memory cells.

Question: What is the relationship between specific heat capacity and thermal inertia?

Answer: Specific heat capacity and thermal inertia are related; substances with high specific heat capacities have high thermal inertia, meaning they resist temperature changes and require more heat to alter their temperature.

Question: What is the principle behind using ultrasound waves to solder metals?

Answer: Ultrasound waves generate heat through vibrations, causing the metals to melt and solder at the contact point.

Question: How is the resultant force of two parallel forces acting in the same direction found?

Answer: The resultant force is found by adding the magnitudes of the two forces.

Question: What is the importance of studying inherited characteristics in plants and animals?

Answer: Studying inherited characteristics in plants and animals helps scientists understand the principles of genetics, improve breeding practices, and develop new varieties with desirable traits.

Question: How do you find the instantaneous speed of an object?

Answer: Instantaneous speed is found using a speedometer or by calculating the derivative of the distance with respect to time.

Question: How does the reaction of magnesium with hydrochloric acid demonstrate a single displacement reaction?

Answer: Magnesium displaces hydrogen from hydrochloric acid, forming magnesium chloride and hydrogen gas:  $\text{Mg} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$ .

Question: What is the equation for the combustion of methane, an exothermic reaction?

Answer:  $\text{CH}_4 (\text{g}) + 2\text{O}_2 (\text{g}) \rightarrow \text{CO}_2 (\text{g}) + 2\text{H}_2\text{O} (\text{g}) + \text{Heat}.$

Question: What is the process of cell growth?

Answer: Cell growth is the irreversible increase in size or dry mass of a cell, which continues until the cell reaches a maximum size and then divides.

Question: How is the chemical formula of ammonium phosphate written?

Answer: The chemical formula of ammonium phosphate is  $(\text{NH}_4)_3\text{PO}_4$ , indicating three ammonium ions and one phosphate ion.

Question: How can you determine the direction of the magnetic field due to a current?

Answer: You can determine the direction using Maxwell's corkscrew rule or the right-hand grip rule, which help visualize the direction of the magnetic field around a current-carrying conductor.

Question: Explain the significance of ATP in active transport.

Answer: ATP provides the energy needed for active transport, enabling the movement of substances against their concentration gradient across the plasma membrane.

Question: What is wavelength?

Answer: Wavelength is the distance between two consecutive points in a wave that are in the same phase, such as from crest to crest or trough to trough.

Question: What are the effects of acid rain on aquatic ecosystems?

Answer: Acid rain increases water acidity, harms aquatic organisms, disrupts reproductive processes, and reduces biodiversity. It can cause long-term damage to freshwater and marine ecosystems.

Question: Describe the formation of a p-n junction.

Answer: A p-n junction is formed by joining p-type and n-type semiconductors. The interface between them creates a depletion region where charge carriers recombine, forming a potential barrier that controls the flow of current.

Question: What is a longitudinal wave?

Answer: A longitudinal wave is a type of mechanical wave where particles of the medium move parallel to the direction of wave propagation.

Question: What is the significance of lignification in xylem tissue?

Answer: Lignification strengthens the cell walls of xylem vessels, tracheids, and fibers, making them rigid and capable of supporting the plant.

Question: How do bacteria benefit the environment?

Answer: Bacteria decompose dead bodies and structures, fix atmospheric nitrogen, and aid in the production of curd, yoghurt, and cheese.

Question: What are the main functions of the different cell types in phloem tissue?

Answer: Sieve tube elements transport nutrients, companion cells regulate metabolic activities, phloem fibers provide support, and phloem parenchyma cells store nutrients.

Question: What are the raw materials required for photosynthesis?

Answer: The raw materials required for photosynthesis are carbon dioxide ( $\text{CO}_2$ ) and water ( $\text{H}_2\text{O}$ ).

Question: How does the concentration of reactants influence the rate of chemical reactions?

Answer: Higher concentration of reactants increases the likelihood of collisions, leading to a faster rate of reaction.

Question: How do you find the gradient of a displacement-time graph?

Answer: The gradient is calculated by dividing the change in displacement by the change in time.

Question: What is a producer in an ecosystem?

Answer: A producer is an organism, such as a green plant, that produces its own food through photosynthesis.

Question: Why is hydrogen gas produced at the cathode during the electrolysis of aqueous sodium chloride?

Answer: Hydrogen gas is produced because  $\text{H}^+$  ions are reduced at the cathode, as hydrogen is less reactive than sodium.

Question: How does the use of nanomaterials enhance the performance of electrochemical sensors?

Answer: The use of nanomaterials enhances the performance of electrochemical sensors by providing a high surface area, improved conductivity, and increased sensitivity, enabling the detection of low concentrations of analytes and rapid response times.

Question: Calculate the amount of oxygen in moles in 32 grams of oxygen ( $\text{O}_2$ )?

Answer: The amount of oxygen in 32 grams is 1 mole, calculated as  $32/32 = 1$  mole.

Question: Explain the investigation of surface roughness on friction.

Answer: The investigation involves using a block of wood with different roughness levels of sandpaper and measuring the force required to move the block, showing that rougher surfaces increase the limiting frictional force.

Question: How is atmospheric pressure measured using a mercury barometer?

Answer: Atmospheric pressure is measured using a mercury barometer by the height of the mercury column in a glass tube. The height of the column represents the atmospheric pressure exerted on the mercury in the container.

Question: What is an example of a homogeneous mixture?

Answer: An example of a homogeneous mixture is a salt solution, where salt is uniformly dissolved in water.

Question: What is the role of the diaphragm in the Downs cell?

Answer: The diaphragm prevents the reaction between sodium and chlorine, ensuring the separation of sodium metal and chlorine gas during electrolysis.

Question: What is the momentum of a 200 g object moving at 5 m/s?

Answer: The momentum is  $p = m \times v = 0.2 \times 5 = 1 \text{ kg m/s}$ .

Question: What are the benefits of using energy-efficient appliances?

Answer: Energy-efficient appliances reduce energy consumption, lower greenhouse gas emissions, and decrease electricity costs. They support sustainable energy use and environmental protection.

Question: How does the induced current direction change during coil rotation in a dynamo?

Answer: The induced current direction changes periodically, resulting in an alternating current as the coil rotates within the magnetic field.

Question: What is the role of thermal radiation in heat transfer from the sun to the earth?

Answer: Thermal radiation is the primary method of heat transfer from the sun to the earth, allowing heat to travel through the vacuum of space as electromagnetic waves, warming the earth's surface.

Question: How is the energy level diagram for an exothermic reaction represented?

Answer: Reactants at a higher energy level than products, with energy released.

Question: How is the chemical formula of aluminium oxide written?

Answer: The chemical formula of aluminium oxide is  $\text{Al}_2\text{O}_3$ , indicating two aluminium ions and three oxide ions.

Question: How does power relate to the efficiency of a machine?

Answer: Power relates to the efficiency of a machine by indicating how effectively the machine performs work over time; higher power means more work done in less time.

Question: Why is the solubility of ionic compounds important in chemistry?

Answer: The solubility of ionic compounds affects their reactivity, availability in solution, and role in chemical reactions and industrial processes.

Question: Describe the reaction of magnesium with steam.

Answer: Magnesium reacts with steam to form magnesium oxide and hydrogen gas:  $\text{Mg} + \text{H}_2\text{O} \rightarrow \text{MgO} + \text{H}_2$ .

Question: What is a homogeneous mixture?

Answer: A homogeneous mixture, also known as a solution, is a mixture in which the components are uniformly distributed, and the properties and

composition are identical throughout.

Question: Give examples of vector quantities.

Answer: Examples of vector quantities include displacement, acceleration, velocity, and weight.

Question: How does the curvature of a mirror affect its focal length and image formation?

Answer: More curved mirrors have shorter focal lengths, allowing them to focus light more strongly and form images at different positions.

Question: What is the significance of the magnetic field direction in a DC motor?

Answer: The magnetic field direction determines the force's direction on the coil, influencing the motor's rotation and overall performance.

Question: What force is required to bring an object to rest if it is being pulled with a force of 20 N in one direction?

Answer: A force of 20 N applied in the opposite direction is required to bring the object to rest, balancing the original force and resulting in equilibrium.

Question: How does an alkaline battery work, and what are its advantages?

Answer: An alkaline battery uses zinc as the anode, manganese dioxide as the cathode, and an alkaline electrolyte (potassium hydroxide). It offers higher energy density, longer shelf life, and better performance at low temperatures compared to zinc-carbon batteries.

Question: How does the frequency of ultrasound waves compare to audible sound waves?

Answer: Ultrasound waves have frequencies above 20,000 Hz, which is higher than the audible range for humans (20 Hz to 20,000 Hz).

Question: How does the depth of a liquid column affect the pressure it exerts at the bottom?

Answer: The pressure exerted at the bottom of a liquid column increases with depth, as it is proportional to the height of the liquid above the bottom point.

Question: What is the role of autotrophs in an ecosystem?

Answer: Autotrophs produce organic compounds from inorganic substances, serving as the primary source of energy and nutrients for other organisms in the ecosystem.

Question: Describe the process of electrochemical synthesis of ammonia and its importance.

Answer: The electrochemical synthesis of ammonia involves the reduction of nitrogen gas and hydrogen gas using an electrochemical cell, providing a sustainable and energy-efficient alternative to the traditional Haber-Bosch process. It is important for producing ammonia, a key ingredient in fertilizers, with lower energy consumption and reduced carbon footprint.

Question: How do ultrasound waves assist in detecting schools of fish?

Answer: SONAR systems use ultrasound pulses to detect and locate schools of fish by analyzing the reflected waves.

Question: What is the impact of nutrient availability on photosynthetic efficiency?

Answer: Nutrient availability, particularly nitrogen, phosphorus, and potassium, affects chlorophyll production, enzyme activity, and overall photosynthetic efficiency.

Question: How do bats use ultrasound waves to navigate at night?

Answer: Bats emit ultrasound waves that reflect back from obstacles, allowing them to judge the position of the obstacles and fly around them.

Question: How does the diaphragm contribute to breathing?

Answer: The diaphragm contracts and flattens during inhalation, increasing thoracic cavity volume and drawing air into the lungs; it relaxes during exhalation, decreasing volume and expelling air.

Question: What is the balanced chemical equation for the reaction between potassium and water?

Answer: The balanced chemical equation for potassium reacting with water is:  $2K + 2H_2O \rightarrow 2KOH + H_2$ .

Question: How does a bicycle dynamo convert mechanical energy into electrical energy?

Answer: A bicycle dynamo converts mechanical energy from the rotating tire into electrical energy by inducing a current in the rotating coil within a magnetic field.

Question: How does adding mass to a trolley affect its acceleration?

Answer: Adding mass to a trolley decreases its acceleration for a constant force, as acceleration is inversely proportional to mass.

Question: How do you measure the voltage across a bulb in a circuit with two dry cells?

Answer: Connect a voltmeter in parallel with the bulb and read the voltage value displayed on the voltmeter.

Question: How does the weight of an object change with altitude?

Answer: The weight of an object decreases with altitude because the gravitational acceleration decreases as you move away from the Earth's surface.

Question: What is the pitch of a sound wave with a frequency of 128 Hz?

Answer: The pitch corresponds to the musical note lower C, with a frequency of 128 Hz.

Question: Explain the importance of using proper insulation in electrical wiring.

Answer: Proper insulation prevents accidental contact with live wires, reduces the risk of electric shocks, and protects against short circuits and electrical fires.

Question: What is the function of the circulatory system in animals?

Answer: The circulatory system transports oxygen, nutrients, hormones, and waste products throughout the body, maintaining homeostasis and supporting cellular functions.

Question: How should an ammeter be connected in a circuit?

Answer: An ammeter should be connected in series with the conductor so that the entire current passes through the ammeter.

Question: What is the deceleration of an object that slows down from 12 m/s to 0 m/s in 4 seconds?

Answer: The deceleration is  $-3 \text{ m/s}^2$ .

Question: What is the minimum voltage required to forward bias a silicon p-n junction?

Answer: The minimum voltage required to forward bias a silicon p-n junction is about 0.7 V.

Question: How are neurons classified based on their function?

Answer: Neurons are classified into sensory neurons, motor neurons, and interneurons based on their function.

Question: What is the relationship between magnetic field strength and induced voltage?

Answer: The induced voltage is directly proportional to the magnetic field strength, with stronger fields generating higher voltage.

Question: How does the diaphragm movement in a microphone relate to sound waves?

Answer: The diaphragm moves in response to sound waves, causing the attached coil to move within a magnetic field and generate an alternating current corresponding to the sound.

Question: Describe the structure of skeletal muscle tissue.

Answer: Skeletal muscle tissue consists of long, cylindrical, unbranched fibers that are multinucleate with striations. The nuclei are located peripherally, and the cells have many mitochondria.

Question: What is the significance of chlorophyll in plants?

Answer: Chlorophyll allows plants to absorb light energy and produce food through photosynthesis.

Question: Describe the process of electrorefining.

Answer: Electrorefining is a process used to purify metals by making the impure metal the anode and a pure metal sheet the cathode in an electrolytic cell. The metal from the anode dissolves into the electrolyte and is deposited onto the cathode, leaving impurities behind.

Question: How does the speed of the bicycle affect the output of the dynamo?

Answer: As the speed of the bicycle increases, the rotation speed of the dynamo's magnet increases, which raises the rate of change of the magnetic field linked to the coil. This increases the induced electromotive

force, resulting in a larger current and brighter bicycle lamp.

Question: What are the principle changes in fetal development during the fourth month?

Answer: During the fourth month, the skeleton starts developing, and hair begins to grow.

Question: What happens to the induced current when the coil in a dynamo moves parallel to the magnetic field?

Answer: When the coil moves parallel to the magnetic field, the induced current becomes zero as there is no intersection of field lines.

Question: What is the purpose of the galvanometer in demonstrating electromagnetic induction?

Answer: The galvanometer measures the induced current, indicating the presence and magnitude of electromagnetic induction in a circuit.

Question: What is the chemical formula for ammonium chloride?

Answer: The chemical formula for ammonium chloride is  $\text{NH}_4\text{Cl}$ .

Question: What is the reaction between magnesium and hydrochloric acid?

Answer: Magnesium reacts with hydrochloric acid to form magnesium chloride and hydrogen gas:  $\text{Mg} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$ .

Question: How do step-down transformers work?

Answer: Step-down transformers decrease the output voltage by having fewer turns in the secondary coil than in the primary coil.

Question: What are the characteristics of the Kingdom Fungi?

Answer: The Kingdom Fungi includes organisms with chitinous cell walls, eukaryotic cellular organization, and the ability to decompose organic matter.

Question: What is the pressure exerted by a 1-meter-high column of mercury with a density of  $13,600 \text{ kg/m}^3$ ?

Answer: The pressure exerted is calculated using  $P = h\rho g$ . For a height of 1 m, the pressure is  $P = 1 \text{ m} * 13,600 \text{ kg/m}^3 * 10 \text{ m/s}^2 = 136,000 \text{ Pa}$ .

Question: What is the mole fraction of a component in a mixture?

Answer: The mole fraction is the ratio of the amount of moles of that component to the total amount of moles of all components in the mixture.

Question: What is the potential barrier in a p-n junction and its typical values for silicon and germanium?

Answer: The potential barrier in a p-n junction is the voltage difference across the depletion region that prevents further movement of charge carriers. It is typically about 0.7 V for silicon and 0.3 V for germanium.

Question: What is the first ionisation energy of lithium?

Answer: The first ionisation energy of lithium is 520 kJ/mol.

Question: What is dry ice, and how is it used?



Answer: Dry ice is solid carbon dioxide, used as a super coolant in food preservation and for creating artificial rain due to its very low temperature.

Question: How are organisms classified into groups?

Answer: Organisms are classified into groups to make it easier to study them, identify specific characteristics, understand the biosphere, reveal relationships between groups, and identify organisms with economic uses.

Question: Calculate the number of molecules in 0.2 moles of carbon dioxide (CO<sub>2</sub>).

Answer: The number of molecules in 0.2 moles of carbon dioxide is  $1.204 \times 10^{23}$ , calculated as  $0.2 \times 6.022 \times 10^{23}$ .

Question: What are the features of vertebrates in the class Aves?

Answer: Vertebrates in the class Aves have a light bony endoskeleton, streamlined bodies, feathers covering their skin, beaks adapted for different modes of nutrition, eyes with eyelids, pentadactyle limbs (forelimbs converted into wings), a four-chambered heart, and are warm-blooded.

Question: Explain the process of electrochemical polymerization and its applications.

Answer: Electrochemical polymerization involves the formation of conductive polymers on an electrode surface through the electrochemical oxidation or reduction of monomers. Applications include sensors, batteries, supercapacitors, and corrosion-resistant coatings.

Question: What is the relationship between atomic size and ionisation energy?

Answer: Generally, as atomic size increases, ionisation energy decreases because the outer electrons are further from the nucleus and less tightly held.

Question: How does mass influence potential energy?

Answer: Mass influences potential energy directly; increasing the mass increases the potential energy proportionally.

Question: What is the speed of sound in air at 30°C?

Answer: The speed of sound in air at 30°C is about 350 m/s.

Question: Activity: Requirement: Calcium carbonate chips and powder of equal mass, dilute hydrochloric acid, two beakers, a stop watch Add equal volumes of acid into two beakers. Add calcium carbonate chips into one beaker with hydrochloric acid and using the stop watch measure the time taken by the chips to disappear. Repeat the same procedure using calcium carbonate powder. Gas bubbles evolve faster in the beaker with calcium carbonate powder. It is observable that calcium carbonate powder disappears faster than the chips. That is, the reaction occurs in a shorter period of time. Accordingly, the rate of reactions in those two instances can be ascertained, comparing the time taken for equal amounts of reactants to be used up. Rate of reaction = (Amount of the reactants used up) / (Time taken) What is the significance of the activity in understanding reaction rates?

Answer: The activity helps illustrate the impact of surface area on the rate of reaction, reinforcing the concept through practical observation.

Question: Describe the decomposition reaction of potassium permanganate when heated.

Answer: When potassium permanganate is heated, it decomposes to form potassium manganate, manganese dioxide, and oxygen gas:  $2\text{KMnO}_4 \rightarrow \text{K}_2\text{MnO}_4 + \text{MnO}_2 + \text{O}_2$ .

Question: How does friction influence the motion of a cart pulled by a bull?

Answer: Friction opposes the motion of the cart. If an additional force is applied in the direction of motion, the cart moves faster. If the force is applied in the opposite direction, the cart slows down.

Question: What is the role of chloroplasts in plant cells?

Answer: Chloroplasts are the sites of photosynthesis, containing chlorophyll and other pigments that capture light energy to convert carbon dioxide and water into glucose and oxygen.

Question: How do animals regulate their internal environment?

Answer: Animals regulate their internal environment through homeostatic mechanisms such as thermoregulation, osmoregulation, and hormonal control to maintain stable conditions.

Question: How do lysosomes facilitate cellular recycling?

Answer: Lysosomes break down damaged or unnecessary cellular components, recycling their building blocks for new cellular structures and functions, maintaining cellular health.

Question: How can a p-type extrinsic semiconductor be formed?

Answer: A p-type extrinsic semiconductor can be formed by doping an intrinsic semiconductor with a group III element.

Question: How does the pressure inside a sealed container change with temperature?

Answer: The pressure inside a sealed container increases with temperature, as the gas molecules move faster and collide with the container walls more frequently.

Question: Describe the operation of a variable frequency drive (VFD).

Answer: A variable frequency drive (VFD) controls the speed and torque of electric motors by varying the input frequency and voltage, improving energy efficiency and performance.

Question: How does the coil's position affect the electromotive force in an alternating current dynamo?

Answer: The electromotive force varies with the coil's position, reaching maximum values when the coil intersects the magnetic field lines perpendicularly.

Question: How does the right-hand grip rule apply to determining field direction?

Answer: The rule helps visualize the field direction around a conductor, with the thumb indicating current flow and fingers showing the field.

Question: How do strong bases behave in an aqueous medium?

Answer: Strong bases completely ionize in an aqueous medium, fully dissociating into ions.

Question: What is the significance of genetic recombination in meiosis?

Answer: Genetic recombination during meiosis increases genetic diversity by creating new combinations of alleles, ensuring that offspring have unique genetic profiles and enhancing the ability of populations to adapt to changing environments.

Question: What is the relative molecular mass of sulfuric acid ( $\text{H}_2\text{SO}_4$ )?

Answer: The relative molecular mass of sulfuric acid is 98, calculated as  $2 \times 1$  for hydrogen, 32 for sulfur, and  $4 \times 16$  for oxygen.

Question: What are the two systems involved in human body coordination?

Answer: The nervous system and the endocrine system.

Question: What is the solute in a solution?

Answer: The solute is the component present in a lesser proportion in a solution.

Question: What is the importance of writing balanced chemical equations?

Answer: Balanced chemical equations ensure the law of conservation of mass is followed and provide accurate information about the reactants and products involved in a reaction.

Question: How does an electric meter measure energy consumption?

Answer: An electric meter measures energy consumption by recording the total kilowatt hours (kWh) of electricity used by the household, based on the power drawn and the duration of use.

Question: What is an energy level diagram, and how does it illustrate exothermic and endothermic reactions?

Answer: It shows the relative energy levels of reactants and products, indicating whether energy is released (exothermic) or absorbed (endothermic).

Question: What is the first ionisation energy of sodium?

Answer: The first ionisation energy of sodium is 495 kJ/mol.

Question: How does gravitational acceleration vary with altitude?

Answer: Gravitational acceleration decreases with altitude, causing the weight of an object to decrease as it moves to higher altitudes, while its mass remains constant.

Question: How does the diaphragm movement in a microphone relate to sound waves?

Answer: The diaphragm moves in response to sound waves, causing the attached coil to move within a magnetic field and generate an alternating current corresponding to the sound.

Question: What is the resultant force of two forces of 8 N and 16 N acting on a trolley?

Answer: The resultant force is 24 N.

Question: What is the latent heat of vaporization?

Answer: The latent heat of vaporization is the amount of heat required to convert a unit mass of a liquid into a gas at its boiling point without changing its temperature.

Question: How do you determine if a potential difference exists across a bulb in a circuit?

Answer: Use a voltmeter to measure the potential difference across the terminals of the bulb in the circuit.

Question: What is the significance of copper sulphate in agriculture?

Answer: Copper sulphate is used as a fungicide to protect crops from fungal infections.

Question: How does an LDR (light-dependent resistor) function in light-sensing applications?

Answer: An LDR changes its resistance based on the intensity of light it is exposed to, making it useful in light-sensing applications such as automatic lighting and alarm systems.

Question: Calculate the number of molecules in 0.1 moles of water (H<sub>2</sub>O).

Answer: The number of molecules in 0.1 moles of water is  $6.022 \times 10^{22}$ , calculated as  $0.1 \times 6.022 \times 10^{23}$ .

Question: How does the boiling point of a mixture affect its separation by distillation?

Answer: The component with the lower boiling point vaporizes first, allowing it to be separated from components with higher boiling points.

Question: What is the chemical formula for magnesium oxide?

Answer: The chemical formula for magnesium oxide is MgO.

Question: Describe the equilibrium of a plank of wood suspended by four strings in terms of forces.

Answer: The plank of wood is in equilibrium because the forces of tension in the four strings balance the weight of the plank. The tensions act vertically upwards and are equal in magnitude to the weight, resulting in no net force.

Question: Explain the decomposition reaction of calcium carbonate.

Answer: Calcium carbonate decomposes upon heating to form calcium oxide and carbon dioxide gas:  $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$ .

Question: What are the essential factors for seed germination?

Answer: The essential factors for seed germination are seed viability, air (oxygen), water or moisture, and optimum temperature.

Question: What is the role of environmental policies in mitigating climate change?

Answer: Environmental policies play a role in mitigating climate change by regulating greenhouse gas emissions, promoting renewable energy, encouraging energy efficiency, and supporting conservation efforts.

Question: What is the principle of thermal equilibrium?

Answer: Thermal equilibrium is the state when two objects in contact reach the same temperature, resulting in no net heat transfer between them.

Question: What is the purpose of the galvanometer in demonstrating electromagnetic induction?

Answer: The galvanometer measures the induced current, indicating the presence and magnitude of electromagnetic induction in a circuit.

Question: What is the role of specific heat capacity in calculating heat change?

Answer: It determines how much heat is required to raise the temperature of a given mass of substance by  $1^{\circ}\text{C}$ .

Question: What is the volume fraction of ethyl alcohol in a solution with  $25\text{ cm}^3$  of ethyl alcohol in  $250\text{ cm}^3$  of water?

Answer: The volume fraction is 0.1 or 10%.

Question: What is the electronic configuration of fluorine?

Answer: The electronic configuration of fluorine is 2, 7.

Question: Explain the function of ribosomes in protein synthesis.

Answer: Ribosomes translate mRNA into amino acid sequences, assembling proteins based on genetic instructions, and can be free-floating or attached to the rough endoplasmic reticulum.

Question: What is the role of phloem fibers in the phloem tissue?

Answer: Phloem fibers provide structural support to the phloem tissue and help maintain its integrity during nutrient transport.

Question: Explain the concept of coulombic efficiency in batteries.

Answer: Coulombic efficiency in batteries is the ratio of the charge extracted during discharge to the charge input during charging. It indicates the efficiency of charge storage and retrieval, with higher values representing better battery performance and lower losses.

Question: What are the potential impacts of rising sea levels on coastal communities?

Answer: Rising sea levels cause coastal erosion, flooding, loss of habitat, and displacement of communities. They threaten infrastructure, economies, and ecosystems in coastal areas.

Question: What are the key features of the Domain Archaea?

Answer: The Domain Archaea includes prokaryotes that can live in extreme environments and are not sensitive to most antibiotics.

Question: How do sclerenchyma fibers differ from sclereids in structure and function?

Answer: Sclerenchyma fibers are long, narrow cells that provide tensile strength, while sclereids are short, irregularly shaped cells that contribute to compressive strength and protection.

Question: How do geneticists use genome-wide association studies (GWAS)?

Answer: GWAS identify genetic variants associated with specific traits or diseases by scanning the genomes of large populations, helping to uncover the genetic basis of complex traits and identify potential therapeutic targets.

Question: How does the reaction of zinc with hydrochloric acid demonstrate the reactivity series?

Answer: Zinc displaces hydrogen from hydrochloric acid, showing it is more reactive than hydrogen:  $\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$ .

Question: What is the significance of the experiment with a metal piece on a spring balance in water?

Answer: The experiment demonstrates that an object experiences an upward thrust when submerged in water, which decreases its apparent weight as read on the spring balance.

Question: How does the specific heat capacity of a substance influence its thermal properties?

Answer: The specific heat capacity of a substance influences its thermal properties by determining how much heat it can absorb or release for a given temperature change, affecting its suitability for various applications.

Question: What factors affect the quality of electroplating?

Answer: Factors include electrolyte concentration, current density, solution temperature, and plating duration.

Question: How does magnesium react with water?

Answer: Magnesium does not react with cold water but reacts with hot water to form magnesium hydroxide and hydrogen gas. When strongly heated in steam, it forms magnesium oxide and hydrogen gas.

Question: What precautions should be taken to minimize errors in heat change experiments?

Answer: Using insulating materials like polystyrene cups, stirring the mixture well, and accounting for heat loss to the surroundings.

Question: What are the three stages of respiration in humans?

Answer: The three stages are gas exchange between the external environment and lungs, gas exchange in alveoli, and cellular respiration.

Question: How do you find the current passing through each resistor in a series circuit with a known total voltage?

Answer: The current passing through each resistor in a series circuit is the same and is calculated using Ohm's Law:  $I = V / R_{\text{total}}$ , where  $V$  is the total voltage and  $R_{\text{total}}$  is the total resistance.

Question: How do convex lenses form real images?

Answer: Convex lenses converge light rays to a focal point on the opposite side of the lens, forming real images.

Question: How do rose and orchid plants demonstrate inherited characteristics?

Answer: Rose and orchid plants show inherited characteristics through variations in flower color and size, which are passed down through generations.

Question: Why is it important to follow safety measures when using electric appliances?

Answer: Following safety measures prevents electric shocks, fires, and other accidents, ensuring the safe and efficient operation of electric appliances.

Question: Describe the experiment to show that light energy is required for photosynthesis.

Answer: Cover part of a leaf with black polythene and another part with colorless polythene, expose the plant to sunlight, and test for starch. The covered area with black polythene shows no photosynthesis, while the area with colorless polythene shows photosynthesis.

Question: What factors determine the efficiency of an electric appliance?

Answer: The efficiency of an electric appliance is determined by the ratio of useful energy output to total energy input, design, and the quality of components used.

Question: What is the magnitude of the resultant force if two collinear forces of 10 N and 6 N act in the same direction?

Answer: The magnitude of the resultant force is 16 N.

Question: How is carbon dioxide used in the production of fizzy drinks?

Answer: Carbon dioxide dissolves in water to form carbonic acid, giving fizzy drinks their characteristic effervescence and taste.

Question: What is the current passing through a 6  $\Omega$  resistor in a parallel circuit with a 6 V power supply?

Answer: The current is  $I = V/R = 6 \text{ V}/6 \Omega = 1 \text{ A}$ .

Question: What are the harmful effects of protozoans to humans?

Answer: Protozoans can cause diseases like Amoebiasis, Malaria, and Sleeping sickness.

Question: How do electromagnetic waves propagate through space?

Answer: Electromagnetic waves propagate through space as oscillating electric and magnetic fields that are perpendicular to each other and the direction of wave travel.

Question: Explain the significance of the cell cycle in growth and development.

Answer: The cell cycle ensures that cells grow, replicate their DNA, and divide properly, contributing to growth, development, and tissue repair in multicellular organisms.

Question: How is the chemical formula of phosphorus pentoxide written?

Answer: The chemical formula of phosphorus pentoxide is  $P_2O_5$ , indicating two phosphorus atoms and five oxygen atoms.

Question: What is the electronic configuration of a carbon atom?

Answer: The electronic configuration of a carbon atom is 2, 4.

Question: How does the Golgi apparatus modify and package proteins?

Answer: The Golgi apparatus modifies proteins by adding carbohydrates and lipids, sorts them, and packages them into vesicles for delivery to their final destinations.

Question: How does the design of a U-tube manometer allow for pressure measurement?

Answer: A U-tube manometer measures pressure by comparing the heights of liquid columns in the two arms, with the difference indicating the pressure.

Question: How is the chemical formula of sodium chloride written?

Answer: The chemical formula of sodium chloride is  $NaCl$ , indicating one sodium ion and one chloride ion.

Question: What happens to the momentum of a vehicle when its velocity increases?

Answer: When the velocity of a vehicle increases, its momentum also increases.

Question: Calculate the molar mass of magnesium oxide ( $MgO$ ).

Answer: The molar mass of magnesium oxide is 40 grams per mole, calculated as 24 for magnesium plus 16 for oxygen.

Question: What is an ion?

Answer: An ion is an atom or a group of atoms with an electrical charge resulting from the loss or gain of electrons.

Question: Why is static friction important?

Answer: Static friction is important because it prevents objects from moving until a sufficient force is applied to overcome it, ensuring stability and control.

Question: What are the three types of environmental pollution?

Answer: The three types of environmental pollution are soil pollution, water pollution, and air pollution.

Question: How does alcohol consumption impact kidney function?

Answer: Excessive alcohol consumption can lead to dehydration, increased blood pressure, and potential kidney damage over time.

Question: How do you prepare a  $1 \text{ mol/dm}^3$  solution of glucose?



Answer: Weigh the required mass of glucose, dissolve it in water, and adjust the final volume in a volumetric flask.

Question: How does a bicycle dynamo convert mechanical energy into electrical energy?

Answer: A bicycle dynamo converts mechanical energy from the rotating tire into electrical energy by inducing a current in the rotating coil within a magnetic field.

Question: What are the potential benefits of personalized medicine?

Answer: Personalized medicine tailors medical treatments to an individual's genetic profile, improving the effectiveness of treatments, reducing side effects, and allowing for earlier diagnosis and prevention of diseases.

Question: How is a hydrogen molecule ( $H_2$ ) formed through covalent bonding?

Answer: A hydrogen molecule ( $H_2$ ) is formed when two hydrogen atoms share their single electrons, resulting in a covalent bond that gives each atom a stable configuration similar to helium.

Question: How does the electrochemical reduction of  $CO_2$  to hydrocarbons contribute to sustainable energy solutions?

Answer: The electrochemical reduction of  $CO_2$  to hydrocarbons converts  $CO_2$ , a greenhouse gas, into valuable fuels and chemicals using renewable electricity, contributing to sustainable energy solutions and reducing carbon emissions.

Question: What is the chemical formula for copper sulfate?

Answer: The chemical formula for copper sulfate is  $CuSO_4$ .

Question: What is the potential difference across a bulb connected to two dry cells with a total voltage of 3 V and a resistance of  $6\ \Omega$ ?

Answer: The potential difference is 3 V, assuming the power supply voltage is the same as the voltage across the bulb.

Question: What are the four kingdoms in the Domain Eukarya?

Answer: The four kingdoms in the Domain Eukarya are Protista, Fungi, Plantae, and Animalia.

Question: Why can't virtual images be projected onto a screen?

Answer: Virtual images cannot be projected onto a screen because they are formed by rays that only appear to converge, not by actual converging rays.

Question: What are some medical applications of ultrasound waves?

Answer: Ultrasound waves are used for examining internal organs, observing fetuses, and treating conditions like bladder stones.

Question: Describe the relationship between work and energy.

Answer: Work and energy are directly related; work is the transfer of energy, and energy is the capacity to do work.

Question: What is the principle behind the operation of a bicycle dynamo?

Answer: The principle behind a bicycle dynamo is electromagnetic induction, where a rotating magnet induces an electromotive force in a coil wound around a soft iron core, generating electricity.

Question: What is the significance of using copper wires in electric circuits?

Answer: Copper wires are used in electric circuits due to their high electrical conductivity, which ensures efficient current flow with minimal resistance.

Question: What is the specific heat capacity of water?

Answer: The specific heat capacity of water is  $4200 \text{ J kg}^{-1} \text{ K}^{-1}$ .

Question: What are the key features of Cnidarians?

Answer: Cnidarians are aquatic, mostly marine, multicellular organisms with diploblastic body structures, a body cavity called coelenteron, radial symmetry, and they are predators with nematocysts.

Question: What is the importance of the F2 generation in Mendel's experiments?

Answer: The F2 generation revealed the reappearance of recessive traits and helped Mendel understand the principles of dominant and recessive inheritance.

Question: Describe the working principle of a capacitor in AC circuits.

Answer: A capacitor in AC circuits stores and releases energy by alternately charging and discharging, affecting the phase and magnitude of the current and voltage.

Question: What are the safety precautions when handling concentrated acids?

Answer: Concentrated acids are corrosive and can cause severe burns; they should be handled with care, using protective equipment and avoiding skin contact.

Question: How is the chemical formula of phosphoric acid written?

Answer: The chemical formula of phosphoric acid is  $\text{H}_3\text{PO}_4$ , indicating three hydrogen atoms, one phosphorus atom, and four oxygen atoms.

Question: How do you measure the resistance of a component using a multimeter?

Answer: Set the multimeter to the resistance ( $\Omega$ ) mode, connect the probes to the component's terminals, and read the resistance value displayed on the multimeter.

Question: How does acid rain affect soil quality?

Answer: Acid rain affects soil quality by leaching essential nutrients, increasing soil acidity, and harming soil microorganisms, which can reduce soil fertility and crop yields.

Question: What are the characteristics of covalent compounds?

Answer: Covalent compounds are composed of molecules, generally have low melting and boiling points, do not conduct electricity in aqueous solutions, and are mostly found in liquid or gaseous states at room

temperature.

Question: How does the diaphragm in a moving coil microphone respond to sound?

Answer: The diaphragm vibrates in response to sound waves, moving the attached coil within a magnetic field and generating an alternating current.

Question: What factors influence the efficiency of electrolysis?

Answer: Factors influencing electrolysis efficiency include electrolyte concentration, electrode material, current density, temperature, and the distance between electrodes.

Question: What are the functions of bile?

Answer: Bile emulsifies fats, aiding in their digestion and absorption in the small intestine.

Question: What is the first ionisation energy of hydrogen?

Answer: The first ionisation energy of hydrogen is 1312 kJ/mol.

Question: What is the formula for the initial (clockwise) moment when a weight is suspended from one end of a balanced rod?

Answer: The initial (clockwise) moment is calculated as the product of the weight and the distance from the pivot point (Moment = Weight × Distance).

Question: What are the effects of nitrogen oxides (NO<sub>x</sub>) on the environment?

Answer: The effects of nitrogen oxides (NO<sub>x</sub>) on the environment include the formation of photochemical smog, acid rain, and respiratory problems in humans and animals.

Question: How do you find the mean velocity of an object that has moved 50 meters in 10 seconds?

Answer: Mean velocity = 50 m / 10 s = 5 m/s.

Question: What is the result of connecting the positive terminals of two dry cells to a bulb?

Answer: Connecting the positive terminals of two dry cells to a bulb results in no potential difference across the bulb, and therefore, no current flow.

Question: What is the result of connecting the negative terminals of two dry cells to a bulb?

Answer: Connecting the negative terminals of two dry cells to a bulb results in no potential difference across the bulb, and therefore, no current flow.

Question: Materials required :- An unopened bottle of soda water (plastic), an empty bottle of the same type. Method :- Take an unopened bottle of soda water available in the market. To an identical empty bottle, add water equal in quantity to that of soda water and close the cap tightly. Now squeeze both bottles with hand and select the harder bottle. What materials are needed for Activity ?

Answer: Materials needed include an unopened bottle of soda water and an identical empty bottle filled with water.

Question: What is the role of a light-dependent resistor (LDR) in a circuit?

Answer: A light-dependent resistor (LDR) changes its resistance based on the intensity of light, making it useful in circuits that respond to light levels.

Question: What is the formula for calculating the heat required for a temperature change in a substance?

Answer: The formula for calculating the heat required is  $Q = mc\Delta T$ , where  $Q$  is the quantity of heat,  $m$  is the mass,  $c$  is the specific heat capacity, and  $\Delta T$  is the temperature change.

Question: What is the general concept of solubility based on polarity?

Answer: The general concept is that polar solutes are soluble in polar solvents, and non-polar solutes are soluble in non-polar solvents, following the principle "like dissolves like."

Question: How much heat is required to convert 1 kg of water at 100°C into steam at the same temperature?

Answer: The amount of heat required to convert 1 kg of water at 100°C into steam at the same temperature is  $2.26 \times 10^6$  J, known as the specific latent heat of vaporization of water.

Question: What happens to the induced current when the coil in a dynamo is vertical?

Answer: When the coil is vertical, the induced current becomes zero as the conductors do not intersect the magnetic field lines.

Question: How is the chemical formula of sodium chloride represented?

Answer: The chemical formula of sodium chloride is NaCl, indicating a 1:1 ratio of sodium and chloride ions.

Question: What is the trend in atomic size down a group?

Answer: The atomic size increases down a group.

Question: What are persistent organic pollutants (POPs), and what are their characteristics?

Answer: Persistent organic pollutants (POPs) are toxic, hazardous organic substances that persist in the environment, accumulate in organisms, are widely dispersed, and are highly toxic. Examples include DDT, PCBs, and dioxins.

Question: Explain the role of the cytoplasm in cellular activities.

Answer: The cytoplasm provides a medium for biochemical reactions, houses organelles, and facilitates the movement of materials within the cell, supporting cellular activities.

Question: How do musical instruments create different pitches?

Answer: Different pitches are created by varying the frequency of vibrations produced by strings, air columns, or membranes in the instrument.

Question: What is the role of mitochondria in cellular respiration?

Answer: Mitochondria are the organelles where cellular respiration occurs, producing energy in the form of ATP by breaking down glucose and other nutrients.

Question: What is the significance of the vertical line passing through the center of gravity in maintaining equilibrium?

Answer: The vertical line passing through the center of gravity indicates the line of action of the weight. For equilibrium, the lines of action of other forces must intersect this vertical line and lie in the same plane.

Question: Explain the function of a magnetic contactor in industrial control systems.

Answer: A magnetic contactor is an electrically operated switch that controls high-power circuits, providing reliable switching and protection for industrial control systems.

Question: How does blood tissue contribute to homeostasis?

Answer: Blood tissue helps maintain homeostasis by regulating body temperature, pH levels, and fluid balance.

Question: How are algae classified based on their color?

Answer: Algae are classified into different groups based on their color, such as green, brown, and red algae.

Question: What is the resultant force of two forces of 8 N and 16 N acting on a trolley?

Answer: The resultant force is 24 N.

Question: What are the uses of carbon dioxide?

Answer: Carbon dioxide is used in fire extinguishers, the production of fizzy drinks, as a raw material for photosynthesis, and in producing carbon monoxide for iron extraction.

Question: How does increasing the mass of an object affect its momentum for a constant velocity?

Answer: Increasing the mass of an object increases its momentum for a constant velocity, as momentum is the product of mass and velocity.

Question: How does the strength of the magnetic field affect the performance of a dynamo?

Answer: A stronger magnetic field increases the induced electromotive force, improving the dynamo's performance and electricity generation.

Question: What happens during the process of peristalsis in the esophagus?

Answer: Peristalsis involves rhythmic contractions and relaxations of the esophageal muscles, propelling the food bolus forward to the stomach.

Question: What is the hearing range of dogs compared to humans?

Answer: Dogs can hear sounds up to about 40,000 Hz, which is higher than the human hearing range of up to 20,000 Hz.

Question: What is the role of Newton's third law in the formation of a force couple?

Answer: Newton's third law states that for every action force, there is an equal and opposite reaction force. This principle is applied in the formation of a force couple, where the reaction force at the pivot creates the couple.

Question: How is the chemical formula of phosphoric acid represented?

Answer: The chemical formula of phosphoric acid is  $\text{H}_3\text{PO}_4$ , indicating three hydrogen atoms, one phosphorus atom, and four oxygen atoms.

Question: How does electroplating enhance the properties of metal objects?

Answer: Electroplating enhances properties like corrosion resistance, appearance, and durability by applying a thin layer of a less reactive metal onto the surface.

Question: How are autotrophs classified based on their energy source?

Answer: Autotrophs are classified into photo-autotrophs, which use sunlight, and chemo-autotrophs, which use chemical energy.

Question: What is the role of chromosomes in genetic inheritance?

Answer: Chromosomes carry genes that determine traits and transmit genetic information from one generation to the next, playing a crucial role in inheritance.

Question: How do non-flowering seedless plants reproduce?

Answer: Non-flowering seedless plants reproduce asexually by spores and vegetative fragmentation.

Question: How is hydrogen gas collected by downward displacement of air?

Answer: Hydrogen gas, less dense than air, is collected by displacing air downwards in an inverted gas jar, a method known as downward displacement of air.

Question: What is the significance of Michael Faraday's experiments on electromagnetic induction?

Answer: Faraday's experiments established the principles of electromagnetic induction, leading to the development of electrical generators and transformers.

Question: How does the thermal conductivity of a material affect its heat transfer properties?

Answer: The thermal conductivity of a material determines its ability to transfer heat. High thermal conductivity materials transfer heat efficiently, while low thermal conductivity materials act as insulators.

Question: How is aerial layering performed?

Answer: Aerial layering involves removing a ring of bark from a twig high above the ground, placing a mixture of compost and coir dust around the area, and tying it with polythene until roots develop.

Question: What are the main types of cells found in blood tissue?

Answer: Blood tissue contains red blood cells, white blood cells, and platelets.

Question: What is the reaction between sodium and water?

Answer: Sodium reacts vigorously with water to form sodium hydroxide and hydrogen gas:  $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$ .

Question: Activity: Requirement: Three pieces of cleaned magnesium ribbon of equal surface area, three test tubes, dilute hydrochloric acid, water Take three test tubes and add 15 ml of water to each tube. Mark the water level of each tube with a rubber band and empty the water. Add 2.5 ml, 5.0 ml, and 7.5 ml of dilute hydrochloric acid to the three test tubes, and fill water to the rubber band mark of each tube. Introduce to each test tube a piece of magnesium ribbon and observe the speed of fizzing. How does the rate of gas evolution change with varying hydrochloric acid concentrations in activity ?

Answer: The rate of gas evolution increases with higher concentrations of hydrochloric acid, indicating a faster reaction rate.

Question: How do geneticists use model organisms in genetic research?

Answer: Geneticists use model organisms such as fruit flies, mice, and yeast because they have short lifespans, well-understood genetics, and can be easily manipulated in the lab to study genetic principles and disorders.

Question: What causes AIDS, and what are its symptoms?

Answer: AIDS is caused by the Human Immunodeficiency Virus (HIV) and can be fatal. Symptoms may appear 2-15 years after infection.

Question: What is a food web?

Answer: A food web is a complex network of interconnected food chains representing the feeding relationships among organisms in an ecosystem.

Question: What is the chemical formula for potassium bromide?

Answer: The chemical formula for potassium bromide is KBr.

Question: What is the significance of the lattice structure in ionic compounds?

Answer: The lattice structure in ionic compounds provides stability and strength due to the regular, repeating pattern of oppositely charged ions, maximizing electrostatic attraction.

Question: Explain half-wave rectification.

Answer: Half-wave rectification is a process where only one half of the AC waveform passes through the diode, resulting in a pulsating DC output that uses only the positive or negative half-cycles of the input AC.

Question: What are the functions of the smooth endoplasmic reticulum in muscle cells?

Answer: The smooth endoplasmic reticulum in muscle cells stores and releases calcium ions, regulating muscle contraction and relaxation.

Question: What is an example of a non-polar organic solute and solvent pair?

Answer: An example is grease (non-polar solute) dissolving in kerosene (non-polar solvent).

Question: What is amplitude in wave motion?

Answer: Amplitude is the maximum displacement of particles from their equilibrium position in a wave.

Question: How does the gravitational acceleration on the moon compare to that on Earth?

Answer: The gravitational acceleration on the moon is about 1/6th of that on Earth.

Question: How do plants transport water and nutrients?

Answer: Plants transport water and nutrients through the vascular system, consisting of xylem (for water and minerals) and phloem (for organic nutrients).

Question: What is electromotive force (EMF)?

Answer: Electromotive force is the force by which the negative terminal of an electric source releases electrons to the external circuit.

Question: How does photosynthesis demonstrate an endothermic process?

Answer: It absorbs solar energy to convert carbon dioxide and water into glucose and oxygen.

Question: What is the observation when citric acid reacts with sodium bicarbonate?

Answer: The temperature decreases, indicating an endothermic reaction.

Question: What is the function of a voltage regulator in electronic devices?

Answer: A voltage regulator maintains a constant output voltage despite variations in input voltage or load conditions, ensuring stable and reliable power supply for electronic devices.

Question: What are the characteristics of the Kingdom Fungi?

Answer: The Kingdom Fungi includes organisms with chitinous cell walls, eukaryotic cellular organization, and the ability to decompose organic matter.

Question: How do kidney transplants restore kidney function in patients with end-stage renal disease?

Answer: Kidney transplants replace the damaged kidney with a healthy donor kidney, restoring filtration ability and overall kidney function.

Question: How do you measure the potential difference across a conductor using a voltmeter?

Answer: Connect the voltmeter in parallel with the conductor and read the voltage value displayed on the voltmeter.

Question: What is the function of brushing rings in an alternating current dynamo?

Answer: Brushing rings connect the rotating coil to the external circuit, allowing current to flow continuously despite the coil's rotation.



Question: What is photorespiration, and how does it affect photosynthesis?

Answer: Photorespiration occurs when the enzyme Rubisco fixes oxygen instead of CO<sub>2</sub>, leading to reduced photosynthetic efficiency and energy loss.

Question: What are the benefits of using eco-friendly building materials?

Answer: Eco-friendly building materials reduce environmental impact, improve energy efficiency, and support sustainable construction practices. They contribute to healthier living environments and resource conservation.

Question: How do sound waves differ from light waves in terms of speed and medium?

Answer: Sound waves are slower than light waves and require a medium (air, liquid, or solid) to travel, while light waves can travel through a vacuum.

Question: How do sound waves differ from light waves in terms of propagation?

Answer: Sound waves require a medium to travel, while light waves can propagate through a vacuum.

Question: How do you measure the current flowing through a bulb in a circuit with two dry cells?

Answer: Connect an ammeter in series with the bulb and the dry cells to measure the current flowing through the bulb.

Question: What factors determine the magnitude of induced voltage in a coil?

Answer: Factors determining the magnitude of induced voltage include the number of coil turns, magnetic field strength, and speed of motion.

Question: What changes occur in the fetus during the sixth month of development?

Answer: During the sixth month, the fetus develops eyebrows and eyelashes.

Question: What is the function of the chloroplast in photosynthesis?

Answer: The chloroplast contains chlorophyll and other pigments that capture light energy, facilitating the conversion of carbon dioxide and water into glucose and oxygen during photosynthesis.

Question: What is the significance of the number of coil turns in electromagnetic induction?

Answer: The number of turns in the coil increases the induced electromotive force, making the process more efficient.

Question: What is the role of heat in neutralization reactions?

Answer: Neutralization reactions between acids and bases release heat, making them exothermic.

Question: Differentiate between physical and chemical changes with examples.

Answer: Physical changes involve changes in the physical state or arrangement of particles without forming new substances, such as melting ice or boiling water. Chemical changes involve forming new substances, such as burning wood or rusting iron.

Question: What is the chemical formula for potassium carbonate?

Answer: The chemical formula for potassium carbonate is  $K_2CO_3$ , indicating two potassium ions and one carbonate ion.

Question: How is potassium permanganate used to produce oxygen gas?

Answer: Potassium permanganate decomposes upon heating to produce potassium manganate, manganese dioxide, and oxygen gas:  $2KMnO_4 \rightarrow K_2MnO_4 + MnO_2 + O_2$ .

Question: What is the function of the live and neutral wires in a domestic circuit?

Answer: The live wire carries the current from the power source to the appliance, while the neutral wire carries it back, completing the circuit.

Question: What are lipids and how are they classified?

Answer: Lipids include fats and oils, with fats being solid at room temperature and oils being liquid.

Question: What is the function of the Golgi apparatus in protein processing?

Answer: The Golgi apparatus modifies, sorts, and packages proteins for transport to their destinations within or outside the cell, playing a key role in protein maturation and secretion.

Question: What hormones are secreted by the testes, and what are their functions?

Answer: The testes secrete testosterone, which develops secondary sexual characteristics in boys and induces spermatogenesis.

Question: What are monosaccharides?

Answer: Monosaccharides are the structural units of carbohydrates, commonly known as simple sugars.

Question: Explain the relationship between work and energy.

Answer: Work is the transfer of energy; when work is done on an object, energy is transferred to or from the object.

Question: What is the purpose of a load cell in weighing systems?

Answer: A load cell measures force or weight by converting mechanical stress into an electrical signal, providing accurate weight measurement in scales and industrial applications.

Question: How does the nature of a solute affect its dissolution in a solvent?

Answer: The chemical structure, polarity, and intermolecular forces of a solute determine its solubility and dissolution behavior in a solvent.

Question: How do you determine the equilibrium of an object under the action of two forces using a ring and spring balances?

Answer: Attach the spring balances to the ring and pull in opposite directions with varying forces. The object remains in equilibrium when the forces are equal in magnitude and opposite in direction, resulting in no net movement.

Question: What are the observations when sodium reacts with water?

Answer: When sodium reacts with water, it moves rapidly on the water's surface, producing a hissing sound and may catch fire. It forms sodium hydroxide and hydrogen gas:  $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$ .

Question: What is the potential difference across a bulb connected to a 3 V power supply with a resistance of  $6\ \Omega$ ?

Answer: The potential difference is 3 V, assuming the power supply voltage is the same as the voltage across the bulb.

Question: How does the mass of an object affect its acceleration for a given force?

Answer: For a given force, the acceleration of an object is inversely proportional to its mass. A larger mass results in a smaller acceleration.

Question: What are the effects of urbanization on natural habitats?

Answer: The effects of urbanization on natural habitats include habitat destruction, fragmentation, and alteration, leading to a decline in species diversity and ecosystem health.

Question: How does the body respond to low blood oxygen levels in terms of kidney function?

Answer: The kidneys produce erythropoietin (EPO) in response to low blood oxygen levels, stimulating red blood cell production to improve oxygen delivery.

Question: How do you calculate the number of atoms in a given mass of an element?

Answer: The number of atoms in a given mass of an element is calculated by dividing the mass by the molar mass to find the number of moles, then multiplying by Avogadro's constant.

Question: What are the potential impacts of climate change on ecosystems?

Answer: Potential impacts of climate change on ecosystems include shifts in species distribution, changes in phenology (timing of biological events), increased frequency of extreme weather events, and disruptions to ecosystem services.

Question: What is the percentage abundance of Cl-35 and Cl-37 in chlorine gas?

Answer: In chlorine gas, Cl-35 is 75% and Cl-37 is 25%.

Question: What are the main types of tissues in multicellular organisms?

Answer: The main types of tissues in multicellular organisms include epithelial tissue, connective tissue, muscle tissue, and nervous tissue, each

with specific functions.

Question: How does a loudspeaker's cone amplify sound waves?

Answer: The cone vibrates in response to the coil's movement, amplifying the sound waves produced by the varying electric current.

Question: What is hypotension, and what causes it?

Answer: Hypotension is low blood pressure, usually caused by nutrient deficiencies.

Question: What is the result of the reaction between sodium hydroxide and hydrochloric acid?

Answer: Sodium hydroxide reacts with hydrochloric acid to form sodium chloride and water ( $\text{NaOH} + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O}$ ).

Question: What is the effect of particle size on the rate of reaction?

Answer: Smaller particles have a larger surface area-to-volume ratio, leading to more collision sites and a higher rate of reaction.

Question: Calculate the relative molecular mass of carbon dioxide ( $\text{CO}_2$ ).

Answer: The relative molecular mass of carbon dioxide is 44, calculated as 12 for carbon plus  $2 \times 16$  for oxygen.

Question: What are some sources of environmental pollutants?

Answer: Sources of environmental pollutants include agrochemical waste, industrial waste, greenhouse gases, heavy metals, particulate matter, domestic waste, electronic waste, and nuclear waste.

Question: How do mitochondria regulate cellular metabolism?

Answer: Mitochondria regulate cellular metabolism by producing ATP through aerobic respiration, controlling energy production, and modulating metabolic pathways.

Question: How does a transducer convert physical quantities into electrical signals?

Answer: A transducer converts physical quantities, such as temperature, pressure, or light, into electrical signals by using sensors that produce corresponding voltage or current changes.

Question: Describe the construction of a simple transformer.

Answer: A simple transformer consists of two insulated copper coils wrapped around a soft iron core. One coil, the primary, is connected to an alternating power supply, and the other coil, the secondary, is connected to a load.

Question: How are fractions collected during the distillation process?

Answer: By condensing the vapor at different temperatures and collecting the resulting liquid fractions separately.

Question: What triggers the secretion of glucagon, and what is its function?

Answer: Low blood glucose levels trigger glucagon secretion, which converts stored glycogen into glucose to raise blood glucose levels.

Question: What is the weight of a 4 kg object on Earth?

Answer: The weight of a 4 kg object on Earth is  $4 \times 9.8 = 39.2$  N.

Question: Define phenotype and genotype.

Answer: Phenotype is the observable characteristic of an organism, while genotype is the genetic makeup that determines the phenotype.

Question: Describe an experiment to construct a bridge rectifier circuit, including the setup, procedure, and observations.

Answer: A bridge rectifier circuit converts alternating current (AC) to direct current (DC) using four diodes arranged in a bridge configuration. Materials Required: Four diodes (e.g., 1N4007), a transformer, a resistor, a load (bulb or LED), connecting wires, and an oscilloscope. Setup: Transformer: Connect the secondary winding of the transformer to the AC input terminals of the bridge rectifier. Diodes: Arrange four diodes in a bridge configuration with two pairs of diodes facing opposite directions. Load: Connect the load across the DC output terminals of the bridge rectifier. Procedure: Assemble the Circuit: Connect the diodes in the bridge configuration. Connect the AC input from the transformer and the load across the DC output. Power On: Switch on the transformer to provide AC input to the rectifier circuit. Measure Output: Use an oscilloscope to observe the output waveform across the load. Observations: AC Input: The oscilloscope shows an alternating waveform at the input. DC Output: The output across the load shows a pulsating DC waveform, indicating rectification. Diode Function: The diodes conduct in pairs during each half-cycle of the AC input, allowing current to flow through the load in one direction, thereby converting AC to DC. Conclusion: The bridge rectifier efficiently converts AC to DC, providing a pulsating DC output suitable for powering electronic devices. The circuit ensures correct voltage supply to the load regardless of the AC input polarity.

Question: How does the resistance of an LDR change with light intensity?

Answer: The resistance of an LDR decreases with increasing light intensity and increases with decreasing light intensity.

Question: What is the conventional direction of electric current?

Answer: The conventional direction of electric current is from the positive terminal to the negative terminal, opposite to the flow of electrons.

Question: How is the energy level diagram for an endothermic reaction represented?

Answer: Reactants at a lower energy level than products, with energy absorbed.

Question: What is the structure and function of the heart?

Answer: The heart is a muscular organ with four chambers that pumps blood throughout the body, facilitating double circulation (pulmonary and systemic).

Question: What factors contribute to pulmonary diseases?

Answer: Factors contributing to pulmonary diseases include harmful gases emitted from vehicles and factories, which affect organs or tissues involved in respiration such as the trachea, bronchi, bronchioles, alveoli, and

associated nerves and muscles.

Question: How is the exothermic reaction between magnesium and hydrochloric acid represented?

Answer:  $\text{Mg (s)} + 2\text{HCl (aq)} \rightarrow \text{MgCl}_2 \text{ (aq)} + \text{H}_2 \text{ (g)} + \text{Heat}$ .

Question: How does lactic acid fermentation occur in human cells?

Answer: During anaerobic respiration, glucose is broken down into lactic acid, releasing energy, which can accumulate in muscles causing pain and cramps.

Question: What are the organizational levels in the biosphere?

Answer: The organizational levels in the biosphere are individual, population, community, ecosystem, and biosphere.

Question: What is the chemical formula for calcium chloride?

Answer: The chemical formula for calcium chloride is  $\text{CaCl}_2$ .

Question: What are the applications of electrochemical cells in renewable energy storage?

Answer: Electrochemical cells are used in renewable energy storage systems like batteries and flow cells to store energy generated from renewable sources (e.g., solar, wind) for later use, ensuring a reliable and continuous power supply.

Question: What is the role of the endoplasmic reticulum in lipid synthesis?

Answer: The smooth endoplasmic reticulum synthesizes lipids, including phospholipids and steroids, and transports them within the cell.

Question: How do we distinguish between different musical instruments playing the same note?

Answer: We distinguish between different instruments by their unique sound quality or timbre, determined by the waveform of the sound they produce.

Question: What occurs during the process of ultrafiltration in the nephron?

Answer: Blood enters the glomerulus, and high pressure forces water, glucose, amino acids, and other small molecules through the glomerular membrane into Bowman's capsule, forming glomerular filtrate.

Question: How does gene flow affect genetic diversity?

Answer: Gene flow, the movement of genes between populations, increases genetic diversity by introducing new alleles into a population, reducing the risk of inbreeding and promoting genetic variation.

Question: What is a common use of metalloids due to their unique properties?

Answer: Metalloids are commonly used in semiconductors and electronics due to their intermediate electrical conductivity.

Question: What are the characteristics of organisms in the Domain Archaea?

Answer: Organisms in the Domain Archaea are prokaryotes that can live in extreme environments and are not sensitive to most antibiotics.

Question: How do geneticists use population genetics to study evolution?

Answer: Geneticists use population genetics to study the distribution of genetic variation within and between populations, examining how evolutionary forces such as natural selection, genetic drift, and gene flow shape genetic diversity over time.

Question: What is the nature of the image formed by a convex mirror?

Answer: The image formed by a convex mirror is virtual, upright, and smaller than the object.

Question: What is an example of an animal that uses sound for communication?

Answer: Whales use sound waves to communicate through water, where sound travels faster and more efficiently than in air.

Question: What is the angle of refraction in light refraction?

Answer: The angle between the refracted ray and the normal to the surface at the point of refraction.

Question: How does the volume of a gas change with pressure according to Boyle's Law?

Answer: According to Boyle's Law, the volume of a gas decreases as the pressure increases, provided the temperature remains constant.

Question: How does a digital oscilloscope display electrical signals?

Answer: A digital oscilloscope samples electrical signals, converts them to digital data, and displays the waveform on a screen, allowing analysis of signal characteristics.

Question: What is the equation for the production of slaked lime, and what type of reaction is it?

Answer:  $\text{CaO (s)} + \text{H}_2\text{O (l)} \rightarrow \text{Ca(OH)}_2 \text{ (s)}$ , an exothermic reaction.

Question: What is the significance of using a polystyrene cup in heat change experiments?

Answer: It acts as a thermal insulator, minimizing heat loss to the surroundings.

Question: How do you achieve equilibrium in a system of forces acting on an object suspended by multiple strings?

Answer: Achieve equilibrium by ensuring that the forces exerted by the strings balance the weight of the object. The tensions in the strings must be equal and opposite to the weight, and their lines of action must intersect at a common point.

Question: Explain the working principle of a supercapacitor and its applications.

Answer: A supercapacitor stores energy through electrostatic charge separation at the electrode-electrolyte interface, providing high power density, rapid charging and discharging, and long cycle life. It is used in

applications like energy storage, power backup, and regenerative braking.

Question: How does the focal length affect the image formation in concave mirrors?

Answer: The focal length determines the point where light rays converge, affecting the position and size of the image formed.

Question: What is the specific heat capacity of aluminium?

Answer: The specific heat capacity of aluminium is  $900 \text{ J kg}^{-1} \text{ K}^{-1}$ .

Question: What happens to light rays that pass through the center of curvature towards a concave mirror?

Answer: They are reflected back along the same path because the angle of incidence is zero.

Question: Describe the electrolysis of aqueous copper sulfate, including the observations and reactions at each electrode.

Answer: The electrolysis of aqueous copper sulfate involves passing an electric current through a solution of copper sulfate ( $\text{CuSO}_4$ ) using carbon electrodes, resulting in the deposition of copper and the evolution of gas.  
Materials Required: Aqueous solution of copper sulfate, carbon rods, connecting wires, and a 9V battery. Method: Connect the carbon electrodes to the battery. Immerse the electrodes in the copper sulfate solution. Observe gas bubbles at the anode and copper deposition at the cathode. Observations: Gas bubbles evolve at the anode (positive terminal). Copper gets deposited on the cathode (negative terminal). The blue color of the solution diminishes over time. Reactions: At the Cathode (Negative Electrode): Reduction of copper ions occurs because copper lies below hydrogen in the activity series, making it easier to reduce. Reaction:  $\text{Cu}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Cu}(\text{s})$  Copper metal is deposited on the cathode. At the Anode (Positive Electrode): Oxidation of hydroxide ions occurs because they have a greater tendency to oxidize. Reaction:  $4\text{OH}^-(\text{aq}) \rightarrow \text{O}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l}) + 4\text{e}^-$  Oxygen gas bubbles evolve at the anode. Overall Reaction:  $\text{CuSO}_4(\text{aq}) + 2\text{H}_2\text{O}(\text{l}) \rightarrow \text{Cu}(\text{s}) + \text{O}_2(\text{g}) + \text{H}_2\text{SO}_4(\text{aq})$  Outcome: Copper is plated onto the cathode, and oxygen gas is released at the anode. The blue color of the solution decreases as copper ions are removed from the solution.

Question: What is the role of a pivot point in the formation of a force couple in practical applications?

Answer: The pivot point provides a fixed point around which the object can rotate due to the action and reaction forces according to Newton's third law, facilitating the formation of a force couple.

Question: What is the role of the radicle in seed germination?

Answer: The radicle is the first part of the seedling to emerge from the seed during germination, developing into the primary root.

Question: Explain the reaction of calcium with cold water.

Answer: Calcium reacts with cold water to form calcium hydroxide and hydrogen gas, although less vigorously than sodium:  $\text{Ca} + 2\text{H}_2\text{O} \rightarrow \text{Ca}(\text{OH})_2 + \text{H}_2$ .



Question: Calculate the amount of sulfuric acid (H<sub>2</sub>SO<sub>4</sub>) in moles in 49 grams.

Answer: The amount of sulfuric acid in 49 grams is 0.5 moles, calculated as  $49/98 = 0.5$  moles.

Question: What is the specific latent heat of fusion of ice?

Answer: The specific latent heat of fusion of ice is  $3.36 \times 10^5$  J/kg.

Question: What is upthrust and how is it experienced by objects in a liquid?

Answer: Upthrust is the upward force exerted by a liquid on an object immersed in it. It is experienced as a reduction in the apparent weight of the object due to the liquid's buoyant force.

Question: How does a liquid manometer measure pressure differences?

Answer: A liquid manometer measures pressure differences by comparing the heights of liquid columns in its two arms, with the difference indicating the pressure difference between the two points.

Question: What is thermal equilibrium?

Answer: Thermal equilibrium is the state when two objects in contact no longer transfer heat between them, having reached the same temperature.

Question: What is the role of an operational amplifier (op-amp) in electronic circuits?

Answer: An operational amplifier (op-amp) amplifies the difference between two input voltages, providing high gain and stability for various analog signal processing applications.

Question: What are the main parts of the male reproductive system?

Answer: The main parts of the male reproductive system include the testes, epididymis, vas deferens, seminal vesicles, prostate gland, Cowper's glands, and penis.

Question: How do intermolecular forces affect the properties of water?

Answer: Intermolecular forces in water result in high boiling points, high specific heat capacity, and a higher density than ice, allowing water to exist as a liquid at room temperature.

Question: How is the maximum number of electrons in an energy level determined?

Answer: The maximum number of electrons in an energy level is determined by the formula  $2n^2$ , where  $n$  is the principal quantum number of the energy level.

Question: What is the reaction between calcium carbonate and hydrochloric acid?

Answer: Calcium carbonate reacts with hydrochloric acid to form calcium chloride, water, and carbon dioxide:  $\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$ .

Question: What are the differences between monocots and dicots in terms of flower structure?

Answer: Monocot flowers are trimerous (parts in threes), while dicot flowers are tetra- or pentamerous (parts in fours or fives).

Question: What is the specific heat capacity of water used in the calculation for the reaction between vinegar and lime water?

Answer:  $4200 \text{ J kg}^{-1}\text{C}^{-1}$ .

Question: How do the properties of elements change across a period?

Answer: The properties of elements change in a systematic pattern across a period from left to right.

Question: What are the conditions for equilibrium in an object under the action of three non-parallel coplanar forces?

Answer: The three forces must be coplanar, their lines of action must intersect at a common point, and the resultant of any two forces must be equal in magnitude and opposite in direction to the third force.

Question: How do prisms produce total internal reflection?

Answer: Prisms with specific angles cause light rays to undergo total internal reflection, bending light by 90 or 180 degrees without loss of intensity.

Question: What are common signs and symptoms of chronic kidney disease (CKD)?

Answer: Symptoms of CKD include fatigue, swelling in the legs and ankles, frequent urination, blood in urine, high blood pressure, and nausea.

Question: What is the significance of a triple bond in a nitrogen ( $\text{N}_2$ ) molecule?

Answer: A triple bond in a nitrogen ( $\text{N}_2$ ) molecule involves the sharing of three pairs of electrons between two nitrogen atoms, resulting in a very strong and stable bond.

Question: Why is binomial nomenclature important?

Answer: Binomial nomenclature provides a standardized way to name organisms, avoiding confusion caused by different common names in various languages and regions, and helps in identifying evolutionary relationships.

Question: Describe the equilibrium of a plank of wood suspended by four strings in terms of forces.

Answer: The plank of wood is in equilibrium because the forces of tension in the four strings balance the weight of the plank. The tensions act vertically upwards and are equal in magnitude to the weight, resulting in no net force.

Question: How does the strength of the magnetic field affect the performance of a dynamo?

Answer: A stronger magnetic field increases the induced electromotive force, improving the dynamo's performance and electricity generation.

Question: What is the concept of "reduce, reuse, recycle"?

Answer: The concept of "reduce, reuse, recycle" encourages minimizing waste generation, reusing materials, and recycling products to conserve resources and protect the environment.

Question: How does the design of an electrochemical cell impact its performance?

Answer: The design of an electrochemical cell impacts its performance by influencing factors like electrode configuration, electrolyte composition, ion transport, and heat management. Optimal design ensures efficient reactions, high power output, and long cell life.

Question: Describe the setup for investigating the equilibrium of a meter ruler under three coplanar parallel forces in Activity.

Answer: In Activity , a meter ruler is suspended horizontally using two rubber bands attached to spring balances at either end. The weight of the ruler and the forces measured by the spring balances are used to investigate the relationship between the forces and the ruler's weight in maintaining equilibrium.

Question: Describe the structure of a typical plant cell.

Answer: A typical plant cell has a cell wall, plasma membrane, large central vacuole, chloroplasts, nucleus, and various organelles like mitochondria, Golgi apparatus, and endoplasmic reticulum.

Question: How are non-flowering seedless plants adapted to their environment?

Answer: Non-flowering seedless plants are adapted to terrestrial environments with low sunlight, shady, and wet places.

Question: What is observed when a plastic rod is rubbed against hair?

Answer: When a plastic rod is rubbed against hair, it can attract tiny bits of paper or rigifoam due to the static electric charges generated.

Question: How does a strain gauge measure pressure indirectly?

Answer: A strain gauge measures pressure indirectly by detecting the deformation (strain) of a material under pressure, converting it into an electrical signal proportional to the pressure.

Question: How do human activities contribute to the greenhouse effect?

Answer: Human activities contribute to the greenhouse effect by increasing the concentration of greenhouse gases through the burning of fossil fuels, deforestation, and industrial processes.

Question: How do different animals utilize sound waves for survival?

Answer: Animals like bats and dolphins use ultrasound waves for navigation, communication, and locating prey, while elephants use infra-sound for long-distance communication.

Question: What energy transformation occurs in a DC motor?

Answer: A DC motor converts electrical energy into mechanical energy.

Question: What is the role of education in promoting environmental awareness?

Answer: Education promotes environmental awareness by increasing knowledge, changing attitudes, and encouraging responsible behavior towards the environment.

Question: What are microwaves, and what are their common uses?

Answer: Microwaves are electromagnetic waves with frequencies below infrared waves, used in RADAR systems, mobile phones, and microwave ovens.

Question: How is the resultant force of two collinear forces acting in opposite directions calculated?

Answer: The resultant force is calculated by subtracting the smaller force from the larger force, in the direction of the larger force.

Question: What is the function of brushing rings in an alternating current dynamo?

Answer: Brushing rings connect the rotating coil to the external circuit, allowing current to flow continuously despite the coil's rotation.

Question: What is the significance of using proper grounding in electric circuits?

Answer: Proper grounding provides a safe path for electric current to flow to the earth in case of a fault, preventing electric shocks and protecting appliances from damage.

Question: What is the role of enzymes in cellular metabolism?

Answer: Enzymes act as biological catalysts that speed up chemical reactions in cellular metabolism, enabling the efficient breakdown and synthesis of molecules.

Question: What is the significance of the cell wall in protecting plant cells?

Answer: The cell wall provides structural support, protects against mechanical damage, pathogens, and osmotic stress, and maintains cell shape in plant cells.

Question: How do you measure the force required to initiate the turning effect using a Newton balance and a stick?

Answer: Measure the force by attaching the Newton balance to the stick, applying a perpendicular force, and recording the minimum force required to slightly move the stick.

Question: What are unisexual flowers?

Answer: Unisexual flowers have either male or female reproductive parts and are classified into staminate (male) and pistillate (female) flowers.

Question: What are the features of invertebrates in the phylum Arthropoda?

Answer: Invertebrates in the phylum Arthropoda are triploblastic, coelomic, have jointed limbs, segmented bodies forming functional segments called Tagma, a chitinous cuticle acting as an exoskeleton, bilateral symmetry, and show sexual dimorphism.

Question: How do ionic and covalent bonds differ in terms of their formation?

Answer: Ionic bonds form through the transfer of electrons from one atom to another, resulting in oppositely charged ions, while covalent bonds form

through the sharing of electrons between atoms.

Question: How is gold extracted from its ore?

Answer: Gold, found as native metal mixed with impurities, is separated by physical methods like sifting and density separation. Solvents that dissolve gold can further purify it.

Question: How is the chemical formula of nitrogen dioxide represented?

Answer: The chemical formula of nitrogen dioxide is  $\text{NO}_2$ , indicating one nitrogen atom and two oxygen atoms.

Question: What is the principle behind the functioning of a tire pressure monitoring system (TPMS)?

Answer: TPMS monitors tire pressure by using sensors that measure the pressure inside the tires and alert the driver if the pressure is too low or too high.

Question: Describe the principle of a redox flow battery.

Answer: A redox flow battery stores energy in liquid electrolyte solutions containing redox-active species. The electrolytes flow through electrochemical cells where redox reactions occur, generating or storing electrical energy, and can be easily scaled for large energy storage applications.

Question: What is the advantage of connecting components in parallel?

Answer: The advantage of connecting components in parallel is that each component operates independently, and the failure of one component does not affect the others.

Question: What is the relationship between current and magnetic field strength in a solenoid?

Answer: The magnetic field strength in a solenoid is directly proportional to the current flowing through it and the number of coil windings.

Question: What are the effects of dehydration on the body?

Answer: Dehydration can lead to reduced blood volume, decreased blood pressure, impaired kidney function, and electrolyte imbalances.

Question: What is the work done in lifting a 3 kg object to a height of 2 m?

Answer: The work done is 60 Joules (J).

Question: How does the speed of a rotating coil influence the dynamo's output?

Answer: A faster rotating coil increases the rate of change of the magnetic field, generating higher voltage and more electrical power.

Question: How does Mendel's work apply to modern genetics?

Answer: Mendel's principles of inheritance form the basis of modern genetics, helping scientists understand how traits are passed down and how genetic disorders occur.

Question: What are the characteristics of organisms in the Kingdom Protista?

Answer: Organisms in the Kingdom Protista have eukaryotic cellular organization, can be unicellular or multicellular without specialized tissues, and live in water-associated environments. Some are photosynthetic, while others are heterotrophic.

Question: How do hydrogen bonds form in water molecules?

Answer: Hydrogen bonds form in water molecules when the hydrogen atoms, bearing partial positive charges, attract the oxygen atoms of neighboring water molecules, which have partial negative charges.

Question: What happens when an object is placed between the lens and its focal point?

Answer: A virtual, upright, and larger-than-object image is formed.

Question: What is the function of the epithelium in Bowman's capsule?

Answer: The epithelium in Bowman's capsule filters blood, allowing the formation of urine while retaining essential molecules in the bloodstream.

Question: What materials are needed to examine how acids affect rusting?

Answer: Three boiling tubes, water, lime juice, and dilute hydrochloric acid (HCl).

Question: What observation indicates that sodium chloride accelerates rusting?

Answer: The nail in the tube with sodium chloride rusts more than the nail in the tube with ordinary water.

Question: What are decomposers?

Answer: Decomposers are organisms that feed on dead organisms and organic waste products, converting complex organic compounds into simple compounds through decomposition.

Question: How does the high specific heat capacity of water influence its use in industrial cooling systems?

Answer: Water's high specific heat capacity allows it to absorb and store large amounts of heat, making it effective for regulating temperatures in industrial cooling systems.

Question: What is the total resistance of a circuit with resistors of 5  $\Omega$ , 10  $\Omega$ , and 15  $\Omega$  connected in parallel?

Answer: The total resistance is  $\frac{1}{R} = \frac{1}{5 \Omega} + \frac{1}{10 \Omega} + \frac{1}{15 \Omega}$ , so  $R \approx 2.73 \Omega$ .

Question: What causes diarrhea and how can it be managed?

Answer: Diarrhea is caused by infections from viruses, bacteria, or parasites, leading to liquid stools and dehydration. It can be managed by consuming more water and seeking medical treatment.

Question: How can the components of a mixture be identified?

Answer: Components of a mixture can be identified by their individual properties and can be separated by physical methods, as demonstrated by the separation of copper sulphate and naphthalene.

Question: What is the purpose of using a U-magnet in electromagnetic experiments?

Answer: A U-magnet provides a strong, uniform magnetic field, allowing for accurate observation and study of electromagnetic effects.

Question: Calculate the kinetic energy of a 4 kg object moving at 6 m/s.

Answer: The kinetic energy is 72 Joules (J).

Question: What is the momentum of a 10 kg object moving at 6 m/s?

Answer: The momentum is  $p = m \times v = 10 \times 6 = 60$  kg m/s.

Question: What is the force required to accelerate a 7 kg object at 3 m/s<sup>2</sup>?

Answer: The force required is  $F = ma = 7 \times 3 = 21$  N.

Question: How should an ammeter be connected in a circuit?

Answer: An ammeter should be connected in series with the conductor so that the entire current passes through the ammeter.

Question: Where is cardiac muscle tissue found?

Answer: Cardiac muscle tissue is exclusively found in the vertebrate heart.

Question: What does a straight line with a positive slope on a velocity-time graph represent?

Answer: It represents uniform acceleration.

Question: What is the role of genetic screening in public health?

Answer: Genetic screening in public health identifies individuals at risk for certain genetic disorders, enabling early intervention, prevention, and management of diseases, and informing public health strategies to reduce the prevalence of genetic conditions.

Question: What is the role of a diaphragm in the Downs cell?

Answer: The diaphragm prevents the reaction between sodium and chlorine, ensuring their separation during electrolysis.

Question: How is the chemical formula of methane written?

Answer: The chemical formula of methane is CH<sub>4</sub>, indicating one carbon atom and four hydrogen atoms.

Question: How do the flowers of monocots and dicots differ?

Answer: Monocot flowers are trimerous (parts in threes), while dicot flowers are tetra- or pentamerous (parts in fours or fives).

Question: How does an ultrasonic sensor measure distance?

Answer: An ultrasonic sensor emits high-frequency sound waves and measures the time it takes for the waves to reflect back from an object, determining the object's distance based on the time delay.

Question: What changes occur in the fetus during the eighth month of development?

Answer: During the eighth month, subcutaneous fat begins to deposit and the fetus weighs about 2 kg.

Question: How does the rate of change of the magnetic field affect the induced voltage?

Answer: A faster rate of change of the magnetic field induces a higher voltage, as the induced electromotive force is directly proportional to the rate of change.

Question: What is the latent heat of fusion?

Answer: The latent heat of fusion is the amount of heat required to convert a unit mass of a solid into a liquid at its melting point without changing its temperature.

Question: How do geneticists use probability to study inheritance patterns?

Answer: Geneticists use probability to study inheritance patterns by calculating the likelihood of certain traits appearing in offspring, based on the known genotypes of the parents and the rules of inheritance.

Question: How does the mass of an object affect its weight?

Answer: The mass of an object directly affects its weight. Weight is the product of mass and gravitational acceleration, so an increase in mass results in an increase in weight.

Question: What is the role of the diaphragm in the Downs cell?

Answer: The diaphragm in the Downs cell prevents the reaction between sodium and chlorine, ensuring the separation of sodium metal and chlorine gas.

Question: What is the potential energy of a 6 kg object at a height of 3 m?

Answer: The potential energy is 180 Joules (J).

Question: How does the specific heat capacity of a substance influence its thermal properties?

Answer: The specific heat capacity of a substance influences its thermal properties by determining how much heat it can absorb or release for a given temperature change, affecting its suitability for various applications.

Question: Explain the importance of cell division in tissue repair.

Answer: Cell division is crucial for tissue repair, as it replaces damaged or dead cells with new cells, maintaining tissue integrity and function.

Question: How does the speed of a rotating coil affect the generated voltage?

Answer: Faster rotation of the coil increases the rate of change of the magnetic field, generating higher voltage.

Question: How do lenses aid in the function of binoculars?

Answer: Lenses in binoculars magnify distant objects by converging light rays to create clear, enlarged images.

Question: What is the angle of emergence in light refraction?

Answer: The angle between the emergent ray and the normal to the surface at the point of emergence.

Question: What is Maxwell's corkscrew rule?



Answer: Maxwell's corkscrew rule states that when a corkscrew is rotated in the direction of current flow, the magnetic field lines produced are in the direction of rotation.

Question: What are the challenges of managing urban waste?

Answer: Challenges of managing urban waste include limited landfill space, high waste generation rates, inadequate recycling infrastructure, and environmental pollution.

Question: What is the relationship between molar mass and Avogadro's constant?

Answer: The molar mass of a substance in grams contains Avogadro's constant ( $6.022 \times 10^{23}$ ) of basic units (atoms, molecules, ions).

Question: What is the molar mass of calcium carbonate ( $\text{CaCO}_3$ )?

Answer: The molar mass of calcium carbonate is 100 grams per mole, calculated as 40 for calcium, 12 for carbon, and  $3 \times 16$  for oxygen.

Question: What is the formula for acceleration?

Answer: Acceleration = Change in Velocity / Time

Question: What is the effect of connecting resistors in parallel on the total resistance of the circuit?

Answer: Connecting resistors in parallel decreases the total resistance, as the reciprocal of the total resistance is the sum of the reciprocals of the individual resistances.

Question: What is the role of a cathode ray oscilloscope in studying sound waves?

Answer: A cathode ray oscilloscope displays the waveform of sound waves, allowing visualization of their frequency, amplitude, and shape.

Question: What are the features of vertebrates in the class Reptilia?

Answer: Vertebrates in the class Reptilia have dry skin with scales, pentadactyle limbs, a heart with two atria and an incompletely divided ventricle, lungs for respiration, and are cold-blooded with internal fertilization.

Question: Explain the decomposition reaction of hydrogen peroxide.

Answer: Hydrogen peroxide decomposes to form water and oxygen gas:  
 $2\text{H}_2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{O}_2$ .

Question: What is the role of genes in determining an organism's traits?

Answer: Genes are specific segments of DNA that code for particular traits, determining the physical and physiological characteristics of an organism.

Question: What is self-pollination?

Answer: Self-pollination occurs when pollen from a flower is deposited on the stigma of the same flower, resulting in fertilization within the same flower.

Question: What are light-dependent resistors (LDRs)?

Answer: Light-dependent resistors are resistors whose resistance varies with the intensity of light. In the dark, they have high resistance, and in the presence of light, their resistance decreases.

Question: What is the reaction between aluminum and copper sulfate solution?

Answer: Aluminum displaces copper from copper sulfate, forming aluminum sulfate and copper:  $2\text{Al} + 3\text{CuSO}_4 \rightarrow \text{Al}_2(\text{SO}_4)_3 + 3\text{Cu}$ .

Question: How is water balance regulated in the body?

Answer: Water balance is regulated by the hormone ADH from the pituitary gland, which increases water reabsorption in the kidneys when water levels are low.

Question: Why is it important to disconnect appliances during lightning strikes?

Answer: Disconnecting appliances during lightning strikes prevents potential damage from power surges and reduces the risk of electrical fires.

Question: How does reducing friction affect the distance traveled by a moving object on a smooth surface?

Answer: Reducing friction increases the distance traveled by a moving object on a smooth surface, as less resistive force opposes its motion, allowing it to move further before coming to rest.

Question: Calculate the number of molecules in 0.2 moles of carbon dioxide ( $\text{CO}_2$ ).

Answer: The number of molecules in 0.2 moles of carbon dioxide is  $1.204 \times 10^{23}$ , calculated as  $0.2 \times 6.022 \times 10^{23}$ .

Question: What is the significance of the area under an acceleration-time graph?

Answer: The area under an acceleration-time graph represents the change in velocity.

Question: What is the relationship between the potential difference and current in a nichrome wire coil?

Answer: The potential difference and current in a nichrome wire coil are directly proportional, as described by Ohm's Law, provided the temperature remains constant.

Question: What is the purpose of the axle in an alternating current dynamo?

Answer: The axle rotates the coil within the magnetic field, enabling continuous induction of electromotive force and generation of alternating current.

Question: How are scalars and vectors different?

Answer: Scalars have only magnitude, while vectors have both magnitude and direction.

Question: What happens to the induced current when the coil in a dynamo moves parallel to the magnetic field?

Answer: When the coil moves parallel to the magnetic field, the induced current becomes zero as there is no intersection of field lines.

Question: What is the kinetic energy of a 2 kg object moving at 3 m/s?

Answer: The kinetic energy is 9 Joules (J).

Question: Why is the evolution of gas bubbles faster in higher concentrations of hydrochloric acid?

Answer: Higher concentrations provide more reactant particles, increasing the frequency of collisions and the rate of reaction.

Question: How do dominant and recessive alleles affect the inheritance of traits?

Answer: Dominant alleles determine the trait expressed when present, while recessive alleles are expressed only when both alleles are recessive.

Question: What is the autonomic nervous system, and what are its components?

Answer: The autonomic nervous system controls involuntary body functions. It has two parts: the sympathetic nervous system and the parasympathetic nervous system.

Question: What is the role of solubility in the design of chemical sensors?

Answer: Solubility is important in the design of chemical sensors for ensuring the selective and sensitive detection of target analytes in various environments.

Question: What is the composition of gastric juice, and what are its functions?

Answer: Gastric juice contains hydrochloric acid (HCl) and the enzyme pepsin, which together help digest proteins and activate digestive enzymes.

Question: How many energy levels are in a magnesium atom?

Answer: There are three energy levels in a magnesium atom.

Question: What conditions must be met for an object to be in equilibrium under two forces?

Answer: For an object to be in equilibrium under two forces, the forces must have equal magnitudes, act in opposite directions, and lie along the same line of action.

Question: How is the mass fraction of a solute expressed in a solution containing 5g of solute in 100g of solution?

Answer: The mass fraction of the solute is 0.05 or 5%.

Question: How does concentration affect the number of collisions in a reaction?

Answer: Higher concentration increases the number of reactant particles in a given volume, leading to more collisions and a faster reaction rate.

Question: What are the features of vertebrates in the class Pisces?

Answer: Vertebrates in the class Pisces have a bony or cartilaginous endoskeleton, streamlined bodies, scales, fins for swimming, a lateral line system for detecting vibrations, a two-chambered heart, gills for respiration, and are cold-blooded.

Question: What happens to the solvent in paper chromatography as it moves up the paper strip?

Answer: The solvent carries the dissolved components of the mixture, separating them based on their different rates of movement.

Question: What are collinear forces?

Answer: Collinear forces are forces that have the same line of action.

Question: How do mutations in DNA contribute to evolution?

Answer: Variations that occur in DNA due to mutations are important in evolution.

Question: What are the effects of using lead in electronic waste?

Answer: The effects of using lead in electronic waste include contamination of soil and water, posing health risks to humans and wildlife.

Question: What is the difference between genotype and phenotype?

Answer: Genotype is the genetic makeup of an organism, while phenotype is the observable expression of traits determined by the genotype.

Question: What are the advantages of using plug circuits for high-power appliances?

Answer: Plug circuits are designed to handle higher currents, providing a safe and reliable power supply for high-power appliances like ovens and heaters.

Question: How does increasing the mass of an object affect its momentum for a constant velocity?

Answer: Increasing the mass of an object increases its momentum for a constant velocity because momentum is the product of mass and velocity.

Question: How does surface roughness affect the limiting frictional force?

Answer: The limiting frictional force increases with the roughness of the surfaces in contact.

Question: What factors should be considered when preparing a solution of specific concentration?

Answer: Consider cleanliness, accurate weighing, proper mixing, and preventing contamination.

Question: What is the charge of an electron?

Answer: An electron has a negative charge.

Question: How do geneticists use symbols to represent alleles?

Answer: Geneticists use capital letters for dominant alleles and lowercase letters for recessive alleles, simplifying the notation of genotypes and inheritance patterns.

Question: How does the mass of an object affect its kinetic energy?

Answer: The mass of an object affects its kinetic energy directly; increasing the mass increases the kinetic energy proportionally.

Question: Experimental determination of the heat change of the reaction between sodium hydroxide (NaOH) and hydrochloric acid (HCl) Materials required : - 50 cm<sup>3</sup> of 2 mol dm<sup>-3</sup> sodium hydroxide solution, 50 cm<sup>3</sup> of 2 mol dm<sup>-3</sup> hydrochloric acid solution, two 100 cm<sup>3</sup> beakers, a thermometer of range 0-100 °C, a polystyrene cup, a glass rod Method : - To two beakers, measure 50 cm<sup>3</sup> of the sodium hydroxide solution and 50 cm<sup>3</sup> of the hydrochloric acid solution separately using the measuring cylinder. With the thermometer, measure the initial temperatures of the two solutions. (After measuring the temperature of the solution of the base, wash the thermometer before measuring the temperature of the acid solution . Mix these two solutions in a polystyrene cup, stir with the glass rod and record the maximum temperature. What is the specific heat capacity of water used in the calculation in the Activity?

Answer: 4200 J kg<sup>-1</sup>°C<sup>-1</sup>.

Question: What is the significance of veins in plant leaves?

Answer: Veins in plant leaves distribute water throughout the leaf, ensuring that all cells receive the necessary water for photosynthesis.

Question: What are the effects of increased radiation levels?

Answer: The effects of increased radiation levels include increased cancer risk, genetic mutations, and damage to living tissues.

Question: What are the deficiency symptoms of iron in plants?

Answer: Deficiency symptoms of iron in plants include chlorosis in tender leaves.

Question: How do microtubules facilitate chromosome movement during cell division?

Answer: Microtubules form the mitotic spindle, which attaches to chromosomes and moves them to opposite poles of the cell, ensuring accurate segregation during division.

Question: How does the cytoskeleton facilitate intracellular transport?

Answer: The cytoskeleton provides tracks for motor proteins to transport vesicles, organelles, and other cargo within the cell, ensuring proper distribution and functioning.

Question: What is the function of chloroplasts in photosynthesis?

Answer: Chloroplasts capture light energy with chlorophyll, converting carbon dioxide and water into glucose and oxygen, providing energy for the plant through photosynthesis.

Question: What is the valency of hydrogen?

Answer: The valency of hydrogen is 1.

Question: Why is it important to understand the factors influencing reaction rates?

Answer: Understanding these factors helps optimize chemical reactions for industrial, laboratory, and everyday applications.

Question: What is the function of a deadweight tester in pressure calibration?

Answer: A deadweight tester calibrates pressure measuring instruments by applying a known weight to a piston, generating a precise pressure for comparison.

Question: How is the total displacement traveled by an object during complete motion calculated using the velocity-time graph?

Answer: Total displacement is calculated as the area of the trapezoid under the velocity-time graph.

Question: What are the main components of the immune system?

Answer: The main components include white blood cells, lymph nodes, spleen, thymus, bone marrow, and antibodies.

Question: How is the chemical formula of aluminium oxide written?

Answer: The chemical formula of aluminium oxide is  $\text{Al}_2\text{O}_3$ , indicating two aluminium ions and three oxide ions.

Question: What is the Lewis structure?

Answer: The Lewis structure represents bonding electron pairs by short lines (-) and non-bonding lone pairs by dots.

Question: How is the chemical formula of magnesium hydroxide written?

Answer: The chemical formula of magnesium hydroxide is  $\text{Mg}(\text{OH})_2$ , indicating one magnesium ion and two hydroxide ions.

Question: Explain the significance of the 3:1 ratio observed by Mendel.

Answer: The 3:1 ratio in the F<sub>2</sub> generation showed that three-quarters of the offspring exhibited the dominant trait, while one-quarter exhibited the recessive trait.

Question: What is displacement?

Answer: Displacement is the straight-line distance between the starting and ending points in a specific direction.

Question: Why is it important to weigh the solute accurately when preparing a solution?

Answer: Accurate weighing ensures the correct concentration and effectiveness of the solution.

Question: Why is it important to consider the physical state of substances in heat change reactions?

Answer: Different physical states can significantly affect the heat change and overall energy dynamics of the reaction.

Question: What is the balanced chemical equation for the reaction between sodium and chlorine?

Answer: The balanced chemical equation for sodium reacting with chlorine is:  $2\text{Na} + \text{Cl}_2 \rightarrow 2\text{NaCl}$ .

Question: How does the electrolysis of brine produce chlorine and sodium hydroxide?

Answer: The electrolysis of brine (aqueous sodium chloride) produces chlorine gas at the anode and hydrogen gas at the cathode. The remaining solution contains sodium hydroxide.

Question: What is the role of a fractionating column in fractional distillation?

Answer: To separate components with close boiling points by providing multiple condensation and vaporization stages.

Question: How do geneticists use bioinformatics in genetic research?

Answer: Bioinformatics combines biology, computer science, and statistics to analyze and interpret large-scale genetic data, helping to identify genes associated with diseases, understand genetic variation, and predict the effects of genetic mutations.

Question: How is oxygen gas prepared by heating potassium nitrate?

Answer: Heating potassium nitrate decomposes it into potassium nitrite and oxygen gas:  $2\text{KNO}_3 \rightarrow 2\text{KNO}_2 + \text{O}_2$ .

Question: What is the role of fruits and seeds in plant reproduction?

Answer: Fruits and seeds play a crucial role in plant reproduction by facilitating the dispersal and germination of new plants.

Question: Experimental determination of the heat change of the reaction between sodium hydroxide (NaOH) and hydrochloric acid (HCl) Materials required : - 50 cm<sup>3</sup> of 2 mol dm<sup>-3</sup> sodium hydroxide solution, 50 cm<sup>3</sup> of 2 mol dm<sup>-3</sup> hydrochloric acid solution, two 100 cm<sup>3</sup> beakers, a thermometer of range 0-100 °C, a polystyrene cup, a glass rod Method : - To two beakers, measure 50 cm<sup>3</sup> of the sodium hydroxide solution and 50 cm<sup>3</sup> of the hydrochloric acid solution separately using the measuring cylinder. With the thermometer, measure the initial temperatures of the two solutions. (After measuring the temperature of the solution of the base, wash the thermometer before measuring the temperature of the acid solution . Mix these two solutions in a polystyrene cup, stir with the glass rod and record the maximum temperature. What assumptions are made in the Activity regarding the heat change calculation?

Answer: It is assumed that the entire quantity of heat of the reaction is used to raise the temperature of 100 cm<sup>3</sup> of the solution, the specific heat capacity of the solution is equal to that of water, and the density of the solution is equal to that of water.

Question: How does urbanization affect the environment?

Answer: Urbanization affects the environment by increasing pollution, reducing green spaces, altering natural habitats, and contributing to climate change.

Question: How is average velocity different from instantaneous velocity?

Answer: Average velocity is the total displacement divided by the total time, while instantaneous velocity is the velocity of an object at a specific moment in time.

Question: What is the role of catalysts in biological systems?

Answer: Catalysts, often enzymes, accelerate biochemical reactions, ensuring efficient metabolic processes in living organisms.

Question: How do sound waves travel through liquids?

Answer: Sound waves travel through liquids by causing particles to vibrate and transfer energy through the medium.

Question: Why are small gaps left between railway tracks?

Answer: Small gaps are left between railway tracks to allow for thermal expansion when the temperature rises, preventing the tracks from deforming due to expansion.

Question: What is the distance if path P is used from A to B?

Answer: The distance is 320 m.

Question: How do electromagnetic waves carry information?

Answer: Electromagnetic waves carry information through variations in their amplitude, frequency, or phase, which can be decoded by receivers.

Question: How is the Fahrenheit scale defined?

Answer: The Fahrenheit scale is defined by taking the melting point of ice as 32°F and the boiling point of water as 212°F, with the range between the two points divided into 180 divisions.

Question: How do you calculate the current passing through a circuit with a 12  $\Omega$  resistor and a 6  $\Omega$  resistor connected in parallel to a 6 V power supply?

Answer: The total current is  $I = \frac{V}{R} = \frac{6 \text{ V}}{4 \Omega} = 1.5 \text{ A}$

Question: How do you determine the direction of the resultant force for two collinear forces acting in opposite directions?

Answer: The direction of the resultant force is in the direction of the larger force.

Question: What are the deficiency symptoms of vitamin C?

Answer: Deficiency symptoms of vitamin C include weakening of gums, internal bleeding, delayed recovery from diseases, and scurvy.

Question: How do you balance a uniform rod with different weights suspended at varying distances from the pivot?

Answer: Balance the rod by ensuring that the clockwise moments due to the weights on one side equal the anti-clockwise moments due to the weights on the other side, achieving equilibrium.

Question: What are the harmful effects of using artificial detergents?

Answer: The harmful effects of using artificial detergents include the formation of detergent swans on the surface of water systems, which are harmful to aquatic organisms and can destroy coral reefs.

Question: What are the ethical considerations of using CRISPR for gene editing?



Answer: Ethical considerations of using CRISPR for gene editing include the potential for unintended consequences, the impact on future generations, concerns about "designer babies," and the need for regulatory oversight and ethical guidelines.

Question: How do geneticists study the genetic basis of aging?

Answer: Geneticists study the genetic basis of aging by identifying genes associated with longevity and age-related diseases, investigating the molecular pathways involved in aging, and exploring the interactions between genetics and environmental factors that influence aging.

Question: How does an ion-selective electrode work?

Answer: An ion-selective electrode measures the concentration of specific ions in a solution by generating a potential difference that is proportional to the ion concentration, providing selective and sensitive detection.

Question: Describe the process of electrochemical water splitting and its significance.

Answer: Electrochemical water splitting involves the use of electricity to split water into hydrogen and oxygen gases. It is significant for producing clean hydrogen fuel and oxygen, providing a sustainable energy solution and reducing dependence on fossil fuels.

Question: What are the functions of lysosomes in a cell?

Answer: Lysosomes digest cellular waste, debris, and foreign invaders using hydrolytic enzymes, playing a key role in cellular cleanup and recycling.

Question: How is the electronic configuration of nitrogen related to the formation of an ammonia molecule?

Answer: The electronic configuration of nitrogen (2, 5) allows it to share three pairs of electrons with three hydrogen atoms, forming an ammonia molecule (NH<sub>3</sub>) with a stable configuration.

Question: How do electromagnetic waves interact with different materials?

Answer: Electromagnetic waves can be absorbed, reflected, transmitted, or refracted depending on the material and the wave's frequency.

Question: How is the chemical formula of methane written?

Answer: The chemical formula of methane is CH<sub>4</sub>, indicating one carbon atom and four hydrogen atoms.

Question: How do terrestrial plants obtain water for photosynthesis?

Answer: Terrestrial plants absorb water from the soil through root hairs by osmosis, which is then transported to the leaves via the xylem.

Question: How does the specific heat capacity of a substance determine its use in thermal storage systems?

Answer: Substances with high specific heat capacities are used in thermal storage systems because they can absorb and store large amounts of heat, making them effective for maintaining stable temperatures.

Question: Explain the decomposition reaction of hydrogen peroxide.

Answer: Hydrogen peroxide decomposes to form water and oxygen gas:  
 $2\text{H}_2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{O}_2$ .

Question: What is the role of solubility in the design of chemical processes?

Answer: Solubility is crucial in designing chemical processes for optimizing reaction conditions, selecting solvents, and ensuring efficient separation and purification of products.

Question: What is the role of the electrolyte in an electroplating setup?

Answer: The electrolyte provides a source of metal ions for the plating process, facilitating the transfer of ions between the anode and cathode and ensuring a consistent and even deposition.

Question: Describe the working principle of an ultrasonic sensor.

Answer: An ultrasonic sensor emits high-frequency sound waves and measures the time it takes for the waves to reflect back from an object, determining the object's distance.

Question: What is the significance of the standard atmospheric pressure at sea level?

Answer: The standard atmospheric pressure at sea level (101,325 Pa) serves as a reference point for measuring and comparing pressures in different locations and conditions.

Question: What is the significance of using proper grounding in electric circuits?

Answer: Proper grounding provides a safe path for electric current to flow to the earth in case of a fault, preventing electric shocks and protecting appliances from damage.

Question: What is the role of steam in steam distillation?

Answer: Steam supplies heat to the mixture, causing volatile compounds to vaporize at temperatures below their boiling points, preventing decomposition.

Question: What changes occur in the female reproductive system during puberty?

Answer: Changes in the female reproductive system during puberty include the growth of pubertal hair, widened pubic region, growth of mammary glands, increased body fat, and the start of the menstrual cycle.

Question: How do sodium and chlorine atoms achieve a stable electronic configuration in sodium chloride?

Answer: Sodium atoms lose electrons to form  $\text{Na}^+$  ions, and chlorine atoms gain electrons to form  $\text{Cl}^-$  ions. The electrostatic attraction between these ions forms sodium chloride ( $\text{NaCl}$ ).

Question: What are non-metals?

Answer: Non-metals are elements that lack metallic properties and are poor conductors of heat and electricity.

Question: What is self-pollination?

Answer: Self-pollination occurs when pollen from a flower is deposited on the stigma of the same flower.

Question: What is the significance of the mass per unit length of a string in determining the sound it produces?

Answer: A string with a lower mass per unit length will vibrate faster, producing higher frequency sounds, while a heavier string will produce lower frequency sounds.

Question: What is the role of slag in the blast furnace?

Answer: Slag, formed from impurities reacting with calcium oxide, floats on molten iron, allowing it to be removed separately, and protects the iron from re-oxidation.

Question: What is the equivalent resistance of a parallel circuit with three resistors having values  $10\ \Omega$ ,  $20\ \Omega$ , and  $30\ \Omega$ ?

Answer: The equivalent resistance is  $1/R = 1/10\ \Omega + 1/20\ \Omega + 1/30\ \Omega$ , so  $R \approx 5.45\ \Omega$ .

Question: What is the role of intermolecular forces in solubility?

Answer: Intermolecular forces, such as hydrogen bonding and van der Waals forces, influence the solubility of solutes in solvents by affecting their interactions.

Question: What is the significance of the resultant force in practical applications?

Answer: The resultant force allows the effective use of multiple small forces to achieve the effect of a single large force.

Question: Explain the relationship between velocity and displacement.

Answer: Velocity is the rate of change of displacement, calculated as Displacement / Time.

Question: How is the Fahrenheit scale defined?

Answer: The Fahrenheit scale is defined by taking the melting point of ice as  $32^\circ\text{F}$  and the boiling point of water as  $212^\circ\text{F}$ , with the range between the two points divided into 180 divisions.

Question: What is the role of a power amplifier in audio systems?

Answer: A power amplifier increases the power of audio signals, driving speakers to produce sound at higher volumes and with better clarity.

Question: What is the molecular formula and structure of propane?

Answer: The molecular formula of propane is  $\text{C}_3\text{H}_8$ , and its structure consists of three carbon atoms bonded in a chain, with each carbon atom bonded to hydrogen atoms.

Question: How does blood tissue transport materials in the body?

Answer: Blood tissue transports respiratory gases, nutrients, waste products, and hormones to and from various organs and tissues.

Question: How does the specific heat capacity of zinc affect its use in industrial applications?

Answer: The specific heat capacity of zinc allows it to absorb and dissipate heat effectively, making it useful in industrial applications where temperature regulation is important.

Question: What is the resultant force when two forces of 8 N and 16 N act on a trolley?

Answer: The resultant force is 24 N.

Question: What are some examples of everyday substances that are acids?

Answer: Lime juice, vinegar, and vitamin C tablets are examples of everyday acids.

Question: What is the effect of pressure on the solubility of gases in liquids?

Answer: Increasing pressure increases the solubility of gases in liquids.

Question: What are some applications of optical fibers?

Answer: Optical fibers are used in medical instruments like endoscopes, telecommunications, internet connections, and decorative lighting.

Question: What is a primary consumer?

Answer: A primary consumer is an herbivore that feeds on producers.

Question: What is the importance of electrolytic cells in industrial applications?

Answer: Electrolytic cells are crucial in industrial applications for processes such as electroplating, extraction of metals, electrorefining, and production of chemicals like chlorine and sodium hydroxide.

Question: How do ionic and covalent bonds differ in terms of their formation?

Answer: Ionic bonds form through the transfer of electrons from one atom to another, resulting in oppositely charged ions, while covalent bonds form through the sharing of electrons between atoms.

Question: How does sodium react with oxygen?

Answer: Sodium shows high reactivity towards oxygen and reacts rapidly with oxygen in air to form sodium oxide.

Question: What is the chemical formula for calcium chloride?

Answer: The chemical formula for calcium chloride is  $\text{CaCl}_2$ .

Question: What are the potential health risks of untreated hypertension for kidney health?

Answer: Untreated hypertension can damage blood vessels in the kidneys, leading to reduced filtration ability, kidney disease, and potential kidney failure.

Question: How do you calculate the total current passing through a parallel circuit with three resistors and a known total voltage?

Answer: Calculate the current through each resistor using  $I_i = \frac{V}{R_i}$ , where  $V$  is the total voltage and  $R_i$  is the resistance of each resistor. Sum the individual currents to find the total current.

Question: What happens when the forces acting on an object are not coplanar?

Answer: When the forces acting on an object are not coplanar, the object will not be in equilibrium and will move or rotate due to the unbalanced forces and moments.

Question: What is the role of the cardboard cone in a loudspeaker?

Answer: The cardboard cone vibrates in response to the coil's movement, amplifying the sound waves generated by the varying electric current.

Question: What is the valency of magnesium?

Answer: The valency of magnesium is 2.

Question: What is total internal reflection?

Answer: Total internal reflection occurs when a light ray traveling from a denser to a rarer medium is entirely reflected back into the denser medium if the angle of incidence exceeds the critical angle.

Question: How are salts formed from acids and bases?

Answer: Salts are formed by the reaction of an acid with a base, resulting in a compound composed of positive and negative ions.

Question: What is the significance of the principal axis in lenses?

Answer: The principal axis is the reference line for measuring angles and distances in ray diagrams, crucial for analyzing lens behavior.

Question: How do plants adapt to different light conditions?

Answer: Plants adapt to different light conditions by adjusting the size and orientation of their leaves, altering chlorophyll content, and changing growth patterns to optimize light capture.

Question: What are the functions of the skeletal system?

Answer: The skeletal system provides support, protection, movement, blood cell production, and mineral storage.

Question: What is the resistance of a bulb connected to a 9 V power supply with a current of 1.5 A?

Answer: Using Ohm's Law,  $R = V/I$ , the resistance is  $R = 9 \text{ V} / 1.5 \text{ A} = 6 \Omega$ .

Question: How is the octet expanded in the phosphorus pentachloride ( $\text{PCl}_5$ ) molecule?

Answer: In phosphorus pentachloride ( $\text{PCl}_5$ ), the phosphorus atom shares five pairs of electrons with five chlorine atoms, resulting in 10 electrons around the central phosphorus atom.

Question: How does the strength of the magnetic field affect the performance of a dynamo?

Answer: A stronger magnetic field increases the induced electromotive force, improving the dynamo's performance and electricity generation.

Question: What is the role of villi in the small intestine?

Answer: Villi increase the surface area for nutrient absorption, with each villus containing blood capillaries and lacteals to transport absorbed

nutrients.

Question: What is the significance of clean energy for sustainable development?

Answer: Clean energy is significant for sustainable development because it reduces greenhouse gas emissions, improves air quality, and provides reliable and affordable energy.

Question: How do you prepare a  $1 \text{ mol/dm}^3$  solution of sodium sulfate?

Answer: Weigh the required mass of  $\text{Na}_2\text{SO}_4$ , dissolve it in water, and adjust the final volume in a volumetric flask.

Question: How do convex mirrors affect the path of light rays incident at an angle?

Answer: Convex mirrors cause incident rays to diverge, making them appear to originate from the focal point behind the mirror.

Question: What are some methods to remove seed dormancy?

Answer: Methods to remove seed dormancy include storing seeds for some period, burning the villi on the seed coat, removing the seed coat, keeping the seeds in hot water, and gently cracking the seed coat.

Question: How does the strength of attraction to the stationary phase affect component movement in chromatography?

Answer: Components with stronger attraction to the stationary phase move slower, while those with weaker attraction move faster, leading to separation.

Question: How does the force on a conductor in a magnetic field relate to the current?

Answer: The force is directly proportional to the current flowing through the conductor, increasing with higher current levels.

Question: What is the relationship between liquid pressure and the depth of the liquid?

Answer: The pressure exerted by a liquid increases with the depth of the liquid because the weight of the liquid above that point increases.

Question: How does the specific heat capacity of mercury make it suitable for use in thermometers?

Answer: Mercury's specific heat capacity allows it to respond quickly to temperature changes, making it suitable for accurate and rapid temperature measurements in thermometers.

Question: What is the role of the large intestine in water absorption?

Answer: The large intestine absorbs water from the remaining indigestible food matter, forming semi-solid fecal matter for excretion.

Question: What is the significance of the root cap in plant roots?

Answer: The root cap protects the growing tip of the root and facilitates its movement through the soil.

Question: What is recrystallization used for?

Answer: Recrystallization is used to purify solid, crystalline substances by dissolving them in a hot solvent and then cooling to form pure crystals.

Question: How do ionic and covalent bonds differ in terms of electron distribution?

Answer: Ionic bonds involve the transfer of electrons from one atom to another, resulting in oppositely charged ions, while covalent bonds involve the sharing of electrons between atoms.

Question: How does the weight of an object in water compare to its weight in air?

Answer: The weight of an object in water is less than its weight in air because the upthrust exerted by the water reduces the apparent weight of the object.

Question: What are the potential health risks associated with exposure to nuclear waste?

Answer: Potential health risks associated with exposure to nuclear waste include cancer, genetic mutations, and damage to tissues and organs due to radiation exposure.

Question: Items required: a nichrome wire coil, a voltmeter, an ammeter, a rheostat, two dry cells, connecting wires, a switch 1. The voltmeter is used to measure the voltage affecting the conductor (nichrome coil). 2. The ammeter is used to measure the current passing through the conductor (nichrome coil). Figure 19.15 - Rheostat 3. The rheostat (Figure 19.15) is used to vary the current and the potential difference across the nichrome coil. The circuit symbol used for the rheostat is 4. Connect the circuit using the items above. 5. Close the switch (s) and quickly obtain the readings of the voltmeter and the ammeter and turn off the switch. The reason for quickly turning off the switch is to prevent the temperature of the nichrome coil from rising. It is essential to maintain a constant temperature throughout the activity. 6. After sometime adjust the rheostat, close the switch and take another set of readings. 7. Repeat the above steps to take at least five sets of readings. What is the purpose of a rheostat in Activity 19.3?

Answer: A rheostat is used to vary the current and potential difference across the nichrome wire coil, allowing multiple measurements to be taken.

Question: What is the role of the hypothalamus in homeostasis?

Answer: The hypothalamus acts as the control center for regulating body temperature and water balance.

Question: How are exothermic and endothermic reactions different in terms of energy content?

Answer: Exothermic reactions have products with lower energy than reactants, while endothermic reactions have products with higher energy than reactants.

Question: What is the molar mass of calcium carbonate ( $\text{CaCO}_3$ )?

Answer: The molar mass of calcium carbonate is 100 grams per mole, calculated as 40 for calcium, 12 for carbon, and  $3 \times 16$  for oxygen.

Question: How does high sodium intake affect kidney function and blood pressure?

Answer: High sodium intake can lead to increased blood pressure, fluid retention, and increased workload on the kidneys, potentially causing damage.

Question: How is the mass number represented?

Answer: The mass number is symbolized by 'A'.

Question: What is the pressure exerted at a depth of 2 meters in a tank with water density of  $1000 \text{ kg/m}^3$  and  $g = 10 \text{ m/s}^2$ ?

Answer: The pressure is 20,000 Pa, calculated as  $2 \text{ m} * 1000 \text{ kg/m}^3 * 10 \text{ m/s}^2$ .

Question: Describe the two types of cell division.

Answer: The two types of cell division are mitosis, which maintains the chromosome number and produces identical daughter cells, and meiosis, which halves the chromosome number to form gametes, ensuring genetic variation.

Question: What is the reaction between zinc and sulfuric acid?

Answer: Zinc reacts with sulfuric acid to form zinc sulfate and hydrogen gas:  $\text{Zn} + \text{H}_2\text{SO}_4 \rightarrow \text{ZnSO}_4 + \text{H}_2$ .

Question: Items required: a nichrome wire coil, a voltmeter, an ammeter, a rheostat, two dry cells, connecting wires, a switch 1. The voltmeter is used to measure the voltage affecting the conductor (nichrome coil). 2. The ammeter is used to measure the current passing through the conductor (nichrome coil). Figure 19.15 - Rheostat 3. The rheostat (Figure 19.15) is used to vary the current and the potential difference across the nichrome coil. The circuit symbol used for the rheostat is 4. Connect the circuit using the items above. 5. Close the switch (s) and quickly obtain the readings of the voltmeter and the ammeter and turn off the switch. The reason for quickly turning off the switch is to prevent the temperature of the nichrome coil from rising. It is essential to maintain a constant temperature throughout the activity. 6. After sometime adjust the rheostat, close the switch and take another set of readings. 7. Repeat the above steps to take at least five sets of readings. What is the significance of maintaining a constant temperature in the Activity ?

Answer: Maintaining a constant temperature ensures accurate measurements of resistance, as resistance varies with temperature.

Question: What is the result of connecting the negative terminals of two dry cells to a bulb?

Answer: Connecting the negative terminals of two dry cells to a bulb results in no potential difference across the bulb, and therefore, no current flow.

Question: What is the role of ATP in cellular respiration?

Answer: ATP stores and releases energy needed for various biological processes, including muscle contraction, active transport, and synthesis of complex molecules.

Question: What happens to light rays as they travel from water to air?



Answer: The light rays bend away from the normal to the surface when entering air from water.

Question: What are the main points of the cell theory?

Answer: The main points of the cell theory are: the cell is the structural and functional unit of life, all organisms are made up of one or more cells, and new cells are formed from pre-existing cells.

Question: What are some common inherited traits observed in plants?

Answer: Common inherited traits in plants include flower color, seed shape, pod shape, and plant height, which can vary among different varieties of the same species.

Question: How does Newton's second law apply to pushing a car?

Answer: When pushing a car, the force applied by the person determines the car's acceleration. The mass of the car and the applied force determine the car's motion according to Newton's second law.

Question: What are the benefits of reforestation for environmental balance?

Answer: Reforestation restores natural habitats, enhances biodiversity, improves air and water quality, sequesters carbon dioxide, and mitigates climate change. It helps maintain ecological balance and supports sustainable development.

Question: How do you calculate the total current passing through a parallel circuit with resistors of 5  $\Omega$ , 10  $\Omega$ , and 20  $\Omega$  connected to a 10 V power supply?

Answer: Calculate the current through each resistor using  $I = V/R$ , then sum the currents to find the total current.

Question: How does increasing the surface area of a reactant affect its reaction with a liquid or gas?

Answer: Increasing the surface area enhances the number of collision sites, thereby increasing the rate of reaction.

Question: How does the accumulation of electronic waste impact the environment?

Answer: The accumulation of electronic waste impacts the environment by releasing harmful substances such as lead, mercury, and cadmium, which can contaminate soil and water and pose health risks to humans and wildlife.

Question: What is Avogadro's constant?

Answer: Avogadro's constant is the number of atoms, molecules, or ions in one mole of a substance, which is  $6.022 \times 10^{23}$ .

Question: How do copper and sulfate ions combine to form copper sulfate?

Answer: Copper ions ( $\text{Cu}^{2+}$ ) and sulfate ions ( $\text{SO}_4^{2-}$ ) combine through electrostatic attraction to form copper sulfate ( $\text{CuSO}_4$ ) with ionic bonds.

Question: How can the heat change in the reaction of vinegar and lime water be calculated?

Answer: Using the formula  $Q = mc\theta$  with the given temperature change, density of water, and specific heat capacity of water.

Question: What is the significance of a double bond in covalent compounds?

Answer: A double bond involves the sharing of two pairs of electrons between atoms, resulting in a stronger and shorter bond compared to a single bond.

Question: What is the role of carbon brushes in an alternating current dynamo?

Answer: Carbon brushes maintain contact with the rotating brushing rings, allowing current to flow to the external circuit without wearing out quickly.

Question: What is the function of a pressure gauge in industrial applications?

Answer: A pressure gauge is used in industrial applications to monitor the pressure of gases and liquids, ensuring they remain within safe and operational limits to prevent accidents and ensure efficiency.

Question: What is environmental pollution?

Answer: Environmental pollution is the discharge of pollutants that cause deleterious effects on the natural environment.

Question: What happens when two forces of equal magnitude act on an object in opposite directions?

Answer: The object remains in equilibrium and does not move.

Question: How does gravitational acceleration affect a body moving vertically upwards?

Answer: When a body moves vertically upwards, its velocity decreases by 9.8 m/s every second due to gravitational acceleration.

Question: What is the force required to accelerate a 3 kg mass at 4 m/s<sup>2</sup>?

Answer: The force required is  $F=ma=3\times 4=12$  N.

Question: What is the role of lone pairs in determining the shape of a molecule?

Answer: Lone pairs influence the shape of a molecule by repelling bonding pairs of electrons, causing the molecule to adopt a geometry that minimizes electron pair repulsion, such as the bent shape of a water molecule.

Question: How does a fluorescent lamp produce light?

Answer: A fluorescent lamp produces light by exciting mercury vapor inside the tube, which emits ultraviolet radiation that excites the phosphor coating, producing visible light.

Question: Why is it important to use appropriate fuses in domestic circuits?

Answer: Appropriate fuses protect domestic circuits from overcurrent, preventing potential damage to appliances and reducing the risk of electrical fires.

Question: What are chloroplasts, and what is their function in plant cells?

Answer: Chloroplasts are organelles found in plant cells that contain chlorophyll, enabling photosynthesis to convert light energy into chemical energy stored in glucose.

Question: How do you balance a uniform rod with different weights suspended at varying distances from the pivot?

Answer: Balance the rod by ensuring that the clockwise moments due to the weights on one side equal the anti-clockwise moments due to the weights on the other side, achieving equilibrium.

Question: How is the value of a resistor indicated using color bands?

Answer: The value of a resistor is indicated using a color code method, where color bands on the resistor represent numerical values and multipliers. The first two bands represent the significant digits, the third band represents the multiplier, and the fourth band represents the tolerance.

Question: What is the impact of greenhouse gas emissions on global warming?

Answer: The impact of greenhouse gas emissions on global warming includes an increase in Earth's average temperature, melting of polar glaciers, rising sea levels, and changes in global climatic patterns.

Question: How do cells maintain their shape and structure?

Answer: Cells maintain their shape and structure through the cytoskeleton, which consists of microtubules, intermediate filaments, and microfilaments, providing mechanical support and stability.

Question: What is the role of the secondary coil in a transformer?

Answer: The secondary coil is linked to the load and receives the induced alternating voltage.

Question: What are the key features of Molluscs?

Answer: Molluscs are triploblastic, soft-bodied animals that live in terrestrial, freshwater, and marine habitats. They have a body divided into head, visceral mass, and muscular foot, and some have internal and external shells made of  $\text{CaCO}_3$ .

Question: What is the formula for calculating displacement using velocity and time?

Answer:  $\text{Displacement} = \text{Velocity} \times \text{Time}$ .

Question: How do dolphins use ultrasound waves?

Answer: Dolphins use ultrasound waves to find prey, avoid predators, and communicate with each other.

Question: What is the role of filtration in water purification plants?

Answer: Filtration removes suspended particles from water, making it cleaner and safer for consumption.

Question: How do chloroplasts contribute to the carbon cycle?

Answer: Chloroplasts convert carbon dioxide into organic compounds through photosynthesis, contributing to the carbon cycle by producing oxygen and glucose.

Question: How do you apply a couple of forces to rotate a steering wheel?

Answer: Apply a couple of forces by using both hands to exert equal and opposite forces on opposite sides of the steering wheel, creating a moment that rotates the wheel.

Question: How does the use of efficient electric appliances impact electricity bills?

Answer: Using efficient electric appliances reduces electricity consumption, leading to lower utility bills and cost savings for households.

Question: Describe the function of a magnetic contactor in industrial control systems.

Answer: A magnetic contactor is an electrically operated switch that controls high-power circuits, providing reliable switching and protection for industrial control systems.

Question: What is the presence of secondary growth in monocots and dicots?

Answer: Monocots do not have secondary growth, while dicots undergo secondary growth.

Question: How does the diaphragm in a moving coil microphone respond to sound?

Answer: The diaphragm vibrates in response to sound waves, moving the attached coil within a magnetic field and generating an alternating current.

Question: What are the advantages of sexual reproduction in plants?

Answer: Sexual reproduction produces genetic variation, leading to offspring with mixed characteristics of both parents, and enables the evolution of new plant varieties.

Question: How do inherited characteristics affect human diversity?

Answer: Inherited characteristics lead to variations among individuals within the same species, such as differences in body features among humans.

Question: What is the role of agrochemicals in environmental pollution?

Answer: Agrochemicals contribute to environmental pollution by contaminating soil and water, harming non-target species, and causing health issues in humans and wildlife.

Question: What is the main source of energy for organisms?

Answer: Carbohydrates are the main source of energy for organisms.

Question: How does the magnetic effect of a current explain the deflection of a compass needle?

Answer: The magnetic effect creates a field around the conductor, influencing the compass needle and causing it to deflect in the field's direction.

Question: What items are required to demonstrate collinear forces?

Answer: The items required are a trolley, three Newton balances, two pulleys, and a ring.

Question: What is the structure of a typical bacterial cell?

Answer: A typical bacterial cell has an envelope, flagella, cell wall, pili, ribosome, cytoplasm, nucleic material (DNA), plasmid, and cell membrane.

Question: What is the potential energy of a 2 kg object at a height of 12 m?

Answer: The potential energy is 240 Joules (J).

Question: What is an oxide?

Answer: An oxide is a chemical compound formed by the combination of an element with oxygen.

Question: What are some practical applications of electromagnets?

Answer: Practical applications include electric motors, magnetic levitation systems, MRI machines, and lifting heavy metal objects.

Question: How does kidney function influence the body's hormonal balance?

Answer: The kidneys produce and regulate hormones like erythropoietin (EPO) and renin, affecting red blood cell production and blood pressure.

Question: What are electrolytes, and can you provide examples?

Answer: Electrolytes are liquids or solutions that conduct electricity. Examples include aqueous solutions of ionic compounds (e.g., sodium chloride, copper sulfate), molten ionic compounds (e.g., fused sodium chloride), and solutions of acids (e.g., hydrochloric acid, sulfuric acid).

Question: How do you measure the force required to initiate the turning effect using a Newton balance and a stick?

Answer: Measure the force by attaching the Newton balance to the stick, applying a perpendicular force, and recording the minimum force required to slightly move the stick.

Question: What is sound, and how is it produced?

Answer: Sound is acoustic energy that produces the sensation of hearing, generated by vibrating objects such as vocal cords, musical instruments, or speakers.

Question: Calculate the kinetic energy of a 1.5 kg object moving at 5 m/s.

Answer: The kinetic energy is 18.75 Joules (J).

Question: What is the purpose of using alternating current in transformers?

Answer: Alternating current allows for continuous variation in the magnetic field, necessary for inducing voltage in the secondary coil.

Question: What is the importance of using inert electrodes in electrolysis?

Answer: Inert electrodes, such as carbon or platinum, do not participate in the electrochemical reactions, ensuring that only the desired ions are involved in the electrolysis process and preventing contamination.

Question: How does the rate of change of the magnetic field affect the induced voltage?

Answer: A faster rate of change of the magnetic field induces a higher voltage, as the induced electromotive force is directly proportional to the rate of change.

Question: What is the significance of the lines of action of forces in maintaining equilibrium in a system of three parallel forces?

Answer: The lines of action of the three parallel forces must be aligned for equilibrium to be maintained. Forces that are not aligned will result in a net moment, causing the object to rotate or move.

Question: What is the force required to accelerate a 4 kg object at 5 m/s<sup>2</sup>?

Answer: The force required is  $F=ma=4\times5=20$  N.

Question: What factors influence the efficiency of electromagnetic induction?

Answer: Factors influencing efficiency include the number of coil turns, the strength of the magnetic field, and the speed of relative motion between the coil and magnet.

Question: What is the work done in lifting a 6 kg object to a height of 9 m?

Answer: The work done is 540 Joules (J).

Question: How does deforestation impact biodiversity?

Answer: Deforestation impacts biodiversity by destroying habitats, leading to the loss of species and genetic diversity.

Question: What is the role of mitochondria in energy production?

Answer: Mitochondria are the powerhouses of the cell, generating ATP through cellular respiration by breaking down glucose and other nutrients.

Question: What is the role of mixing in the preparation of standard solutions?

Answer: Proper mixing ensures that the solute is evenly distributed throughout the solvent, ensuring accurate concentration.

Question: What is the role of iodine in the human body?

Answer: Iodine is essential for the synthesis of thyroxine hormone, development of intelligence, and maintaining body height.

Question: How is the Fahrenheit scale defined?

Answer: The Fahrenheit scale is defined by taking the melting point of ice as 32°F and the boiling point of water as 212°F, with the range between the two points divided into 180 divisions.

Question: How does temperature affect the efficiency of an electrochemical cell?

Answer: Temperature affects the efficiency of an electrochemical cell by influencing reaction rates and ion mobility. Higher temperatures generally increase reaction rates but can also increase side reactions and decrease cell lifespan.

Question: How do vibrating objects generate sound waves?

Answer: Vibrating objects create alternating regions of compression and rarefaction in the surrounding medium, generating sound waves.

Question: What are the advantages of using electrochemical sensors for medical diagnostics?

Answer: Electrochemical sensors for medical diagnostics offer advantages like high sensitivity, rapid response, portability, and the ability to detect a wide range of biomolecules, enabling point-of-care testing and continuous monitoring of health conditions.

Question: Describe the decomposition reaction of calcium carbonate when heated.

Answer: When calcium carbonate is heated, it decomposes to form calcium oxide and carbon dioxide gas:  $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$ .

Question: What are the changes that occur in the male reproductive system during puberty?

Answer: Changes in the male reproductive system during puberty include the growth of pubertal hair, widened shoulders, deepened voice, accelerated growth of bones and muscles, production of sperms, and growth of genitals.

Question: What are the physical components of the environment?

Answer: The physical components of the environment include soil, water, and air.

Question: What is the function of the diaphragm in a moving coil microphone?

Answer: The diaphragm in a moving coil microphone vibrates in response to sound waves, moving the attached coil and inducing an electromotive force.

Question: What is the role of chloroplasts in plant cells?

Answer: Chloroplasts are responsible for photosynthesis, converting light energy into chemical energy stored in glucose, and producing oxygen as a byproduct.

Question: How do sound waves differ from light waves in terms of energy?

Answer: Sound waves carry less energy and travel slower than light waves, which can propagate through a vacuum and carry more energy.

Question: What is the significance of Avogadro's constant in determining the number of particles in a mole?

Answer: Avogadro's constant provides the exact number of particles (atoms, molecules, or ions) in one mole of a substance, which is  $6.022 \times 10^{23}$ , allowing for precise calculations in chemical reactions.

Question: What materials are attracted by magnets?

Answer: Materials made of magnetic substances such as iron, steel, and nickel are attracted by magnets.

Question: How does mass remain constant while weight changes?

Answer: Mass is the amount of matter in an object and remains constant regardless of location. Weight changes with gravitational acceleration, which varies with location.

Question: What is the role of a photocoupler (optocoupler) in electronic circuits?

Answer: A photocoupler (optocoupler) isolates different sections of a circuit by using light to transfer signals between an LED and a photodetector, providing electrical isolation and protection.

Question: What are the potential benefits of gene therapy?

Answer: Gene therapy has the potential to treat or cure genetic disorders by replacing faulty genes with healthy ones, correcting genetic defects at their source, and providing long-lasting or permanent therapeutic effects.

Question: How do non-flowering seedless plants differ from flowering plants?

Answer: Non-flowering seedless plants do not produce flowers or seeds, while flowering plants produce flowers and have seeds covered by a fruit.

Question: How do white blood cells (WBCs) protect the body from infections?

Answer: WBCs destroy infectious particles through phagocytosis and produce antibodies to fight off pathogens.

Question: How does ultrasound help in finding schools of fish and detecting capsized ships?

Answer: SONAR technology uses ultrasound waves to locate schools of fish and remnants of capsized ships by emitting pulses and analyzing the reflected waves.

Question: How does the sharing of electrons lead to the formation of a covalent bond in a hydrogen molecule?

Answer: The sharing of electrons between two hydrogen atoms allows each atom to achieve the stable configuration of helium, forming a covalent bond and resulting in a hydrogen molecule ( $H_2$ ).

Question: What is the speed of sound in air, water, and steel?

Answer: The speed of sound is about 330 m/s in air at  $0^\circ C$ , 1400 m/s in water, and 5000 m/s in steel.

Question: How does the depth of a liquid column affect the hydrostatic pressure it exerts?

Answer: Hydrostatic pressure increases with the depth of the liquid column, as it is directly proportional to the height of the liquid above the measurement point.

Question: Calculate the relative formula mass of calcium carbonate ( $CaCO_3$ ).

Answer: The relative formula mass of calcium carbonate is 100, calculated as 40 for calcium, 12 for carbon, and  $3 \times 16$  for oxygen.



Question: What is the role of thermal radiation in heat transfer from the sun?

Answer: Thermal radiation is the primary method of heat transfer from the sun, allowing heat to travel through the vacuum of space as electromagnetic waves and warm the earth's surface.

Question: What is the specific heat capacity of zinc?

Answer: The specific heat capacity of zinc is  $380 \text{ J kg}^{-1} \text{ K}^{-1}$ .

Question: How does applying paint, grease, or oil prevent rusting?

Answer: These coatings prevent iron from coming into contact with oxygen and water, essential factors for rusting.

Question: What is the molar mass of carbon dioxide ( $\text{CO}_2$ )?

Answer: The molar mass of carbon dioxide is 44 grams per mole, calculated as 12 for carbon plus  $2 \times 16$  for oxygen.

Question: How do you connect two dry cells to ensure a potential difference across a bulb?

Answer: Connect the positive terminal of one cell and the negative terminal of the other cell to the terminals of the bulb to create a potential difference and allow current to flow.

Question: How does a compressed gas exert pressure?

Answer: A compressed gas exerts pressure due to the force of the gas molecules colliding with the walls of the container. The more the gas is compressed, the higher the pressure.

Question: Explain the purpose of a voltage stabilizer in power supplies.

Answer: A voltage stabilizer maintains a constant output voltage despite fluctuations in the input voltage, protecting sensitive electronic devices from damage.

Question: How does the use of detergents affect aquatic ecosystems?

Answer: The use of detergents affects aquatic ecosystems by causing the formation of detergent swans on water surfaces, which can harm aquatic organisms and reduce biodiversity.

Question: How do you calculate the number of atoms in a given mass of an element?

Answer: The number of atoms in a given mass of an element is calculated by dividing the mass by the molar mass to find the number of moles, then multiplying by Avogadro's constant.

Question: How does smoking affect the respiratory system?

Answer: Smoking can cause lung cancer, bronchitis, and other respiratory diseases, potentially leading to severe health consequences or death.

Question: How do you maintain equilibrium in an object under the action of more than three forces?

Answer: Maintain equilibrium by applying the forces in such a way that their resultant is zero, meaning the sum of the forces and moments balance out, resulting in no net force or moment acting on the object.

Question: How does the electrolysis of fused sodium chloride produce sodium and chlorine?

Answer: In the electrolysis of fused sodium chloride, sodium ions ( $\text{Na}^+$ ) migrate to the cathode and gain electrons to form sodium metal, while chloride ions ( $\text{Cl}^-$ ) migrate to the anode and lose electrons to form chlorine gas.

Question: How does a nichrome wire coil behave when connected to a power supply?

Answer: A nichrome wire coil exhibits resistance and allows current to flow through it when connected to a power supply, producing heat.

Question: What is the significance of chlorophyll in plants?

Answer: Chlorophyll is significant because it captures light energy required for photosynthesis, enabling plants to produce glucose and oxygen from carbon dioxide and water.

Question: How do you achieve equilibrium in a rod with weights at different points using the principle of moments?

Answer: Achieve equilibrium by adjusting the positions and magnitudes of the weights such that the moments on either side of the pivot are equal, resulting in no net rotation.

Question: Why is the term "AMBULANCE" written in reverse on the front of ambulances?

Answer: It is written in reverse so that it appears correctly when viewed in the rearview mirrors of vehicles in front.

Question: Why is touching not a suitable method for measuring temperature?

Answer: Touching is not suitable for measuring temperature because it is not accurate, cannot be expressed as a numerical value, and provides only a rough estimate.

Question: What is the role of zinc in plants?

Answer: Zinc is important for the activity of most enzymes and the synthesis of chlorophyll.

Question: What is the importance of the xylem in water transport?

Answer: Xylem transports water and dissolved minerals from the roots to the leaves, providing the necessary water for photosynthesis.

Question: How does the combustion of fuels illustrate exothermic reactions?

Answer: The combustion process releases heat, providing energy for various activities like running vehicles and machinery.

Question: What is the pressure exerted at a depth of 2 meters in a tank with water density of  $1000 \text{ kg/m}^3$  and  $g = 10 \text{ m/s}^2$ ?

Answer: The pressure is  $20,000 \text{ Pa}$ , calculated as  $2 \text{ m} \times 1000 \text{ kg/m}^3 \times 10 \text{ m/s}^2$ .

Question: How does thermal expansion affect the design of metallic bottle lids?

Answer: Thermal expansion allows metallic bottle lids to expand when heated, making them easier to open, and contract when cooled, ensuring a secure fit.

Question: What are the effects of deforestation on biodiversity?

Answer: Deforestation affects biodiversity by destroying habitats, leading to the loss of species and genetic diversity.

Question: What happens during the electrolysis of water?

Answer: During the electrolysis of water, water molecules are split into hydrogen and oxygen gases. At the cathode, hydrogen ions ( $H^+$ ) are reduced to form hydrogen gas ( $H_2$ ), and at the anode, hydroxide ions ( $OH^-$ ) are oxidized to form oxygen gas ( $O_2$ ).

Question: How do fungi reproduce?

Answer: Fungi reproduce through both sexual and asexual methods, including spore formation, budding, and fragmentation, depending on the species and environmental conditions.

Question: How does urbanization affect the environment?

Answer: Urbanization affects the environment by increasing pollution, reducing green spaces, altering natural habitats, and contributing to climate change.

Question: What is the role of combustion of fuels in meeting energy requirements?

Answer: Combustion of fuels like coal, bio gas, and petrol releases energy used for running vehicles and machinery.

Question: How do snakes perceive sound?

Answer: Snakes perceive sound through vibrations in the ground, which are detected by their lower jaw bone and transmitted to their sensory system.

Question: How do chloroplasts convert light energy into chemical energy?

Answer: Chloroplasts use chlorophyll to capture light energy, which is then used to convert carbon dioxide and water into glucose and oxygen during photosynthesis.

Question: What is an exothermic reaction, and give an example from daily life?

Answer: An exothermic reaction releases heat to the surroundings. Examples include the combustion of fuels and cellular respiration.

Question: How does the reaction of zinc with hydrochloric acid demonstrate a single displacement reaction?

Answer: Zinc displaces hydrogen from hydrochloric acid, forming zinc chloride and hydrogen gas:  $Zn + 2HCl \rightarrow ZnCl_2 + H_2$ .

Question: How do you find the acceleration during the first 6 seconds of motion for an object that acquires a velocity of 15 m/s?

Answer: Acceleration = (Final velocity) / (Time) =  $15 \text{ m/s} / 6 \text{ s} = 2.5 \text{ m/s}^2$ .

Question: What is the purpose of a varistor in surge protection?

Answer: A varistor protects electronic devices from voltage surges by clamping excessive voltage and absorbing surge energy, preventing damage to sensitive components.

Question: What are the steps in tissue culture?

Answer: The steps in tissue culture include introducing vegetative tissue into the culture medium, allowing callus to form, separating plantlets, and gradually adapting them to natural conditions.

Question: What is static friction?

Answer: Static friction is the frictional force that acts on a body when there is no relative motion, even though a force is applied.

Question: How is oxygen gas prepared by heating potassium permanganate?

Answer: Oxygen gas is prepared by heating potassium permanganate, which decomposes to form potassium manganate, manganese dioxide, and oxygen gas.

Question: What occurs when zinc reacts with dilute sulfuric acid?

Answer: Zinc reacts with dilute sulfuric acid to form zinc sulfate and hydrogen gas:  $\text{Zn} + \text{H}_2\text{SO}_4 \rightarrow \text{ZnSO}_4 + \text{H}_2$ .

Question: What is the role of an electrolyte in a lithium-ion battery?

Answer: The electrolyte in a lithium-ion battery facilitates the movement of lithium ions between the anode and cathode during charging and discharging, enabling the electrochemical reactions that store and release energy.

Question: Give an example of an element and its atomic number.

Answer: Sodium has an atomic number of 11, meaning it has 11 protons.

Question: What is the significance of the phase diagram in understanding the states of matter?

Answer: A phase diagram shows the conditions of temperature and pressure under which a substance exists as a solid, liquid, or gas, providing insight into phase transitions and critical points.

Question: What is the chemical formula for ethyl alcohol?

Answer: The chemical formula for ethyl alcohol is  $\text{C}_2\text{H}_5\text{OH}$ .

Question: What lifestyle changes can help manage chronic kidney disease (CKD)?

Answer: Managing CKD involves a healthy diet, regular exercise, controlling blood pressure and blood sugar levels, staying hydrated, and avoiding smoking.

Question: How does an electrochemical gradient drive the production of ATP in chloroplasts?

Answer: In chloroplasts, an electrochemical gradient created by the transport of protons across the thylakoid membrane during photosynthesis

drives the production of ATP through chemiosmosis, where protons flow back into the stroma through ATP synthase, generating ATP.

Question: What does a steeper slope on a displacement-time graph indicate?

Answer: It indicates a higher velocity.

Question: Materials required :- Two small beakers, common salt, sugar

Method :- Take 50 ml of water at the same temperature into each of two small beakers. Accurately weigh 50 g each of salt and sugar. Adding a little at a time, dissolve salt in one beaker and sugar in the other. When it comes to the point beyond which no more solid dissolves, stop adding the substance and weigh the remaining solid. See whether the amounts left are equal. What does this Activity demonstrate about solubility?

Answer: Activity demonstrates that different solutes dissolve in different amounts in equal volumes of the same solvent at the same temperature, indicating that the nature of the solute affects solubility.

Question: What is the nature of the image when an object is placed on the center of curvature of a concave mirror?

Answer: The image is real, inverted, the same size as the object, and formed at the center of curvature.

Question: What is the electronic configuration of argon?

Answer: The electronic configuration of argon is 2, 8, 8.

Question: How does friction affect the motion of a sliding object?

Answer: Friction opposes the motion of a sliding object, causing it to slow down and eventually stop. It balances the applied force until an unbalanced force is applied to maintain motion.

Question: How does the structure of graphite contribute to its use as a lubricant?

Answer: The structure of graphite, with layers of carbon atoms that can slide over each other due to weak interlayer forces, makes it an effective lubricant.

Question: What is the formula for calculating force using Newton's second law?

Answer: The formula for calculating force using Newton's second law is  $F=ma$ .

Question: What happens when the forces acting on an object are not aligned along the same line?

Answer: When the forces acting on an object are not aligned along the same line, the object will experience a net moment, causing it to rotate or move, indicating that it is not in equilibrium.

Question: What is the role of normal reaction in frictional forces?

Answer: The normal reaction is the perpendicular force exerted by a surface on an object in contact, which affects the magnitude of the frictional force.

Question: What is the principal axis in spherical mirrors, and why is it important?

Answer: The principal axis is the line passing through the center of curvature and the pole, used as a reference for constructing ray diagrams and analyzing reflections.

Question: How do different musical instruments create unique sound qualities?

Answer: Unique sound qualities are created by the specific construction and vibration patterns of each instrument, resulting in distinctive waveforms.

Question: What is the latent heat of fusion?

Answer: The latent heat of fusion is the amount of heat required to convert a unit mass of a solid into a liquid at its melting point without changing its temperature.

Question: What is the purpose of a volume controller (variable resistor) in a transistor circuit?

Answer: A volume controller (variable resistor) in a transistor circuit is used to adjust the resistance and control the base current ( $I_B$ ).

Question: How do you measure the current flowing through a bulb in a circuit with two dry cells?

Answer: Connect an ammeter in series with the bulb and the dry cells to measure the current flowing through the bulb.

Question: What is the significance of the hearing range in animals like dogs and bats?

Answer: The hearing range allows animals like dogs and bats to perceive frequencies beyond human hearing, aiding in their survival and communication.

Question: What are the common examples of exothermic reactions in daily life?

Answer: Combustion of fuels, cellular respiration, and neutralization reactions between acids and bases.

Question: What is the role of a pivot point in the formation of a force couple?

Answer: A pivot point allows the formation of a force couple by providing a fixed point around which the object can rotate due to the action and reaction forces according to Newton's third law.

Question: How is the electronic configuration of oxygen related to the formation of a water molecule?

Answer: The electronic configuration of oxygen (2, 6) allows it to share two pairs of electrons with two hydrogen atoms, forming a water molecule ( $H_2O$ ) with a stable electronic configuration.

Question: What is the significance of power factor correction in electrical systems?

Answer: Power factor correction improves the efficiency of electrical systems by reducing reactive power, minimizing energy losses, and lowering utility bills.

Question: How is the total resistance of resistors in parallel calculated?

Answer: The total resistance of resistors in parallel is given by the reciprocal of the sum of the reciprocals of their individual resistances, expressed as  $1/R_{\text{total}} = 1/R_1 + 1/R_2 + 1/R_3 + \dots$

Question: Describe the reactivity of magnesium with hydrochloric acid.

Answer: Magnesium reacts vigorously with hydrochloric acid, producing magnesium chloride and hydrogen gas:  $\text{Mg} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$ .

Question: What are the features of parenchyma tissue?

Answer: Parenchyma tissue consists of living cells that are isodiametric with a large central vacuole, a thin cell wall made of cellulose, and intercellular spaces.

Question: What are some examples of reptiles?

Answer: Examples of reptiles include Tortoise, Crocodile, and Cobra.

Question: How does a plane mirror reflect light?

Answer: A plane mirror reflects light according to the law of reflection, where the angle of incidence equals the angle of reflection.

Question: How can solvent extraction be used to separate iodine from an aqueous solution?

Answer: By adding carbon tetrachloride, which is more soluble in iodine, causing the iodine to transfer to the carbon tetrachloride layer.

Question: What is the role of hemoglobin in respiration?

Answer: Hemoglobin in red blood cells binds to oxygen and transports it from the lungs to tissues, and carries carbon dioxide back to the lungs for exhalation.

Question: How is ground layering performed?

Answer: Ground layering involves making a small cut on the underside of a branch close to the ground, bending and burying the branch in the soil, and separating it from the mother plant once roots develop.

Question: What is the valency of sulphur?

Answer: The valency of sulphur is 6 and 2.

Question: Explain the concept of the depletion region in a p-n junction.

Answer: The depletion region in a p-n junction is an area around the junction where free electrons and holes have recombined, leaving behind charged ions. This region acts as an insulator and creates a potential barrier.

Question: How do geneticists study the inheritance of traits in humans?

Answer: Geneticists study the inheritance of traits in humans by analyzing family pedigrees, conducting genetic tests, and studying the genotypes and phenotypes of individuals.

Question: How does ecotourism benefit conservation efforts?

Answer: Ecotourism benefits conservation efforts by generating revenue for protected areas, raising awareness, and involving local communities in sustainable tourism practices.

Question: How is the chemical formula of calcium hydroxide represented?

Answer: The chemical formula of calcium hydroxide is  $\text{Ca}(\text{OH})_2$ , indicating one calcium ion and two hydroxide ions.

Question: How does body temperature change during the menstrual cycle?

Answer: Body temperature slightly increases during the secretory phase of the menstrual cycle due to the influence of progesterone.

Question: How do sound waves interact with different surfaces?

Answer: Sound waves can be absorbed, reflected, or transmitted depending on the surface material and the wave's frequency.

Question: What is the resultant force of multiple people pushing a car in the same direction?

Answer: The resultant force is the sum of all individual forces applied in the same direction, resulting in a larger single force.

Question: How do you determine the equilibrium of an object under the action of two forces using a ring and spring balances?

Answer: Attach the spring balances to the ring and pull in opposite directions with varying forces. The object remains in equilibrium when the forces are equal in magnitude and opposite in direction, resulting in no net movement.

Question: What is the significance of the experiment with a polythene bag filled with water and holes?

Answer: The experiment demonstrates that water pressure acts in every direction within the liquid.

Question: What structure is adapted for sexual reproduction in plants?

Answer: In plants, the flower is the structure specially formed for sexual reproduction.

Question: What physical property does magnetic separation utilize?

Answer: Magnetic separation utilizes the magnetic property of components to separate them.

Question: What is the molar mass of urea ( $\text{CO}(\text{NH}_2)_2$ )?

Answer: The molar mass of urea is 60 g/mol.

Question: What is the relationship between solubility and temperature for most solid solutes in water?

Answer: For most solid solutes in water, solubility increases with temperature, allowing more solute to dissolve at higher temperatures.

Question: What is the difference between direct currents (DC) and alternating currents (AC)?



Answer: Direct currents (DC) flow in a constant direction and have a constant voltage over time, while alternating currents (AC) change direction periodically and have a voltage that varies sinusoidally with time.

Question: How does the polarity of a molecule affect its interactions with other molecules?

Answer: The polarity of a molecule affects its interactions with other molecules by creating partial charges that attract or repel other polar molecules, influencing properties like solubility, boiling point, and reactivity.

Question: What distinguishes essential amino acids from non-essential amino acids?

Answer: Essential amino acids cannot be synthesized by the body and must be obtained through diet, whereas non-essential amino acids can be synthesized by the body.

Question: How do ammonium and chloride ions combine to form ammonium chloride?

Answer: Ammonium ions ( $\text{NH}_4^+$ ) and chloride ions ( $\text{Cl}^-$ ) combine through electrostatic attraction to form ammonium chloride ( $\text{NH}_4\text{Cl}$ ) with ionic bonds.

Question: What is the resultant force when two forces of 8 N and 6 N act in opposite directions?

Answer: The resultant force is 2 N in the direction of the larger force (8 N).

Question: Describe the function of a thermistor in temperature control circuits.

Answer: A thermistor is a temperature-sensitive resistor whose resistance changes significantly with temperature, used in temperature control and sensing applications.

Question: What is the importance of using distilled water in the electrolysis of acidulated water?

Answer: Distilled water is free of impurities that could interfere with the electrolysis process and produce unwanted reactions.

Question: Describe the equilibrium of a sphere suspended by a string in terms of forces.

Answer: The sphere is in equilibrium because the tension in the string balances the weight of the sphere. The forces are equal in magnitude, opposite in direction, and their lines of action are along the same line, resulting in no net force.

Question: Why is a potted plant kept in the dark for 48 hours before photosynthesis experiments?

Answer: Keeping the plant in the dark depletes stored starch, ensuring that any starch detected during the experiment is newly synthesized.

Question: How does electromagnetic induction apply to credit and debit cards?

Answer: Electromagnetic induction is used in magnetic stripes on credit and debit cards, storing data that is read by inducing a current in a reader device.

Question: How do you calculate the potential difference across a bulb with a resistance of  $4\ \Omega$  and a current of  $0.8\text{ A}$ ?

Answer: Using Ohm's Law,  $V = IR$ , the potential difference is  $V = 0.8\text{ A} \times 4\ \Omega = 3.2\text{ V}$ .

Question: How does the thermal conductivity of a material influence its use in cooking utensils?

Answer: Materials with high thermal conductivity, like metals, are used in cooking utensils because they transfer heat efficiently, ensuring even cooking and quick heating.

Question: How is solubility important in environmental chemistry?

Answer: Solubility influences the behavior and distribution of pollutants, nutrients, and gases in the environment, affecting ecosystems and water quality.

Question: How does the right-hand grip rule apply to solenoids?

Answer: For solenoids, the right-hand grip rule helps determine the magnetic field direction inside the coil, with the thumb pointing in the direction of current flow.

Question: How do geneticists identify carriers of genetic disorders?

Answer: Geneticists identify carriers through genetic testing, which can detect the presence of recessive genes for specific disorders. Carrier screening is often done for couples planning to have children.

Question: What are the melting and boiling points of potassium chloride (KCl)?

Answer: The melting point of potassium chloride (KCl) is  $776^\circ\text{C}$ , and its boiling point is  $1500^\circ\text{C}$ .

Question: How do proteins act as enzymes?

Answer: Proteins act as enzymes that catalyze biochemical reactions in organisms.

Question: How is the chemical formula of calcium hydroxide written?

Answer: The chemical formula of calcium hydroxide is  $\text{Ca}(\text{OH})_2$ , indicating one calcium ion and two hydroxide ions.

Question: What is electronegativity?

Answer: Electronegativity is the ability of an atom of an element to attract the electrons of a bond towards itself when bonded to an atom of another element.

Question: What is the significance of the Joule-Thomson effect in gas behavior?

Answer: The Joule-Thomson effect describes the temperature change in a gas when it expands without performing external work, important for understanding refrigeration and liquefaction processes.

Question: What is the electronic configuration of a calcium atom?

Answer: The electronic configuration of a calcium atom is 2, 8, 8, 2.

Question: What is an example that illustrates Newton's first law of motion?

Answer: An example is a carom disc that moves a short distance and comes to rest due to friction. If the surface is made smoother with talcum powder, the disc moves further before coming to rest, illustrating that friction opposes motion.

Question: How does the reaction of aluminum with hydrochloric acid demonstrate a single displacement reaction?

Answer: Aluminum displaces hydrogen from hydrochloric acid, forming aluminum chloride and hydrogen gas:  $2\text{Al} + 6\text{HCl} \rightarrow 2\text{AlCl}_3 + 3\text{H}_2$ .

Question: Why is it easier to untie a knot made with a nylon string than a coir string?

Answer: It is easier to untie a knot made with a nylon string because the frictional forces among the nylon fibers are weaker compared to the stronger frictional forces among the coir fibers.

Question: What are some examples of skeletal muscles?

Answer: Examples include the biceps, triceps, leg muscles, and facial muscles.

Question: How do the base pairs in DNA contribute to genetic diversity?

Answer: The sequence of base pairs in DNA stores genetic information, and variations in these sequences lead to genetic diversity among organisms.

Question: How do lenses help in vision correction for farsightedness?

Answer: Lenses for farsightedness use convex lenses to converge light rays before they enter the eye, aiding in clear vision of close objects.

Question: How does the galvanometer behave in a DC circuit?

Answer: In a DC circuit, the galvanometer shows a constant deflection, indicating a steady current.

Question: How do inherited traits vary within a species?

Answer: Inherited traits vary within a species due to the combination of different alleles, leading to a wide range of phenotypic variations among individuals.

Question: What is the difference between speed and velocity?

Answer: Speed is a scalar quantity that measures the rate of distance traveled, while velocity is a vector quantity that measures the rate of displacement in a specific direction.

Question: Explain the working principle and uses of a Light Emitting Diode (LED).

Answer: A Light Emitting Diode (LED) is a semiconductor device that emits light when an electric current passes through it. The basic working principle and uses of LEDs are outlined below: Working Principle: Structure: An LED is made from a semiconductor material, typically gallium arsenide (GaAs)

or similar compounds. p-n Junction: LEDs are formed by creating a p-n junction in the semiconductor. When forward biased (positive voltage applied to the p-side and negative to the n-side), electrons and holes recombine at the junction. Light Emission: During recombination, electrons drop from a higher energy level to a lower energy level, releasing energy in the form of photons (light). The color of the light depends on the energy gap of the semiconductor material used. Identification: The longer terminal of an LED is its anode, and the shorter terminal is its cathode. When the base of the LED is pointed towards the observer, the terminal near the cut is the cathode. Uses: Indicators: Initially, LEDs were used as indicator lights in electronic devices due to their low power consumption and long lifespan. Displays: They are now widely used in displays, including large television screens and digital billboards. Lighting: With the development of white light LEDs, their use has expanded to general lighting, such as in homes, streets, and flashlights. LEDs are preferred for lighting due to their energy efficiency, durability, and long life (about 50,000 hours). Special Applications: LEDs are also used in infrared (IR) and ultraviolet (UV) applications, including remote controls, sensors, and medical devices. Minimum Bias Voltage for Color LEDs: Red (GaAs): 1.8 V Orange (GaAsP): 2 V Yellow (AlInGaP): 1.8 V Green (GaP): 2.2 V Blue (GaN): 5 V

Question: What is the molar mass of calcium carbonate ( $\text{CaCO}_3$ )?

Answer: The molar mass of calcium carbonate is 100 grams per mole, calculated as 40 for calcium, 12 for carbon, and  $3 \times 16$  for oxygen.

Question: Calculate the power of a 6V electric bulb drawing a current of 0.6A.

Answer: The power (P) of the bulb is  $P = VI = 6V \times 0.6A = 3.6W$ .

Question: What are the benefits of early detection and management of hypertension for kidney health?

Answer: Early detection and management of hypertension can prevent kidney damage, slow the progression of kidney disease, and improve overall health outcomes.

Question: What is the significance of the pH scale in chemistry?

Answer: The pH scale indicates the acidity or basicity of a solution, with values ranging from 0 (highly acidic) to 14 (highly basic).

Question: What is SONAR and how is it used?

Answer: SONAR (Sound Navigation and Ranging) is used to find the depth of the sea by emitting ultrasound pulses and measuring the time taken for the pulses to return after reflecting from the sea bottom.

Question: How does electroplating contribute to the manufacturing of decorative items?

Answer: Electroplating applies a thin metallic layer with desirable properties, such as luster and resistance to tarnishing, onto decorative items, enhancing their appearance and durability.

Question: What is the function of the hypothalamus in hunger and thirst regulation?

Answer: The hypothalamus regulates hunger and thirst by responding to signals of nutrient deficiency and dehydration, triggering appropriate responses.

Question: What happens when two forces of equal magnitude act on an object in opposite directions?

Answer: The object remains in equilibrium and does not move.

Question: How is the chemical formula of calcium chloride written?

Answer: The chemical formula of calcium chloride is  $\text{CaCl}_2$ , indicating one calcium ion and two chloride ions.

Question: What is the total displacement of a body with multiple displacements in the same direction?

Answer: The total displacement is the sum of all displacements.

Question: How does friction affect the motion of a rolling object on a rough surface?

Answer: Friction opposes the motion of a rolling object on a rough surface, causing it to slow down and eventually stop. A rougher surface increases friction, reducing the distance traveled.

Question: What is the function of Bowman's capsule in the nephron?

Answer: Bowman's capsule surrounds the glomerulus and collects the glomerular filtrate formed during ultrafiltration.

Question: What are the effects of acid rain on terrestrial ecosystems?

Answer: Acid rain damages plants, soil, and water bodies, reduces biodiversity, and disrupts nutrient cycles. It affects forest health, soil fertility, and overall ecosystem stability.

Question: How does a U-magnet create a uniform field for studying electromagnetic effects?

Answer: The U-shape focuses the field between the poles, providing a strong, uniform magnetic field for experiments.

Question: What is the effect of a plano-concave lens on light rays?

Answer: Plano-concave lenses diverge light rays, creating virtual, upright, and smaller images.

Question: What are the potential health risks associated with exposure to volatile organic compounds (VOCs)?

Answer: Exposure to VOCs increases the risk of respiratory problems, headaches, dizziness, and long-term health issues such as cancer. VOCs are harmful pollutants found in many household and industrial products.

Question: How is the chemical formula of sodium oxide written?

Answer: The chemical formula of sodium oxide is  $\text{Na}_2\text{O}$ , indicating two sodium ions and one oxide ion.

Question: What are the benefits of using electrochemical methods for wastewater treatment?

Answer: Electrochemical methods for wastewater treatment offer benefits like high efficiency, ability to treat a wide range of contaminants, low chemical usage, and the potential for on-site treatment, reducing the environmental impact and operational costs.

Question: What is the role of stomata in regulating gas exchange and water loss in plants?

Answer: Stomata open to allow CO<sub>2</sub> intake for photosynthesis and close to minimize water loss through transpiration, balancing gas exchange and hydration.

Question: What is the significance of Avogadro's constant in chemistry?

Answer: Avogadro's constant is significant because it defines the number of atoms, molecules, or ions in one mole of a substance, providing a bridge between the atomic scale and the macroscopic scale.

Question: Define reproduction.

Answer: Reproduction is the production of new generation by an organism to continue their species. It can be sexual or asexual.

Question: What is the resultant force when two forces of 4 N and 6 N act in opposite directions?

Answer: The resultant force is 2 N in the direction of the 6 N force.

Question: What is the filtrate in filtration?

Answer: The filtrate is the solution that passes through the filter during the filtration process.

Question: How does natural classification explain the relationships among organisms?

Answer: Natural classification explains the evolutionary relationships among organisms by considering morphological, physiological, cytological, and molecular biological features.

Question: How do geneticists use model organisms to study human diseases?

Answer: Geneticists use model organisms such as mice, fruit flies, and zebrafish to study human diseases because these organisms have similar genetic structures, allowing researchers to investigate disease mechanisms and test potential treatments.

Question: What are the uses of polythene, PVC, and Teflon?

Answer: Polythene is used for making plastic bottles, toys, and bags; PVC is used for making water pipes, gutters, and conduits; Teflon is used for making non-stick cookware and snow shoes.

Question: How is sulphuric acid used in the production of fertilizers?

Answer: Sulphuric acid is used to produce ammonium sulphate and triple superphosphate fertilizers.

Question: What is the principle behind drinking with a straw?

Answer: Drinking with a straw works by creating a lower pressure inside the straw when air is sucked out, allowing atmospheric pressure to push the

liquid up the straw into the mouth.

Question: What is the purpose of a rectifier diode in power supplies?

Answer: A rectifier diode converts AC to DC by allowing current to flow in only one direction, providing the necessary DC voltage for electronic devices.

Question: What is the relationship between specific heat capacity and thermal inertia?

Answer: Specific heat capacity and thermal inertia are related; substances with high specific heat capacities have high thermal inertia, meaning they resist temperature changes and require more heat to alter their temperature.

Question: What is the role of environmental policies in protecting ecosystems?

Answer: Environmental policies protect ecosystems by regulating activities that impact the environment, promoting conservation, and ensuring sustainable use of natural resources.

Question: What are the advantages of using electrochemical methods for carbon capture and utilization?

Answer: Electrochemical methods for carbon capture and utilization offer advantages like high efficiency, selective conversion of CO<sub>2</sub> to valuable products, integration with renewable energy sources, and reduced environmental impact compared to traditional methods.

Question: How does a compass help study the magnetic field around a current-carrying conductor?

Answer: A compass shows the magnetic field direction by deflecting its needle, indicating the presence and orientation of the magnetic field.

Question: What are some examples of artificial classification?

Answer: Examples include grouping plants as ornamental, herbal, and poisonous, and grouping animals with wings and without wings.

Question: What adaptations do alveoli have for efficient gas exchange?

Answer: Alveoli have a large surface area, thin walls, and are surrounded by capillaries, ensuring efficient diffusion of gases.

Question: How do mitochondria generate ATP?

Answer: Mitochondria generate ATP through oxidative phosphorylation, where electrons are transferred through the electron transport chain, creating a proton gradient that drives ATP synthesis.

Question: What are the physical and chemical properties of hydrogen gas?

Answer: Hydrogen is the lightest gas, with a density less than that of normal air. It is colorless, odorless, combustible, and slightly soluble in water.

Question: What are common reproductive system disorders?

Answer: Common disorders include polycystic ovary syndrome (PCOS), endometriosis, erectile dysfunction, and infertility.

Question: What is the significance of the direction of the force in motion?

Answer: The direction of the force determines the direction of the resulting motion. A force applied in the same direction as motion increases speed, while a force applied in the opposite direction decreases speed.

Question: What is the role of the ring magnet in a loudspeaker?

Answer: The ring magnet creates a magnetic field that interacts with the coil, producing the necessary force to vibrate the cone and generate sound.

Question: Discuss the change of state of matter, including the concepts of melting point, boiling point, and latent heat, with examples of specific substances.

Answer: The change of state of matter involves the transformation of a substance from one state (solid, liquid, gas) to another due to the absorption or release of heat. **Melting Point:** The temperature at which a solid changes to a liquid. The melting point is the same as the freezing point for a given substance and depends on pressure. Examples: Ice melts at 0°C, paraffin wax melts at 54°C, and aluminum melts at 660°C. **Boiling Point:** The temperature at which a liquid changes to a gas by forming bubbles within the liquid. The boiling point depends on pressure. Examples: Water boils at 100°C, ethanol at 78°C, and zinc at 907°C. **Latent Heat:** The heat absorbed or released during a change of state without changing the temperature. It includes latent heat of fusion (melting) and latent heat of vaporization (boiling). **Specific Latent Heat of Fusion:** The amount of heat required to convert 1 kg of a solid into a liquid at the same temperature. Example: The specific latent heat of fusion of ice is  $3.36 \times 10^5$  J/kg. **Specific Latent Heat of Vaporization:** The amount of heat required to convert 1 kg of a liquid into a gas at the same temperature. Example: The specific latent heat of vaporization of water is  $2.26 \times 10^6$  J/kg. **Example of Change of State: Melting of Ice:** Heat is supplied to a block of ice at a temperature slightly below 0°C. The temperature increases to 0°C, where the ice starts to melt. The heat supplied during melting is used to break intermolecular bonds, not to increase temperature, demonstrating latent heat of fusion. **Boiling of Water:** Heat is supplied to water at 100°C. The temperature remains constant at 100°C as the water boils and turns into steam. The heat supplied during boiling is used to overcome intermolecular forces, demonstrating latent heat of vaporization. These concepts illustrate the energy changes and temperature behavior associated with the change of state in substances.

Question: How are glucose and other monosaccharides absorbed in the small intestine?

Answer: Glucose, galactose, and fructose are absorbed into the blood capillaries of the villi and transported to the liver and other body parts.

Question: How does an optocoupler provide electrical isolation?

Answer: An optocoupler uses an LED and a photosensitive device (phototransistor or photodiode) to transfer electrical signals between isolated circuits, preventing high voltages from damaging sensitive components.



Question: How does photosynthesis help maintain the O<sub>2</sub> and CO<sub>2</sub> balance in the atmosphere?

Answer: Photosynthesis absorbs CO<sub>2</sub> for glucose production and releases O<sub>2</sub> as a byproduct, maintaining the balance of these gases in the atmosphere.

Question: What are the main functions of the large intestine?

Answer: The large intestine absorbs water from indigestible food matter, forms feces, and eliminates waste from the body.

Question: What is the valency of carbon?

Answer: The valency of carbon is 4.

Question: What is gonorrhea?

Answer: Gonorrhea is a bacterial STD caused by *Neisseria gonorrhoeae*, characterized by secretions from sex organs, pain, and blockage of the fallopian tube. It can lead to blindness and lameness if untreated.

Question: What is the relationship between liquid pressure and the depth of the liquid?

Answer: The pressure exerted by a liquid increases with the depth of the liquid because the weight of the liquid above that point increases.

Question: What is the role of decomposers in nutrient cycling?

Answer: Decomposers break down dead organic matter, releasing nutrients back into the soil and making them available for producers.

Question: Explain the process of rusting of iron, including the chemical reactions involved and the experimental demonstration of the necessity of water for rusting.

Answer: Rusting of iron is an electrochemical process that results in the formation of hydrated ferric oxide, commonly known as rust. This process occurs when iron is exposed to oxygen and moisture. Chemical Reactions Involved: Oxidation of Iron (Anodic Reaction): Iron atoms lose electrons to form iron ions.  $\text{Fe(s)} \rightarrow \text{Fe}^{2+}(\text{aq}) + 2\text{e}^-$  Reduction of Oxygen (Cathodic Reaction): Oxygen gas in the presence of water gains electrons to form hydroxide ions.  $2\text{H}_2\text{O(l)} + \text{O}_2(\text{g}) + 4\text{e}^- \rightarrow 4\text{OH}^-(\text{aq})$  Formation of Rust: The iron ions react with hydroxide ions to form iron(II) hydroxide, which further reacts with oxygen to form hydrated ferric oxide (rust).  $2\text{Fe(OH)}_2(\text{s}) + \text{O}_2(\text{g}) \rightarrow \text{Fe}_2\text{O}_3 \cdot \text{H}_2\text{O(s)}$  Experiment to Demonstrate the Necessity of Water for Rusting: Materials Required: Four cleaned iron nails Two boiling tubes Two rubber stoppers Anhydrous calcium chloride or silica gel Method: Fix two iron nails to each rubber stopper. Insert one stopper with nails into an empty boiling tube (Tube A). Insert the other stopper with nails into a boiling tube containing anhydrous calcium chloride or silica gel (Tube B). Observe after a few days and record the observations. Observations: In Tube A, the nails both inside and outside the tube show rusting. In Tube B, only the parts of the nails outside the tube show rusting, while the parts inside do not. Conclusion: This experiment demonstrates that water is essential for the rusting of iron. The anhydrous calcium chloride or silica gel in Tube B absorbs moisture, preventing rusting inside the tube.

Question: What is the mother liquor or bittern in salt production?

Answer: The solution left after the precipitation of sodium chloride, containing other dissolved salts like magnesium chloride and magnesium sulfate.

Question: How is the heat change of a reaction expressed experimentally?

Answer: By measuring the temperature change and using the formula  $Q = mc\theta$ , considering the specific heat capacity and mass of the solution.

Question: What is the significance of gene-environment interactions in genetics?

Answer: Gene-environment interactions highlight the complex interplay between genetic factors and environmental influences, demonstrating that both genetics and the environment contribute to the development of traits and diseases.

Question: What are the deficiency symptoms of calcium?

Answer: Deficiency symptoms of calcium include weakening of bones and teeth, growth disorders, and osteoporosis.

Question: How is the Celsius scale defined?

Answer: The Celsius scale is defined by taking the temperature at which pure ice melts into liquid water under one atmosphere as  $0^{\circ}\text{C}$  and the temperature at which water vaporizes into steam as  $100^{\circ}\text{C}$ .

Question: In which direction does a trolley move if pulled by forces of 20 N to the East and 15 N to the West?

Answer: The trolley moves towards the East with a resultant force of 5 N.

Question: What are the three stages of respiration in humans?

Answer: The three stages are gas exchange between the external environment and lungs, gas exchange in alveoli, and cellular respiration.

Question: How do cardiac muscle cells maintain continuous heart contractions?

Answer: Cardiac muscle cells contract rhythmically and do not fatigue, allowing the heart to pump blood continuously throughout life.

Question: How are infrared waves used in medical and technological applications?

Answer: Infrared waves are used for physiotherapy, in remote controls, and in infrared cameras for thermal imaging.

Question: What is the atomic number of chlorine?

Answer: The atomic number of chlorine is 17.

Question: What is the significance of the focal point in lenses?

Answer: The focal point is where light rays converge (convex) or appear to diverge (concave), determining the lens's magnifying power.

Question: How does the diaphragm contribute to breathing?

Answer: The diaphragm contracts and flattens during inhalation, increasing thoracic cavity volume and drawing air into the lungs; it relaxes during exhalation, decreasing volume and expelling air.

Question: How does hydration status affect kidney function and urine production?

Answer: Proper hydration maintains adequate urine production, helps flush out waste, and prevents kidney stones and urinary tract infections.

Question: How does solubility influence the design of pharmaceuticals?

Answer: Solubility affects the formulation, delivery, and bioavailability of pharmaceuticals, determining their effectiveness and therapeutic potential.

Question: How do convex lenses form real images?

Answer: Convex lenses converge light rays to a focal point on the opposite side of the lens, forming real images.

Question: What is the function of brushing rings in an alternating current dynamo?

Answer: Brushing rings connect the rotating coil to the external circuit, allowing current to flow continuously despite the coil's rotation.

Question: What is the effect of a convex lens on parallel light rays?

Answer: A convex lens converges parallel light rays to a focal point on the opposite side of the lens.

Question: What is the difference between distance and displacement?

Answer: Distance is a scalar quantity representing the total path length traveled, while displacement is a vector quantity representing the straight-line distance between the starting and ending points with direction.

Question: What is the functional unit of the nervous system?

Answer: The reflex arc.

Question: What are the properties of covalent compounds that differ from ionic compounds?

Answer: Covalent compounds generally have lower melting and boiling points, do not conduct electricity in any state, and can be found in liquid or gaseous states at room temperature, unlike ionic compounds.

Question: How is the chemical formula of magnesium hydroxide represented?

Answer: The chemical formula of magnesium hydroxide is  $\text{Mg}(\text{OH})_2$ , indicating one magnesium ion and two hydroxide ions.

Question: What is the total resistance of a circuit with resistors of  $4\ \Omega$ ,  $6\ \Omega$ , and  $12\ \Omega$  connected in parallel?

Answer: The total resistance is  $\frac{1}{R} = \frac{1}{4}\ \Omega + \frac{1}{6}\ \Omega + \frac{1}{12}\ \Omega$ , so  $R \approx 2\ \Omega$ .

Question: What is the work done in lifting a  $2.5\ \text{kg}$  object to a height of  $3\ \text{m}$ ?

Answer: The work done is  $75\ \text{Joules (J)}$ .

Question: What method is used to remove chaff from rice and what physical property does it utilize?

Answer: Winnowing, which utilizes the difference in densities of the components.

Question: What is an anion?

Answer: An anion is a negatively charged ion formed by the gain of electrons.

Question: How do convex mirrors provide a wider field of view?

Answer: Convex mirrors diverge incoming light rays, allowing them to reflect a wider area than flat mirrors.

Question: Why is it important to use energy-efficient lighting in households?

Answer: Using energy-efficient lighting reduces electricity consumption, lowers utility bills, and decreases the environmental impact of energy production.

Question: How does the high specific heat capacity of water influence its use in industrial cooling systems?

Answer: Water's high specific heat capacity allows it to absorb and store large amounts of heat, making it effective for regulating temperatures in industrial cooling systems.

Question: What is the function of bile in digestion?

Answer: Bile emulsifies fats, breaking them into small droplets to increase the surface area for enzyme action, aiding in lipid digestion.

Question: How does the weight of a plank of wood suspended by four strings maintain equilibrium?

Answer: The weight of the plank of wood is balanced by the forces of tension exerted by the four strings. These tensions act vertically upwards and are equal in magnitude to the weight of the plank, keeping it in equilibrium.

Question: Describe the operation of a triac in AC power control.

Answer: A triac is a bidirectional semiconductor switch that controls AC power by allowing current to flow in both directions when triggered, used in light dimmers and motor speed controls.

Question: What is the significance of the melting point in phase transitions?

Answer: The melting point is the temperature at which a solid changes to a liquid, important for understanding the thermal properties and behavior of substances.

Question: How are X-rays produced?

Answer: X-rays are generated by bombarding high-speed electrons on metal targets, converting part of the kinetic energy of the electrons into X-rays.

Question: What is the specific heat capacity of water, and why is it significant?

Answer: The specific heat capacity of water is  $4200 \text{ J kg}^{-1} \text{ K}^{-1}$ . It is significant because it allows water to absorb and store large amounts of

heat, moderating temperature changes and making it useful in various applications.

Question: Explain the principle of a potentiostat and its use in electrochemical experiments.

Answer: A potentiostat controls the potential of the working electrode relative to a reference electrode while measuring the current flow. It is used in electrochemical experiments to study reaction mechanisms, kinetics, and electrode behavior.

Question: How is ultrasound used to examine the condition of a fetus inside the womb?

Answer: Ultrasound waves are used to visualize the fetus, providing information about its health, size, and position within the womb.

Question: How is carbon dioxide collected by upward displacement of air?

Answer: Carbon dioxide, denser than air, is collected by allowing it to displace air upwards in an inverted gas jar, a method known as upward displacement of air.

Question: How does a commutator ensure continuous rotation in a DC motor?

Answer: The commutator switches the current direction every half-cycle, preventing reverse motion and maintaining continuous rotation.

Question: How does the release of nitrogen oxides (NO<sub>x</sub>) contribute to smog formation?

Answer: Nitrogen oxides react with volatile organic compounds (VOCs) in the presence of sunlight to form ground-level ozone, a major component of smog. Smog affects air quality and human health.

Question: How do bacteria benefit the environment?

Answer: Bacteria decompose dead bodies and structures, fix atmospheric nitrogen, and aid in the production of curd, yoghurt, and cheese.

Question: What is the potential energy of a 4 kg object at a height of 10 m?

Answer: The potential energy is 400 Joules (J).

Question: What is the effect of touching a live wire while standing on the ground?

Answer: Touching a live wire while standing on the ground completes a circuit through the body, allowing current to flow, which can result in electric shock.

Question: What is the specific latent heat of fusion of ice?

Answer: The specific latent heat of fusion of ice is  $3.36 \times 10^5$  J/kg.

Question: What is the function of skeletal muscle tissue?

Answer: Skeletal muscle tissue facilitates voluntary movements, locomotion, and posture maintenance.

Question: What is the difference between genotype and phenotype?

Answer: Genotype is the genetic makeup of an organism, while phenotype is the observable expression of traits determined by the genotype.

Question: What is electromotive force (EMF)?

Answer: Electromotive force is the force by which the negative terminal of an electric source releases electrons to the external circuit.

Question: What is the purpose of using a hot solvent in recrystallization?

Answer: A hot solvent ensures the solute dissolves completely, allowing impurities to be filtered out before the solution cools and crystallizes.

Question: How can the refraction of light be investigated using a glass block?

Answer: By marking the position of the glass block and pins, viewing through the glass, and tracing the path of light rays.

Question: What equipment is required to prepare a standard solution in a laboratory?

Answer: Required equipment includes volumetric flasks, a wash bottle, a watch glass, and a funnel.

Question: How do animals, wind, and water contribute to pollination?

Answer: Animals, wind, and water contribute to pollination by transferring pollen from one flower to another, facilitating fertilization.

Question: What is the relationship between concentration and the number of collisions in a reaction?

Answer: Higher concentration increases the number of particles per unit volume, leading to more frequent collisions and a faster reaction rate.

Question: What is the significance of electronegativity differences in determining bond type?

Answer: Electronegativity differences determine bond type by influencing whether atoms will share electrons equally (covalent bond), unequally (polar covalent bond), or transfer electrons completely (ionic bond).

Question: What changes occur in the fetus during the seventh month of development?

Answer: During the seventh month, the eyelids open and the skin becomes wrinkled.

Question: What are the main features of the Kingdom Protista?

Answer: The Kingdom Protista includes eukaryotic organisms that can be unicellular or multicellular without specialized tissues and live in water-associated environments.

Question: What is excretion in living organisms?

Answer: Excretion is the process by which organisms remove waste products of metabolism from their body.

Question: Describe the carbon and nitrogen cycles, including their significance and processes.

Answer: The carbon and nitrogen cycles are biogeochemical cycles crucial for maintaining environmental balance by recycling essential elements through the biosphere. Carbon Cycle: The carbon cycle involves the movement of carbon through the atmosphere, lithosphere, hydrosphere, and biosphere. Photosynthesis is the main method of carbon fixation, where green plants convert CO<sub>2</sub> into organic compounds. Animals obtain carbon by consuming plants, and decomposers release carbon back into the atmosphere by breaking down dead organisms. Carbon can also be stored in fossil fuels, which release CO<sub>2</sub> during combustion.

Microorganisms play a vital role in this cycle by rapidly recycling carbon from dead matter (Figure 15.17). Nitrogen Cycle: The nitrogen cycle describes the transformation of nitrogen among the atmosphere, soil, and living organisms. The main source of nitrogen is the atmosphere. Nitrogen fixation occurs through biological means (bacteria in soil and root nodules), atmospheric processes (lightning), and industrial activities (fertilizer production). Nitrifying bacteria convert ammonium compounds into nitrites and nitrates, which plants absorb to synthesize proteins. These proteins pass through food chains to animals. Decomposition releases nitrogen back into the soil as ammonium compounds, while denitrifying bacteria convert nitrates back into atmospheric nitrogen (Figure 15.18). Both cycles are essential for the biosphere's functioning, ensuring the availability of carbon and nitrogen for various biological processes.

Question: How is the pitch of sound determined in wind instruments?

Answer: The pitch is determined by the length of the air column within the instrument, with shorter columns producing higher pitches and longer columns producing lower pitches.

Question: What is gene therapy?

Answer: Gene therapy is a technique that involves replacing faulty genes with healthy ones to treat genetic disorders. It aims to correct the underlying genetic cause of the disease.

Question: How is an endothermic reaction represented in a simple equation?

Answer: Reactants + Heat → Products.

Question: Describe the equilibrium of a sphere suspended by a string in terms of forces.

Answer: The sphere is in equilibrium because the tension in the string balances the weight of the sphere. The forces are equal in magnitude, opposite in direction, and their lines of action are along the same line, resulting in no net force.

Question: What is the role of the primary coil in a transformer?

Answer: The primary coil is connected to the alternating power supply and generates an alternating magnetic field.

Question: What historical evidence exists for the extraction of iron in Sri Lanka?

Answer: Archaeological excavations in the Samanawewa area revealed that a furnace smelting iron ores was operated with the aid of monsoonal winds, and steel for making the ceremonial sword of the Emperor of Arab

was brought from 'Serendib'.

Question: What is the concentration of a solution containing 1 mol of NaCl in 500 cm<sup>3</sup> of water?

Answer: The concentration is 2 mol/dm<sup>3</sup>.

Question: How do you calculate pressure?

Answer: Pressure is calculated using the formula: Pressure = Force / Area.

Question: How is the blast furnace operated in iron extraction?

Answer: The blast furnace is operated by feeding raw materials from the top, blowing hot air from the bottom, and maintaining high temperatures to facilitate the reduction reactions that produce liquid iron.

Question: How does smoking affect the respiratory system?

Answer: Smoking can cause lung cancer, bronchitis, and other respiratory diseases, potentially leading to severe health consequences or death.

Question: How is the chemical formula of nitrogen dioxide written?

Answer: The chemical formula of nitrogen dioxide is NO<sub>2</sub>, indicating one nitrogen atom and two oxygen atoms.

Question: What are some applications of electromagnets in modern devices?

Answer: Applications include electric motors, magnetic locks, MRI machines, and magnetic separation equipment.

Question: How does the thermal expansion of solids differ from that of liquids and gases?

Answer: The thermal expansion of solids typically involves a change in length, area, or volume, while liquids and gases primarily expand in volume. Solids expand less than liquids and gases for the same temperature change due to their rigid structure.

Question: What is the charge of a proton?

Answer: A proton has a positive charge.

Question: What are the disadvantages of using polythene?

Answer: Polythene is not biodegradable and contributes to environmental pollution. It can also release harmful chemicals when burned.

Question: Describe the process of protein synthesis in a cell.

Answer: Protein synthesis involves transcription of DNA into mRNA in the nucleus, followed by translation of mRNA into a protein on ribosomes in the cytoplasm or rough ER.

Question: How are reactive metals like sodium and potassium found in nature?

Answer: Reactive metals like sodium and potassium are found as very stable ionic compounds in the environment and are extracted by the electrolysis of their molten chlorides.



Question: How does pressure influence the rate of reaction for gaseous reactants?

Answer: Increased pressure raises the concentration of gas molecules, leading to more collisions and a faster reaction rate.

Question: How is the human population growth curve different from natural populations?

Answer: The human population growth curve is J-shaped, indicating that the human population is still in the exponential phase.

Question: How do you calculate the current passing through a series circuit with a total resistance of  $50\ \Omega$  and a power supply voltage of  $25\text{ V}$ ?

Answer: The current is  $I = V/R = 25\text{ V}/50\ \Omega = 0.5\text{ A}$ .

Question: What is the molar mass of carbon dioxide ( $\text{CO}_2$ )?

Answer: The molar mass of carbon dioxide is 44 grams per mole, calculated as 12 for carbon plus  $2 \times 16$  for oxygen.

Question: How is the Kingdom Animalia divided?

Answer: The Kingdom Animalia is divided into invertebrates (without a vertebral column) and vertebrates (with a vertebral column).

Question: Describe the working principle of an operational amplifier (op-amp).

Answer: An operational amplifier (op-amp) amplifies the difference between two input voltages, providing high gain and stability for various analog signal processing applications.

Question: Describe the structure of a longitudinal section of a root apex.

Answer: A longitudinal section of a root apex shows regions with different cell types: the growing tip (meristematic tissue) and the mature part (permanent tissue).

Question: What is the significance of heat changes in chemical reactions?

Answer: Heat changes provide insight into the energy dynamics of reactions, indicating whether energy is released or absorbed.

Question: How is the chemical formula of calcium oxide written?

Answer: The chemical formula of calcium oxide is  $\text{CaO}$ , indicating one calcium ion and one oxide ion.

Question: What is the role of enzymes in digestion?

Answer: Enzymes break down carbohydrates into glucose, lipids into fatty acids and glycerol, and proteins into amino acids.

Question: What is the role of electromagnetic waves in satellite communication?

Answer: Electromagnetic waves transmit signals between satellites and ground stations, enabling global communication and data transfer.

Question: What gases are produced at the electrodes during the electrolysis of aqueous sodium chloride?

Answer: Hydrogen gas is produced at the cathode, and chlorine gas is produced at the anode.

Question: How do you calculate the resultant moment when two forces are applied simultaneously on an object?

Answer: The resultant moment is calculated by subtracting the anti-clockwise moment from the clockwise moment (Resultant moment = Clockwise moment - Anti-clockwise moment).

Question: What is the role of acetone in paper chromatography?

Answer: Acetone acts as the mobile phase, carrying the components of the mixture up the paper strip.

Question: What is the purpose of using a Liebig condenser in distillation?

Answer: To cool and condense the vapor produced during distillation, converting it back into liquid form for collection.

Question: How does the force on a conductor change with magnetic field strength?

Answer: The force increases with stronger fields, as it is directly proportional to the field strength.

Question: How do geneticists use genome-wide association studies (GWAS)?

Answer: GWAS identify genetic variants associated with specific traits or diseases by scanning the genomes of large populations, helping to uncover the genetic basis of complex traits and identify potential therapeutic targets.

Question: How does the orientation of the coil affect the output of an alternating current dynamo?

Answer: The coil's orientation affects the output, with maximum voltage generated when the coil is perpendicular to the magnetic field lines.

Question: What is the principle of operation of a Pitot-static tube in measuring airspeed?

Answer: A Pitot-static tube measures airspeed by comparing the dynamic pressure of the airflow with the static pressure, with the difference indicating the aircraft's airspeed.

Question: What role do mesophyll cells play in photosynthesis?

Answer: Mesophyll cells contain chloroplasts and are the primary sites of photosynthesis, capturing light energy and converting it into chemical energy.

Question: What is the molar mass of magnesium oxide (MgO)?

Answer: The molar mass of magnesium oxide is 40 grams per mole, calculated as 24 for magnesium plus 16 for oxygen.

Question: What is the atomic number of potassium?

Answer: The atomic number of potassium is 19.

Question: How do hydrogen bonds affect the behavior of water at different temperatures?

Answer: Hydrogen bonds affect the behavior of water at different temperatures by requiring significant energy to break, influencing water's high boiling point and specific heat capacity, and the expansion of water when it freezes into ice.

Question: Materials required: - Hydrated copper sulphate, naphthalene (moth balls), mortar and pestle Method: - Take some copper sulphate and naphthalene (moth balls) into a mortar, grind them together with the pestle into a powder and mix well. Transfer the powder onto a piece of paper and observe. What materials are needed for this Activity to study mixtures?

Answer: Materials needed include hydrated copper sulphate, naphthalene (moth balls), and a mortar and pestle.

Question: What is the function of a bridge rectifier circuit?

Answer: A bridge rectifier circuit converts AC to DC using four diodes arranged in a bridge configuration, allowing both halves of the AC waveform to contribute to the output DC.

Question: What is the role of a voltage stabilizer in power supply systems?

Answer: A voltage stabilizer maintains a constant output voltage despite fluctuations in the input voltage, protecting sensitive electronic devices from damage.

Question: What is a light-dependent resistor (LDR) used for?

Answer: A light-dependent resistor is used in control circuits of instruments that need to operate based on the amount of light falling on them, such as light sensors and automatic lighting systems.

Question: What is the relationship between ionisation energy and reactivity for non-metals?

Answer: For non-metals, higher ionisation energy generally means higher reactivity because it is easier to attract electrons.

Question: How do you convert a temperature from Kelvin to Celsius?

Answer: To convert a temperature from Kelvin to Celsius, subtract 273 from the Kelvin temperature.

Question: What is the process of anabolism?

Answer: Anabolism is the process of synthesizing complex compounds from simple compounds within the living body, storing energy in the process.

Question: What is the effect of increasing frequency on the energy of electromagnetic waves?

Answer: Increasing frequency increases the energy of electromagnetic waves, as energy is directly proportional to frequency.

Question: What role does the magnetic field play in the operation of a bicycle dynamo?

Answer: The magnetic field interacts with the rotating coil, inducing an electromotive force that generates electrical power for the bicycle's lights.

Question: What are valence electrons?

Answer: Valence electrons are the electrons present in the outermost energy level of an atom.

Question: What is the electronic configuration of sulphur?

Answer: The electronic configuration of sulphur is 2, 8, 6.

Question: What is the reaction between aluminum and hydrochloric acid, and what are the products?

Answer: Aluminum reacts with hydrochloric acid to form aluminum chloride and hydrogen gas:  $2\text{Al} + 6\text{HCl} \rightarrow 2\text{AlCl}_3 + 3\text{H}_2$ .

Question: Why should acid be added to water when diluting concentrated acids?

Answer: Because the dilution of concentrated acids is highly exothermic and can be dangerous, so adding acid to water helps manage the heat released.

Question: What adaptations do fruits dispersed by water have?

Answer: Fruits dispersed by water have porous or fibrous pericarps, floatation-suited pericarps, and air-filled shells.

Question: What is limiting friction?

Answer: Limiting friction is the maximum frictional force that is exerted by a surface just before an object starts to move.

Question: How does increasing the height of an object affect its gravitational potential energy?

Answer: Increasing the height increases the gravitational potential energy proportionally.

Question: What is a tissue in biological terms?

Answer: A tissue is a group of cells that are modified to perform a specific function within an organism.

Question: How do bi-concave lenses affect light rays?

Answer: Bi-concave lenses diverge light rays, making them appear to originate from a focal point on the same side as the object.

Question: What is the valency of an element?

Answer: Valency is the combining ability of an atom of an element, measured relative to hydrogen. It is the number of hydrogen atoms that can combine with or be replaced by an atom of that element.

Question: What is the simplest amino acid?

Answer: The simplest amino acid is glycine.

Question: Calculate the power required to do 500 J of work in 25 seconds.

Answer: The power required is 20 Watts (W).

Question: What is the role of carbon brushes in an alternating current dynamo?

Answer: Carbon brushes maintain contact with the rotating brushing rings, allowing current to flow to the external circuit without wearing out quickly.

Question: What is the effect of a plano-convex lens on light rays?

Answer: A plano-convex lens converges light rays to a focal point on the convex side.

Question: How does the root apex contribute to root growth?

Answer: The root apex contains meristematic tissues that actively divide to enable root growth and elongation.

Question: What conclusion can be drawn from the chlorophyll experiment using mosaic leaves?

Answer: The experiment concludes that chlorophyll is essential for photosynthesis, as only green areas with chlorophyll produce starch.

Question: What is seed germination?

Answer: Seed germination is the activation of the embryo in a seed and its development into a seedling, requiring viability, air (oxygen), water (moisture), and optimum temperature.

Question: What is the balanced equation for the reaction between sodium and oxygen?

Answer: The balanced equation for sodium reacting with oxygen is:  $4\text{Na} + \text{O}_2 \rightarrow 2\text{Na}_2\text{O}$ .

Question: Describe the effect of friction on the performance of machines.

Answer: Friction affects the performance of machines by causing wear and tear on parts, reducing efficiency due to energy loss as heat, and necessitating additional work to overcome frictional resistance.

Question: How does sustainable development benefit society?

Answer: Sustainable development benefits society by promoting economic stability, social equity, and environmental sustainability, ensuring a better quality of life for current and future generations.

Question: How does a concave mirror form an image when the object is placed between the focal point and the mirror?

Answer: The image is virtual, upright, and magnified, formed behind the mirror.

Question: How does lactic acid fermentation occur in human cells?

Answer: During anaerobic respiration, glucose is broken down into lactic acid, releasing energy, which can accumulate in muscles causing pain and cramps.

Question: What are the advantages of using solid-state electrolytes in batteries?

Answer: Solid-state electrolytes in batteries offer advantages like improved safety, higher energy density, longer cycle life, and the potential for flexible and lightweight designs, making them suitable for advanced energy storage applications.

Question: What are transformers used for?

Answer: Transformers are used to change the voltage of a supply. They can step up or step down voltage, making them essential for power distribution in electrical systems.

Question: What is a mixture in chemistry?

Answer: A mixture is matter consisting of two or more substances that are not chemically combined and can be separated by physical methods.

Question: What is the role of vegetative propagation in plant reproduction?

Answer: Vegetative propagation allows for the reproduction of plants using vegetative parts such as stems, roots, and leaves, rather than seeds.

Question: How does kidney function affect the body's immune response?

Answer: The kidneys filter and remove waste products and toxins, supporting the immune system and preventing infections.

Question: What are compressions and rarefactions in a longitudinal wave?

Answer: Compressions are regions where particles are close together, and rarefactions are regions where particles are spread apart in a longitudinal wave.

Question: What is the relationship between liquid pressure and the depth of the liquid?

Answer: The pressure exerted by a liquid increases with the depth of the liquid because the weight of the liquid above that point increases.

Question: How is the resultant force of two collinear forces acting in opposite directions calculated?

Answer: The resultant force is calculated by subtracting the smaller force from the larger force, in the direction of the larger force.

Question: What is an ionic bond?

Answer: An ionic bond is a type of chemical bond formed by the electrostatic attraction between oppositely charged ions, resulting from the transfer of electrons from one atom to another.

Question: Why is it important to have a certain level of friction in everyday activities?

Answer: A certain level of friction is important in everyday activities to prevent slipping, enable controlled movements, and provide traction for walking and driving.

Question: How do mitochondria and chloroplasts generate energy in eukaryotic cells?

Answer: Mitochondria generate ATP through cellular respiration, while chloroplasts convert light energy into chemical energy stored in glucose through photosynthesis in eukaryotic cells.

Question: What is the purpose of disc brakes in modern vehicles?

Answer: Disc brakes in modern vehicles use frictional forces caused by pressing the brake pads against a disc attached to the wheel, effectively stopping the wheel from rotating.

Question: How does the induced current direction change during coil rotation in a dynamo?

Answer: The induced current direction changes periodically, resulting in an alternating current as the coil rotates within the magnetic field.

Question: How is the relative atomic mass of an element defined?

Answer: The relative atomic mass of an element is defined as the weighted average mass of the atoms in a naturally occurring sample of the element, compared to 1/12 of the mass of a carbon-12 atom.

Question: What are the main characteristics of Kingdom Plantae?

Answer: Kingdom Plantae includes multicellular organisms known as plants, which have cell walls with cellulose, appear green due to chlorophyll, and reproduce sexually and asexually.

Question: How does the frequency of electromagnetic waves vary across the spectrum?

Answer: Frequency increases from radio waves to gamma rays, with each type of wave occupying a specific frequency range.

Question: How does the release of methane (CH<sub>4</sub>) from landfills contribute to climate change?

Answer: Methane is a potent greenhouse gas released from the decomposition of organic waste in landfills. It traps heat in the atmosphere, contributing significantly to global warming and climate change.

Question: How does a moving coil microphone generate electrical signals?

Answer: A moving coil microphone generates electrical signals by vibrating a coil within a magnetic field, inducing an electromotive force corresponding to sound waves.

Question: Calculate the energy consumption of a 75W fan running for 8 hours daily over a month.

Answer: The energy consumption is  $(75\text{W} \times 8 \text{ hours} \times 30 \text{ days}) / 1000 = 18 \text{ kWh}$ .

Question: What is the role of the urethra in the urinary system?

Answer: The urethra is the tube that carries urine from the bladder to the outside of the body during urination.

Question: What is the resultant force of two children pulling a thread connected to a box with forces of 8 N and 6 N?

Answer: The resultant force is 14 N in the same direction.

Question: How does the body's renin-angiotensin-aldosterone system (RAAS) affect kidney function?

Answer: RAAS regulates blood pressure and fluid balance, with renin released by the kidneys triggering a cascade that increases blood pressure and sodium reabsorption.

Question: Why is chlorine gas produced at the anode during the electrolysis of aqueous sodium chloride?

Answer: Chlorine gas is produced because  $\text{Cl}^-$  ions are oxidized at the anode, having a greater tendency to oxidize than  $\text{OH}^-$  ions.

Question: What happens to the induced current when the coil in a dynamo is vertical?

Answer: When the coil is vertical, the induced current becomes zero as the conductors do not intersect the magnetic field lines.

Question: What are the principle changes in fetal development during the ninth month?

Answer: During the ninth month, the nails of the fingers are fully grown, testes descend into the scrotum, and the body shows a full-grown nature, weighing about 2-3 kg.

Question: Describe the secretory function of epithelial tissue.

Answer: Epithelial tissue in the respiratory tract secretes mucus, trapping dust and microbes to protect the respiratory system.

Question: What is the first ionisation energy of argon?

Answer: The first ionisation energy of argon is 1521 kJ/mol.

Question: What are the potential health risks associated with exposure to heavy metals in food?

Answer: Exposure to heavy metals in food increases the risk of neurological damage, kidney disease, reproductive issues, and cancer. Heavy metals pose significant health risks to humans.

Question: What does an energy level diagram for an endothermic reaction show?

Answer: It shows that the energy in the products is greater than the energy in the reactants, indicating energy is absorbed.

Question: What is the purpose of using a fractionating column in fractional distillation?

Answer: To provide multiple condensation and vaporization stages for separating components with close boiling points.

Question: What is the general trend in metallic character down a group?

Answer: The metallic character increases down a group.

Question: What are the uses of carbon dioxide in fire extinguishers?

Answer: Carbon dioxide is used in fire extinguishers because it does not support combustion and can smother flames effectively.

Question: Calculate the kinetic energy of a 6 kg object moving at 8 m/s.

Answer: The kinetic energy is 192 Joules (J).

Question: Describe the energy transformation in a moving vehicle.

Answer: In a moving vehicle, chemical energy from fuel is converted into kinetic energy and heat energy, enabling the vehicle to move.

Question: How do microfilaments support cell movement?



Answer: Microfilaments, composed of actin, generate contractile forces for cell movement, enable muscle contraction, and support cell shape changes during migration.

Question: What causes syphilis, and what are its symptoms?

Answer: Syphilis is caused by the bacterium *Treponema pallidum* and presents with painless blisters, fever, and throat pain. It can spread to other organs if untreated.

Question: How do concave lenses form images?

Answer: Concave lenses diverge light rays, creating virtual, upright, and smaller images of objects.

Question: How does the height of an object affect its gravitational potential energy?

Answer: The height of an object affects its gravitational potential energy directly; increasing the height increases the potential energy proportionally.

Question: How does electrochemical impedance spectroscopy help in battery research?

Answer: Electrochemical impedance spectroscopy (EIS) helps in battery research by analyzing the impedance response of a battery over a range of frequencies, providing insights into charge transfer resistance, diffusion processes, and overall battery performance and degradation.

Question: Explain the reaction of aluminum with sodium hydroxide.

Answer: Aluminum reacts with sodium hydroxide and water to form sodium aluminate and hydrogen gas:  $2\text{Al} + 2\text{NaOH} + 2\text{H}_2\text{O} \rightarrow 2\text{NaAlO}_2 + 3\text{H}_2$ .

Question: What are vacuoles, and what are their functions in plant cells?

Answer: Vacuoles are large fluid-filled organelles in plant cells, surrounded by a membrane called tonoplast. They store water, sugars, ions, and pigments, and help maintain water balance and provide structural support.

Question: What is mechanical separation?

Answer: It is the process of separating components in a mixture based on physical properties such as density, particle size, shape, magnetic properties, and electric properties.

Question: What is the role of the coil in a DC motor?

Answer: The coil generates rotational motion by interacting with the magnetic field when current passes through it.

Question: How many molecules are there in 0.2 moles of water ( $\text{H}_2\text{O}$ )?

Answer: There are  $1.204 \times 10^{23}$  molecules in 0.2 moles of water, calculated as  $0.2 \times 6.022 \times 10^{23}$ .

Question: How is the chemical formula of phosphine written?

Answer: The chemical formula of phosphine is  $\text{PH}_3$ , indicating one phosphorus atom and three hydrogen atoms.

Question: Explain the energy transformation in a compressed spring.

Answer: In a compressed spring, potential energy is stored as elastic potential energy. When the spring is released, the potential energy converts to kinetic energy.

Question: What is the kinetic energy of a 2.5 kg object moving at 6 m/s?

Answer: The kinetic energy is 45 Joules (J).

Question: How do concave lenses affect light rays coming from a distant object?

Answer: Concave lenses diverge light rays, making them appear to originate from a focal point on the same side as the object.

Question: Describe the reactivity of magnesium with hydrochloric acid.

Answer: Magnesium reacts vigorously with hydrochloric acid, producing magnesium chloride and hydrogen gas:  $\text{Mg} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$ .

Question: What is the role of a resistor in a series circuit?

Answer: In a series circuit, a resistor controls the current flow by providing resistance, which affects the voltage drop across the resistor and the overall current in the circuit.

Question: How do brushes work in a DC motor?

Answer: Brushes in a DC motor are parts that make contact with the split rings. They are connected to the external circuit, providing current to the motor without rotating themselves.

Question: Why are most cells not visible to the naked eye?

Answer: Most cells are not visible to the naked eye due to their small size and require observation using a light microscope.

Question: What is the reaction between acids and carbonates or bicarbonates?

Answer: Acids react with carbonates or bicarbonates to produce carbon dioxide gas, a characteristic reaction of acids.

Question: How do you investigate the equilibrium of an object under the action of two forces using a block of wood and Newton balances?

Answer: Attach the Newton balances to the block of wood and pull in opposite directions with varying forces. The object remains in equilibrium when the forces are equal in magnitude and opposite in direction, resulting in no net movement.

Question: How does the addition of an acid or base affect the pH of water?

Answer: Adding an acid to water lowers the pH, making it more acidic, while adding a base raises the pH, making it more basic.

Question: What is the group number of potassium?

Answer: Potassium belongs to Group I.

Question: What components are essential for the operation of a bicycle dynamo?

Answer: Essential components of a bicycle dynamo include the rotating coil, magnetic field, mechanical connection to the tire, and electrical circuit.

Question: How does a membrane electrode assembly (MEA) function in a fuel cell?

Answer: A membrane electrode assembly (MEA) in a fuel cell consists of a proton-conducting membrane sandwiched between two electrodes (anode and cathode). It facilitates the electrochemical reactions, allowing protons to pass through the membrane while electrons flow through an external circuit, generating electricity.

Question: Describe the relationship between forces A, B, and C in maintaining equilibrium.

Answer: For forces A, B, and C to maintain equilibrium, the resultant of forces A and B must be equal in magnitude and opposite in direction to force C.

Question: How are sound waves generated?

Answer: Sound waves are generated by vibrations of objects, such as vocal cords, musical instruments, or speakers, causing air particles to oscillate.

Question: What are some harmful effects of protozoans to humans?

Answer: Harmful effects of protozoans include causing diseases like Amoebiasis, Malaria, and Sleeping sickness.

Question: How do you measure the power supplied by a power source in a circuit?

Answer: Measure the current and voltage supplied by the power source and use  $P = IV$  to calculate the power supplied.

Question: What is the volume fraction of acetic acid in a solution with 20 cm<sup>3</sup> of acetic acid in 500 cm<sup>3</sup> of water?

Answer: The volume fraction is 1/25 or 0.04.

Question: What are the conditions for equilibrium in an object under the action of three non-parallel coplanar forces?

Answer: The three forces must be coplanar, their lines of action must intersect at a common point, and the resultant of any two forces must be equal in magnitude and opposite in direction to the third force.

Question: What charge does a proton have?

Answer: A proton has a positive charge.

Question: Describe the process of electrochemical etching and its applications.

Answer: Electrochemical etching involves the controlled removal of material from a workpiece using an anodic dissolution process. It is used for creating intricate patterns, microfabrication, and surface texturing in industries like electronics and aerospace.

Question: How many elements are present in the living body?

Answer: There are about 25 elements present in the living body.

Question: What are some examples of artificial classification?

Answer: Examples include grouping plants as ornamental, herbal, and poisonous, and grouping animals with wings and without wings.

Question: What is DNA, and why is it important in genetics?

Answer: DNA (Deoxyribonucleic Acid) is the genetic material in chromosomes that transmits features from one generation to the next. It stores genetic information in the sequence of base pairs.

Question: How do convex mirrors affect the field of view for drivers?

Answer: Convex mirrors provide a wider field of view by diverging light rays, allowing drivers to see more area behind their vehicles.

Question: What is the velocity of a body falling vertically down after starting from rest for 4 seconds?

Answer: The velocity at the end of 4 seconds is calculated as:  $\text{Velocity} = \text{Initial velocity} + (\text{Gravitational acceleration} \times \text{Time}) = 0 + (9.8 \text{ m/s}^2 \times 4 \text{ s}) = 39.2 \text{ m/s}$ .

Question: How do light rays incident on a convex mirror parallel to the principal axis behave?

Answer: These rays are reflected as if they are diverging from the focal point behind the mirror.

Question: What is the relationship between atomic number and the position of an element in the Periodic Table?

Answer: The atomic number determines the position of an element in the Periodic Table, with elements arranged in ascending order of their atomic numbers.

Question: How do you determine the acceleration of an object from a velocity-time graph?

Answer: Acceleration is determined by the slope of the velocity-time graph.

Question: How does the pH value indicate the strength of acids and bases?

Answer: A pH value less than 7 indicates acidity, and a pH value greater than 7 indicates basicity; the further from 7, the stronger the acid or base.

Question: What is the resultant force if two forces of 10 N and 6 N act in the same direction?

Answer: The resultant force is 16 N in the same direction.

Question: What is the impact of coil windings on a solenoid's magnetic field strength?

Answer: More windings increase the magnetic field strength, enhancing the solenoid's magnetic effect.

Question: Explain the principle of a fuel cell.

Answer: A fuel cell generates electrical energy by converting chemical energy from a fuel (e.g., hydrogen) and an oxidant (e.g., oxygen) into electricity through electrochemical reactions, producing water as a byproduct.

Question: What is the boiling point of nitrogen during fractional distillation of atmospheric air?

Answer: Nitrogen boils at  $-196^{\circ}\text{C}$ .

Question: Why is the specific latent heat of fusion important for understanding phase changes?

Answer: The specific latent heat of fusion is important for understanding phase changes because it quantifies the amount of heat required to convert a solid into a liquid at its melting point, providing insight into the energy involved in phase transitions.

Question: How does air pollution affect crop growth and yields?

Answer: Air pollution reduces photosynthesis, damages plant tissues, and affects nutrient uptake. It decreases crop growth and yields, posing challenges to agricultural productivity.

Question: Explain the structure and uses of polychloroethene (PVC) and discuss why it is preferred over iron for water pipes.

Answer: Polychloroethene, commonly known as polyvinyl chloride (PVC), is a polymer formed by the polymerization of chloroethene (vinyl chloride) molecules. The polymerization process can be represented as follows:  $n\text{CH}_2 = \text{CHCl} \rightarrow [-\text{CH}_2-\text{CHCl}-]_n$ . Properties of PVC: Resistant to fire, Electrical insulator, Impervious to water, Lightweight and durable. Uses of PVC: Making gutters and water pipes, Producing conduits and flexible pipes, Manufacturing various building and construction materials. Advantages of PVC over Iron for Water Pipes: Corrosion Resistance: Unlike iron, PVC does not rust or corrode when exposed to water, ensuring a longer lifespan for water pipes. Lightweight: PVC pipes are much lighter than iron pipes, making them easier to transport and install. Cost-Effective: PVC is generally cheaper than iron, reducing the overall cost of plumbing systems. The monomer used to produce PVC is chloroethene (vinyl chloride), with the structure:  $\text{CH}_2 = \text{CHCl}$ . PVC's combination of durability, resistance to corrosion, and cost-effectiveness makes it an ideal material for water pipes and various other applications.

Question: How can you demonstrate the focusing ability of a convex lens with sunlight?

Answer: By holding a convex lens towards sunlight and placing a white paper in front, adjusting the distance until a small patch of light is formed, demonstrating that parallel rays converge at a focal point.

Question: What are the results of a monohybrid cross involving tall (TT) and short (tt) pea plants?

Answer: The F1 generation consists of all tall plants (Tt), and the F2 generation shows a 3:1 ratio of tall (TT or Tt) to short (tt) plants.

Question: What is the purpose of grounding in electrical systems?

Answer: Grounding provides a safe path for electrical current to dissipate into the earth, reducing the risk of electric shock and damage to equipment.

Question: What is the first ionisation energy of oxygen?

Answer: The first ionisation energy of oxygen is  $1314 \text{ kJ/mol}$ .

Question: What is the principle behind the magnifying glass?

Answer: A magnifying glass uses a convex lens to enlarge the appearance of small objects by converging light rays to a focal point.

Question: How does the right-hand grip rule apply to determining magnetic field direction?

Answer: The rule helps visualize the field direction around a conductor, with the thumb indicating current flow and fingers showing the magnetic field.

Question: What is the significance of the high specific heat capacity of water in regulating climate?

Answer: Water's high specific heat capacity moderates temperature fluctuations, contributing to stable and mild climates by absorbing and releasing heat with minimal temperature change.

Question: What are the environmental benefits of using electrochemical methods for wastewater treatment?

Answer: The environmental benefits of using electrochemical methods for wastewater treatment include efficient removal of contaminants, reduced chemical usage, minimal sludge production, and the ability to treat a wide range of pollutants, resulting in cleaner water and reduced environmental impact.

Question: What is the significance of the discovery of the double helix structure of DNA?

Answer: The discovery of the double helix structure of DNA by Watson and Crick provided insights into the molecular basis of inheritance, revealing how genetic information is stored, replicated, and transmitted from one generation to the next.

Question: What causes appendicitis, and what are its symptoms?

Answer: Appendicitis is caused by infection and swelling of the appendix, leading to symptoms such as abdominal pain, fever, and digestive disturbances.

Question: What is the principle behind the operation of a hydraulic press?

Answer: The principle behind a hydraulic press is that pressure applied to a confined fluid is transmitted undiminished in all directions, allowing a small force applied to a small piston to generate a larger force on a larger piston.

Question: What is dynamic friction?

Answer: Dynamic friction is the frictional force acting on bodies that are in motion, and it is slightly less than the limiting frictional force.

Question: How does the specific heat capacity of ethanol make it suitable for use in thermometers?

Answer: Ethanol has a high expansion relative to most other liquids and increases uniformly with temperature, making it suitable for use in thermometers.

Question: Explain the role of a printed circuit board (PCB) in electronic devices.

Answer: A printed circuit board (PCB) provides a platform for mounting electronic components and interconnecting them with conductive tracks, ensuring reliable and compact circuit assembly.

Question: What are the potential impacts of invasive species on ecosystems?

Answer: Invasive species outcompete native species, disrupt ecosystem functions, alter habitats, and reduce biodiversity. They pose significant threats to ecosystem stability and health.

Question: What is the effect of gravitational acceleration on the weight of an object on the moon?

Answer: The weight of an object on the moon is about  $\frac{1}{6}$ th of its weight on Earth because the gravitational acceleration on the moon is about  $\frac{1}{6}$ th of that on Earth.

Question: What is the role of intermolecular forces in determining the boiling point of a substance?

Answer: Intermolecular forces determine the boiling point of a substance by influencing the amount of energy required to separate the molecules; stronger intermolecular forces result in higher boiling points.

Question: How does reducing friction affect the distance traveled by a moving object on a smooth surface?

Answer: Reducing friction increases the distance traveled by a moving object on a smooth surface, as less resistive force opposes its motion, allowing it to move further before coming to rest.

Question: What is the principle behind the operation of a thermos flask?

Answer: A thermos flask operates on the principle of insulation and reflection. It has a vacuum layer to prevent heat transfer by conduction and convection, and reflective surfaces to reduce heat transfer by radiation, maintaining the temperature of its contents.

Question: What are some uses of essential oils?

Answer: Essential oils are used as flavors, condiments, in perfumes, toothpaste, and pharmaceuticals.

Question: What are the potential health risks of low magnesium levels (hypomagnesemia) for kidney function?

Answer: Hypomagnesemia can cause muscle cramps, seizures, and abnormal heart rhythms, affecting kidney function and overall health.

Question: What are the potential health risks associated with exposure to particulate matter?

Answer: Exposure to particulate matter increases the risk of respiratory problems, cardiovascular diseases, lung cancer, and premature death. It is particularly harmful to vulnerable populations such as children and the elderly.

Question: How does the body eliminate excess urea through the kidneys?

Answer: The kidneys filter urea from the blood and excrete it in urine, removing this waste product from protein metabolism.

Question: What are the two allotropic forms of carbon mentioned?

Answer: The two allotropic forms of carbon mentioned are graphite and diamond.

Question: What is a reflex arc?

Answer: A reflex arc is the functional unit of the nervous system that maintains coordination, involving sensory neurons, inter neurons, and motor neurons.

Question: What is the average speed of an object that traveled 300 meters in 50 seconds?

Answer: Average speed =  $300 \text{ m} / 50 \text{ s} = 6 \text{ m/s}$ .

Question: What is the significance of solubility in chemical engineering?

Answer: Solubility is crucial in chemical engineering for designing separation processes, purifying compounds, and optimizing reaction conditions.

Question: What is the role of plasmodesmata in plant cells?

Answer: Plasmodesmata are channels that connect plant cells, allowing the transport of nutrients, signaling molecules, and other substances between adjacent cells.

Question: Explain the importance of using the appropriate cross-sectional area for connecting wires.

Answer: Using the appropriate cross-sectional area for connecting wires ensures they can safely carry the required current without overheating or causing electrical faults.

Question: How do corrective lenses work for astigmatism?

Answer: Corrective lenses for astigmatism are specially shaped to compensate for irregular curvature in the cornea or lens of the eye.

Question: What is the principle behind detecting fractures in solid components using ultrasound waves?

Answer: High-frequency ultrasound waves do not penetrate air gaps, indicating potential fractures or structural issues in solid components.

Question: What is the plasma membrane, and what is its function?

Answer: The plasma membrane is a semi-permeable membrane that encloses the cell, allowing the entry and exit of materials, and is present in both animal and plant cells.

Question: How does the specific heat capacity of mercury affect its use in thermometers?

Answer: The specific heat capacity of mercury allows it to respond quickly to temperature changes, making it suitable for use in thermometers.

Question: What are the two types of reproduction in organisms?

Answer: The two types of reproduction are sexual reproduction and asexual reproduction.



Question: How does the boiling point of elements change down a group?  
Answer: The boiling point of elements generally increases down a group.

Question: What is parturition?  
Answer: Parturition, or childbirth, is the process of delivering the fetus from the uterus through the vagina, facilitated by the contraction of uterine muscles.

Question: How do you find the resultant force when two collinear forces act in opposite directions?  
Answer: The resultant force is found by subtracting the smaller force from the larger force, in the direction of the larger force.

Question: What is the significance of balanced chemical equations?  
Answer: Balanced chemical equations ensure that the law of conservation of mass is followed and provide a clear representation of the reactants and products in a chemical reaction.

Question: How does the current in the secondary coil of a transformer relate to the primary coil?  
Answer: The current in the secondary coil is inversely proportional to the current in the primary coil, adjusted for the voltage ratio ( $I_s = I_p * (V_p/V_s)$ ).

Question: What is the equivalent resistance of a circuit with resistors of 8  $\Omega$ , 12  $\Omega$ , and 24  $\Omega$  connected in parallel?  
Answer: The equivalent resistance is  $\frac{1}{R} = \frac{1}{8 \Omega} + \frac{1}{12 \Omega} + \frac{1}{24 \Omega}$ , so  $R \approx 4.8 \Omega$ .

Question: How are fish classified based on their endoskeleton?  
Answer: Fish are classified into Chondrichthyes (cartilaginous skeleton) and Osteichthyes (bony skeleton).

Question: How does the endoplasmic reticulum contribute to membrane synthesis?  
Answer: The endoplasmic reticulum synthesizes phospholipids and cholesterol, which are essential components of cellular membranes, contributing to membrane formation and maintenance.

Question: How does the specific heat capacity of ethanol make it useful in laboratory thermometers?  
Answer: Ethanol's specific heat capacity and high expansion rate with temperature changes make it useful in laboratory thermometers, providing accurate temperature measurements.

Question: What is the kinetic energy of a 4 kg object moving at 5 m/s?  
Answer: The kinetic energy is 50 Joules (J).

Question: How does deforestation affect the environment?  
Answer: Deforestation leads to loss of biodiversity, disruption of water cycles, increased soil erosion, and contribution to climate change by reducing the Earth's capacity to absorb carbon dioxide.

Question: What is the resultant force when two forces of 4 N and 6 N act in opposite directions?

Answer: The resultant force is 2 N in the direction of the 6 N force.

Question: What is the role of carbon brushes in an alternating current dynamo?

Answer: Carbon brushes maintain contact with the rotating brushing rings, allowing current to flow to the external circuit without wearing out quickly.

Question: What are antiseptics, and what are their uses?

Answer: Antiseptics are chemicals applied on living tissues to destroy microorganisms or prevent their growth. They are used for cleaning wounds and preventing infections.

Question: How does the presence of impurities affect the solubility of a solute?

Answer: Impurities can either increase or decrease solubility by interacting with the solute or solvent, altering the dissolution process.

Question: What are the applications of electrochemical sensors?

Answer: Electrochemical sensors are used for detecting and measuring various chemical species in applications like environmental monitoring, medical diagnostics, industrial process control, and food quality testing.

Question: What is a resistor?

Answer: A resistor is a component used in electrical circuits to control the flow of electric current by providing resistance.

Question: What is the importance of using inert electrodes in electrolysis?

Answer: Inert electrodes, such as carbon or platinum, do not participate in the electrochemical reactions, ensuring that only the desired ions are involved in the electrolysis process and preventing contamination.

Question: What are the main excretory materials in organisms?

Answer: The main excretory materials in organisms include urea, salts, carbon dioxide ( $\text{CO}_2$ ), and water ( $\text{H}_2\text{O}$ ).

Question: How does the menstrual cycle regulate female fertility?

Answer: The menstrual cycle involves hormonal changes that prepare the uterus for potential pregnancy, with ovulation marking the release of an egg for fertilization.

Question: How do flowering plants reproduce?

Answer: Flowering plants reproduce sexually through flowers and have seeds covered by a fruit.

Question: Describe the function of fuses in protecting electric circuits.

Answer: Fuses protect electric circuits by breaking the circuit when the current exceeds a safe level, preventing overheating and potential fires.

Question: How do light rays coming through the focal point reflect off a concave mirror?

Answer: They reflect parallel to the principal axis.

Question: How are radio waves transmitted and received?

Answer: Radio waves are transmitted by a radio transmission station and received by radio sets, traveling through the air but not requiring it for propagation.

Question: Name some common conductors.

Answer: Common conductors include metals such as copper, aluminum, and iron.

Question: How do covalent bonds differ from ionic bonds in terms of electron sharing?

Answer: Covalent bonds involve the sharing of electrons between atoms, while ionic bonds involve the transfer of electrons, resulting in oppositely charged ions that attract each other.

Question: What role do decomposers play in the carbon cycle?

Answer: Decomposers obtain carbon by digesting dead organisms and release it back into the atmosphere as  $\text{CO}_2$  during respiration.

Question: What is the purpose of the neutral wire in an electric circuit?

Answer: The neutral wire completes the electrical circuit by carrying the current back to the power source, ensuring a continuous flow of electricity.

Question: What is the chemical formula for calcium carbonate?

Answer: The chemical formula for calcium carbonate is  $\text{CaCO}_3$ .

Question: How does a loudspeaker convert electrical signals into sound?

Answer: A loudspeaker converts electrical signals into sound by using a varying current to move the coil and cone, generating sound waves.

Question: What is the significance of gut microbiota?

Answer: Gut microbiota play a crucial role in digestion, nutrient absorption, immune function, and protecting against pathogens.

Question: How is the concept of solubility used in solvent extraction?

Answer: Solubility principles allow the transfer of a solute from a solvent in which it is less soluble to one in which it is more soluble, facilitating extraction.

Question: Describe the equilibrium of a child sitting on a swing in terms of forces.

Answer: The child remains in equilibrium because the forces exerted by the two ropes balance the weight of the child. These forces are coplanar and parallel, and their magnitudes add up to equal the weight of the child.

Question: What are some uses of carbon?

Answer: Carbon is used to produce black ink, vulcanize rubber, make pencils, electrodes of electrochemical cells, as a lubricant, in jewelry (diamond), cutting glass and gems, as pivots in machines, absorb gases (charcoal), and purify water. Carbon fibers and tubes are used to produce goods reinforced by nanomaterials.

Question: How does the coil's position affect the electromotive force in an alternating current dynamo?

Answer: The electromotive force varies with the coil's position, reaching maximum values when the coil intersects the magnetic field lines perpendicularly.

Question: How are covalent bonds formed?

Answer: Covalent bonds are formed by the sharing of electrons between atoms, allowing them to achieve a stable electronic configuration similar to noble gases.

Question: How is oxygen gas prepared in the laboratory?

Answer: Oxygen gas can be prepared by heating potassium permanganate, potassium nitrate, hydrogen peroxide, or potassium chlorate, collecting the gas by downward displacement of water.

Question: What happens during evaporation and why is it important for regulating body temperature?

Answer: During evaporation, liquid water absorbs latent heat and converts into a gaseous state at temperatures below boiling. This process removes heat from the body during perspiration, helping to regulate body temperature.

Question: How is the chemical formula of hydrogen sulphide written?

Answer: The chemical formula of hydrogen sulphide is  $\text{H}_2\text{S}$ , indicating two hydrogen atoms and one sulphur atom.

Question: How do lipids help in maintaining body temperature?

Answer: Lipids, particularly those in the form of fat, act as thermal insulators, helping to maintain a stable body temperature in warm-blooded animals.

Question: How can early detection and management of kidney disease improve outcomes?

Answer: Early detection and management through regular check-ups, blood tests, urine analysis, and lifestyle changes can slow the progression of kidney disease and improve health outcomes.

Question: How do xylem vessel elements function in water transport?

Answer: Xylem vessel elements are cylindrical elongated cells that stack on top of each other, forming a continuous tubular structure that helps in transporting water in plants.

Question: What is the current passing through a  $15\ \Omega$  resistor connected in parallel with a 12 V power supply?

Answer: The current is  $I = V/R = 12\ \text{V}/15\ \Omega = 0.8\ \text{A}$ .

Question: What are the primary functions of the respiratory system's main parts?

Answer: The nasal cavity filters and moistens air, the pharynx directs air to the lungs, the larynx produces sound, the trachea conducts air, bronchi and bronchioles distribute air, and alveoli facilitate gas exchange.

Question: How does the voltage of a galvanic cell depend on the concentration of reactants and products?

Answer: The voltage of a galvanic cell depends on the concentration of reactants and products as described by the Nernst equation. Changes in concentration affect the reaction quotient (Q), altering the cell potential.

Question: What is the resistance of a nichrome wire coil if a current of 0.5 A flows through it with a potential difference of 3 V?

Answer: Using Ohm's Law,  $R = V/I$ , the resistance is  $R = 3 \text{ V} / 0.5 \text{ A} = 6 \Omega$ .

Question: How do you calculate the moment of a force applied to a stick with a loop and Newton balance?

Answer: Calculate the moment by multiplying the applied force by the perpendicular distance from the axis of rotation to the line of action of the force, measured using the loop and Newton balance.

Question: How does electromagnetic induction enable the operation of a moving coil microphone?

Answer: Electromagnetic induction enables the microphone to convert sound waves into electrical signals by inducing a current in the vibrating coil.

Question: What is the purpose of a voltmeter in a circuit?

Answer: A voltmeter is used to measure the potential difference (voltage) between two points in a circuit.

Question: How does the combustion of propane and butane compare to firewood in terms of environmental impact?

Answer: The combustion of propane and butane is more environmentally friendly than firewood, as it produces fewer pollutants and greenhouse gases.

Question: What is an example of a unicellular organism?

Answer: Examples of unicellular organisms include Chlamydomonas, Euglena, Amoeba, and Paramecium.

Question: What is the role of hydrogen bonds in the structure and function of proteins?

Answer: Hydrogen bonds play a crucial role in the structure and function of proteins by stabilizing their three-dimensional shapes, facilitating folding, and enabling specific interactions with other molecules.

Question: How does the power output of an electric appliance relate to its energy consumption?

Answer: The power output of an electric appliance determines the rate at which it consumes energy. Higher power output results in higher energy consumption over time.

Question: How does body resistance affect the severity of an electric shock?

Answer: Body resistance affects the amount of current that flows through the body for a given voltage. Higher resistance reduces the current flow, while lower resistance increases the current flow.

Question: How does the body regulate electrolyte balance through kidney function?

Answer: The kidneys regulate electrolyte balance by filtering blood, reabsorbing necessary ions, and excreting excess ions in urine.

Question: Describe the structure and function of xylem vessel elements.

Answer: Xylem vessel elements are cylindrical, elongated cells with dissolved cross walls, forming continuous tubes that transport water and minerals from roots to shoots.

Question: What is the relationship between genotype and phenotype?

Answer: Genotype is the genetic makeup of an organism, while phenotype is the observable expression of traits determined by the genotype.

Question: How does temperature affect the solubility of solids in liquids?

Answer: Generally, the solubility of solids in liquids increases with an increase in temperature, allowing more solute to dissolve.

Question: Who discovered gene linkage and what does it mean?

Answer: Gene linkage was discovered by Morgan. It refers to genes located on the same chromosome that are not segregated independently during gamete formation.

Question: What is the relationship between wavelength and frequency in the electromagnetic spectrum?

Answer: Wavelength and frequency are inversely related; as frequency increases, wavelength decreases, and vice versa.

Question: What is the role of the nervous system in coordination?

Answer: The nervous system coordinates responses to stimuli by transmitting signals between different parts of the body, ensuring an appropriate and timely reaction.

Question: What is vegetative propagation by stem cuttings?

Answer: Vegetative propagation by stem cuttings involves planting stem cuttings from a mother plant to produce new plants, commonly used for plants like roses and bougainvillea.

Question: How do you determine the center of gravity of an object using the method described in the document?

Answer: Hang the object from different points and mark the vertical lines along the string. The point where these lines intersect is the center of gravity, where the weight of the object acts.

Question: Describe the operation of a triac in AC power control.

Answer: A triac is a bidirectional semiconductor switch that controls AC power by allowing current to flow in both directions when triggered, used in light dimmers and motor speed controls.

Question: What are the potential risks of using undersized cables in electrical installations?

Answer: Undersized cables can overheat due to high current flow, leading to insulation damage, short circuits, and potential fire hazards.

Question: Classify the following quantities as scalars or vectors: Distance, Displacement, Speed, Velocity.

Answer: Distance and Speed are scalars; Displacement and Velocity are vectors.

Question: Describe the equilibrium of a child sitting on a swing in terms of forces.

Answer: The child remains in equilibrium because the forces exerted by the two ropes balance the weight of the child. These forces are coplanar and parallel, and their magnitudes add up to equal the weight of the child.

Question: What is the unit used to measure potential difference?

Answer: The unit used to measure potential difference is the Volt (V).

Question: How can corrosion be prevented using electrochemical methods?

Answer: Corrosion can be prevented using electrochemical methods like cathodic protection, where a more easily oxidized metal (sacrificial anode) is used to protect the main metal structure, or by applying coatings to prevent exposure to corrosive environments.

Question: How does mass affect the difficulty of stopping a moving object?

Answer: A larger mass makes it more difficult to stop a moving object because it results in a greater momentum for a given velocity.

Question: What conclusion can be drawn from the experiment using mosaic leaves to test for chlorophyll's role in photosynthesis?

Answer: The experiment concludes that chlorophyll is essential for photosynthesis, as only areas with chlorophyll produced starch.

Question: How is the relative molecular mass of a compound determined from its molecular formula?

Answer: The relative molecular mass is determined by summing the relative atomic masses of all the atoms in the compound's molecular formula.

Question: How do geneticists predict the outcomes of genetic crosses?

Answer: Geneticists use Punnett squares and probability calculations to predict the outcomes of genetic crosses, estimating the likelihood of different genotypes and phenotypes in offspring.

Question: What is the current passing through a  $12\ \Omega$  resistor connected in series with a 24 V power supply?

Answer: The current is  $I = \frac{V}{R} = \frac{24\text{ V}}{12\ \Omega} = 2\text{ A}$ .

Question: How do animals, wind, and water contribute to pollination?

Answer: Animals, wind, and water contribute to pollination by transferring pollen from one flower to another, facilitating fertilization.

Question: What is a real image, and how is it formed by concave mirrors?

Answer: A real image is formed where actual rays of light converge, and it can be projected onto a screen. It is formed by concave mirrors when the object is placed beyond the focal point.

Question: What are the properties of acids?

Answer: Acids have a corrosive nature, characteristic sour taste, react with metals above hydrogen in the reactivity series, produce carbon dioxide with carbonates/bicarbonates, and turn blue litmus red.

Question: Calculate the energy consumption of a 1500W water heater used for 30 minutes daily over a month.

Answer: The energy consumption is  $(1500\text{W} \times 0.5 \text{ hours} \times 30 \text{ days}) / 1000 = 22.5 \text{ kWh}$ .

Question: What is the general trend in density of elements across a period?

Answer: The density of elements generally increases across a period from left to right.

Question: What is wave motion?

Answer: Wave motion is the movement of a disturbance through a medium or space, where particles of the medium oscillate to transmit energy.

Question: What are the functions of the blood circulatory system?

Answer: The blood circulatory system circulates substances in the body and protects it from microorganisms.

Question: How does ecotourism benefit conservation efforts?

Answer: Ecotourism benefits conservation efforts by generating revenue for protected areas, raising awareness, and involving local communities in sustainable tourism practices.

Question: How do antacids work to relieve heartburn?

Answer: Antacids neutralize excess stomach acid, providing relief from heartburn and indigestion.

Question: What are the different colors of algae in the Kingdom Protista?

Answer: Algae in the Kingdom Protista can have different colors such as green, brown, and red.

Question: What is the function of vitamin A?

Answer: Vitamin A is important for the formation of visual pigments, maintaining healthy skin, and supporting the respiratory tract.

Question: How does the induced voltage waveform look in an alternating current dynamo?

Answer: The induced voltage waveform in an alternating current dynamo is sinusoidal, alternating between positive and negative values.

Question: What is the role of chromosomes in the transmission of genetic information?

Answer: Chromosomes carry genes that determine traits and transmit genetic information from one generation to the next, playing a crucial role in inheritance.

Question: What is the specific heat capacity of lead?

Answer: The specific heat capacity of lead is  $130 \text{ J kg}^{-1} \text{ K}^{-1}$ .



Question: What is the current passing through a 10  $\Omega$  resistor connected to a 12 V power supply?

Answer: The current is  $I = V/R = 12 \text{ V}/10 \Omega = 1.2 \text{ A}$ .

Question: How does the specific heat capacity of a substance relate to its heat capacity?

Answer: The specific heat capacity of a substance is the heat capacity per unit mass. The heat capacity of an object can be obtained by multiplying its specific heat capacity by its mass.

Question: How is the weight of an object calculated?

Answer: The weight of an object is calculated using the formula  $\text{Weight} = mg$ , where

Question: How does the electrolysis of acidulated water differ from that of pure water?

Answer: The electrolysis of acidulated water involves additional  $\text{H}^+$  ions from sulfuric acid, increasing conductivity and efficiency, while pure water has limited ionization and slower electrolysis.

Question: What occurs when zinc reacts with copper sulfate?

Answer: Zinc displaces copper from copper sulfate, forming zinc sulfate and copper:  $\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$ .

Question: How does the structure of covalent compounds influence their solubility in water?

Answer: The structure of covalent compounds influences their solubility in water based on their polarity; polar covalent compounds are more likely to dissolve in water, while non-polar covalent compounds are not.

Question: How does the body regulate cholesterol levels?

Answer: The body regulates cholesterol levels through liver production, dietary intake, and removal via bile, with HDL and LDL particles transporting cholesterol in the blood.

Question: What is the chemical formula for potassium carbonate?

Answer: The chemical formula for potassium carbonate is  $\text{K}_2\text{CO}_3$ , indicating two potassium ions and one carbonate ion.

Question: What is the effect of tightening a screw on the moment of force required to rotate a stick?

Answer: Tightening the screw increases the moment of force required to rotate the stick, confirming that the moment depends on the magnitude of the force.

Question: How does the electrolysis of aqueous sodium chloride produce sodium hydroxide?

Answer: During electrolysis,  $\text{Na}^+$  and  $\text{OH}^-$  ions remain in the solution, combining to form sodium hydroxide.

Question: How does the solubility of organic compounds differ from inorganic compounds?

Answer: The solubility of organic compounds depends on their functional groups and polarity, while inorganic compounds' solubility is influenced by ionic interactions and lattice energy.

Question: How does an aneroid barometer measure atmospheric pressure?

Answer: An aneroid barometer measures atmospheric pressure using a sealed, air-evacuated cavity with flexible walls. Changes in pressure cause the walls to flex, moving an indicator to show the pressure on a scale.

Question: What is the significance of the cell cycle in maintaining genetic stability?

Answer: The cell cycle ensures accurate DNA replication and distribution to daughter cells, maintaining genetic stability and preventing mutations or chromosomal abnormalities.

Question: What is the effect of temperature on the rate of reaction?

Answer: Increasing temperature generally increases the rate of reaction by providing more kinetic energy for reactant collisions.

Question: How is the chemical formula of ammonium phosphate written?

Answer: The chemical formula of ammonium phosphate is  $(\text{NH}_4)_3\text{PO}_4$ , indicating three ammonium ions and one phosphate ion.

Question: What happens when the forces acting on an object are not aligned along the same line?

Answer: When the forces acting on an object are not aligned along the same line, the object will experience a net moment, causing it to rotate or move, indicating that it is not in equilibrium.

Question: What is the formula to find the final temperature of a substance when a known amount of heat is transferred?

Answer: The formula to find the final temperature is  $\text{Final Temperature} = \text{Initial Temperature} + \frac{Q}{mC}$ , where  $Q$  is the heat transferred,  $m$  is the mass, and  $C$  is the specific heat capacity.

Question: What is the maximum number of electrons that can be accommodated in the outermost energy level of an element?

Answer: The maximum number of electrons that can be accommodated in the outermost energy level of an element is 8.

Question: Explain the concept of standard electrode potential.

Answer: The standard electrode potential is the measure of the tendency of a chemical species to gain or lose electrons under standard conditions (1 M concentration, 1 atm pressure, 25°C), relative to the standard hydrogen electrode.

Question: Why is phosphorus important for living organisms?

Answer: Phosphorus is important for living organisms because it is a key component of DNA, RNA, ATP, and cell membranes.

Question: Calculate the power output of a machine that does 250 J of work in 5 seconds.

Answer: The power output is 50 Watts (W).

Question: How does thermal expansion affect the design of bridges?

Answer: Thermal expansion affects the design of bridges by requiring expansion joints to accommodate changes in length due to temperature variations, preventing structural damage and ensuring stability.

Question: What is the significance of a triple bond in a nitrogen (N<sub>2</sub>) molecule?

Answer: A triple bond in a nitrogen (N<sub>2</sub>) molecule involves the sharing of three pairs of electrons between two nitrogen atoms, resulting in a very strong and stable bond.

Question: What is the reaction between sodium hydroxide and hydrochloric acid in aqueous solution?

Answer:  $\text{HCl (aq)} + \text{NaOH (aq)} \rightarrow \text{NaCl (aq)} + \text{H}_2\text{O (l)}$ .

Question: What components are essential for the operation of a bicycle dynamo?

Answer: Essential components of a bicycle dynamo include the rotating coil, magnetic field, mechanical connection to the tire, and electrical circuit.

Question: Describe the equilibrium of a framed picture hanging on the wall.

Answer: The framed picture is in equilibrium because the tensions in the two strings balance the weight of the picture. The three forces are coplanar, and their lines of action intersect at a common point.

Question: What is the significance of the valence shell in chemical bonding?

Answer: The valence shell is the outermost shell of an atom that contains electrons involved in chemical bonding. The configuration of electrons in the valence shell determines the atom's reactivity and bonding behavior.

Question: What is the role of carbon brushes in an alternating current dynamo?

Answer: Carbon brushes maintain contact with the rotating brushing rings, allowing current to flow to the external circuit without wearing out quickly.

Question: What is the role of genetic counseling in managing inherited disorders?

Answer: Genetic counseling provides individuals and families with information about the risks, inheritance patterns, and implications of genetic disorders, helping them make informed decisions about their health and reproduction.

Question: What factors determine the magnitude of induced voltage in a coil?

Answer: Factors determining the magnitude of induced voltage include the number of coil turns, magnetic field strength, and speed of motion.

Question: How does the structure of chloroplasts facilitate the photosynthesis process?

Answer: Chloroplasts have a double membrane, thylakoids stacked into grana, and stroma, providing distinct compartments for light-dependent and light-independent reactions.

Question: What is the significance of the light compensation point in photosynthesis?

Answer: The light compensation point is the light intensity at which the rate of photosynthesis equals the rate of respiration, resulting in no net gain of oxygen or glucose.

Question: How does velocity affect the kinetic energy of a moving object?

Answer: Velocity affects kinetic energy quadratically; doubling the velocity quadruples the kinetic energy.

Question: How do lithium and oxygen atoms achieve a stable electronic configuration in lithium oxide?

Answer: Lithium atoms lose electrons to form  $\text{Li}^+$  ions, and oxygen atoms gain electrons to form  $\text{O}^{2-}$  ions. The electrostatic attraction between these ions forms lithium oxide ( $\text{Li}_2\text{O}$ ) with ionic bonds.

Question: Define a scalar quantity.

Answer: A scalar quantity is a physical quantity that has only magnitude.

Question: What is the role of the large central vacuole in plant cells?

Answer: The large central vacuole in plant cells stores water, nutrients, and waste products, helps maintain turgor pressure, and supports cell structure and growth.

Question: Describe the purpose of an uninterruptible power supply (UPS).

Answer: A UPS provides backup power during mains power failures, ensuring continuous operation of critical devices like computers and medical equipment.

Question: What is the significance of coil windings in a solenoid's magnetic field strength?

Answer: More windings increase the field strength, enhancing the solenoid's magnetic effect and overall performance.

Question: What is the significance of the constant value in Ohm's Law?

Answer: The constant value in Ohm's Law represents the electrical resistance of the conductor.

Question: Describe the use of a function generator in electronic testing.

Answer: A function generator produces various waveform signals, such as sine, square, and triangle waves, used for testing, troubleshooting, and developing electronic circuits.

Question: What are the main functions of the large intestine?

Answer: The large intestine absorbs water from indigestible food matter, forms feces, and eliminates waste from the body.

Question: What is the first ionisation energy of chlorine?

Answer: The first ionisation energy of chlorine is 1251 kJ/mol.

Question: What is the significance of Ohm's Law in electrical safety?

Answer: Ohm's Law helps understand the relationship between voltage, current, and resistance, which is essential for designing safe electrical systems and preventing electric shock.

Question: What is the significance of biodiversity in maintaining ecosystem health?

Answer: Biodiversity is significant in maintaining ecosystem health by enhancing resilience, stability, and productivity, providing essential services such as pollination, nutrient cycling, and climate regulation.

Question: How do animals perform respiration?

Answer: Animals perform respiration by inhaling oxygen, which is transported to cells for cellular respiration, and exhaling carbon dioxide produced as a waste product.

Question: How is ultraviolet radiation used in everyday applications?

Answer: It is used in hospitals to kill germs, in banks to check hidden symbols in currency notes, and in washing powders to make clothes appear brighter.

Question: What does the velocity-time graph look like for an object starting from rest and acquiring a velocity of 15 m/s after moving for 6 seconds under uniform acceleration?

Answer: The velocity-time graph is a straight line starting from the origin (0,0) and ending at (6 s, 15 m/s), indicating uniform acceleration.

Question: What is the purpose of fractional distillation in crude oil refining?

Answer: To separate the different hydrocarbon components based on their boiling points.

Question: How does a solenoid convert electrical energy into mechanical movement?

Answer: A solenoid converts electrical energy into mechanical movement by using an electromagnet to move a metal plunger, providing linear actuation for various applications.

Question: How does a thermocouple measure temperature?

Answer: A thermocouple measures temperature by generating a voltage proportional to the temperature difference between its two junctions, allowing temperature monitoring.

Question: How does the use of synthetic pesticides impact pollinators?

Answer: Synthetic pesticides harm pollinators by causing toxicity, disrupting navigation and foraging behavior, and reducing reproductive success. They pose significant threats to pollinator populations and ecosystem health.

Question: What is the role of the placenta in fetal development?

Answer: The placenta facilitates the exchange of nutrients, oxygen, and waste products between the mother and fetus through the umbilical cord.

Question: How do the features of parenchyma cells make them suitable for storage functions?

Answer: Parenchyma cells have large central vacuoles and thin cell walls, allowing them to store water, nutrients, and carbohydrates effectively.

Question: What components are essential for the operation of a bicycle dynamo?

Answer: Essential components of a bicycle dynamo include the rotating coil, magnetic field, mechanical connection to the tire, and electrical circuit.

Question: What is the acceleration of a car that goes from 0 to 60 km/h in 5 seconds?

Answer: Acceleration =  $(60 \text{ km/h} - 0 \text{ km/h}) / 5 \text{ s} = 12 \text{ km/h/s}$ .

Question: How does a digital oscilloscope display electrical signals?

Answer: A digital oscilloscope samples electrical signals, converts them to digital data, and displays the waveform on a screen, allowing analysis of signal characteristics.

Question: How does natural classification explain the relationships among organisms?

Answer: Natural classification explains the evolutionary relationships among organisms by considering morphological, physiological, cytological, and molecular biological features.

Question: Can you give examples of strong acids and their ionization in water?

Answer: Examples include Hydrochloric acid (HCl), which ionizes into  $\text{H}^+$  and  $\text{Cl}^-$ , Sulphuric acid ( $\text{H}_2\text{SO}_4$ ) into  $2\text{H}^+$  and  $\text{SO}_4^{2-}$ , and Nitric acid ( $\text{HNO}_3$ ) into  $\text{H}^+$  and  $\text{NO}_3^-$ .

Question: What are the potential impacts of climate change on ecosystems?

Answer: Potential impacts of climate change on ecosystems include shifts in species distribution, changes in phenology (timing of biological events), increased frequency of extreme weather events, and disruptions to ecosystem services.

Question: How do you find the resultant force when two collinear forces act in opposite directions?

Answer: The resultant force is found by subtracting the smaller force from the larger force, in the direction of the larger force.

Question: What are the main features of the Kingdom Fungi?

Answer: The Kingdom Fungi includes organisms with chitinous cell walls, eukaryotic cellular organization, and the ability to decompose organic matter.

Question: How does the position of a compass affect its deflection near a conductor?

Answer: The compass deflection depends on its position relative to the conductor, with different deflection directions above and below the conductor.

Question: How does the rate of change of the magnetic field affect the induced voltage?

Answer: A faster rate of change of the magnetic field induces a higher voltage, as the induced electromotive force is directly proportional to the rate of change.

Question: How do calcium and sulfate ions combine to form calcium sulfate?

Answer: Calcium ions ( $\text{Ca}^{2+}$ ) and sulfate ions ( $\text{SO}_4^{2-}$ ) combine through electrostatic attraction to form calcium sulfate ( $\text{CaSO}_4$ ) with ionic bonds.

Question: How do you find the total current in a circuit with multiple resistors connected in parallel?

Answer: Calculate the current through each resistor using  $I = V/R$  then sum the currents to find the total current.

Question: What is the role of the kidneys in maintaining calcium and phosphate balance?

Answer: The kidneys regulate calcium and phosphate levels by filtering and reabsorbing these minerals, influenced by parathyroid hormone (PTH).

Question: How does light behave when it enters a denser medium from a rare medium?

Answer: The light ray bends towards the normal when entering a denser medium from a rare medium.

Question: How does the concentration of the electrolyte affect electrolysis?

Answer: The concentration of the electrolyte affects the rate of electrolysis. Higher concentrations generally increase the rate of ion migration and reaction rates, while very low concentrations can limit ion availability and reduce efficiency.

Question: How does the siphon method work for transferring liquids between containers at different heights?

Answer: The siphon method works by using a tube to transfer liquid from a higher container to a lower container. The pressure at the higher level pushes the liquid through the tube to the lower level where the pressure is lower.

Question: An athlete who runs in this track from A to B reaches the point B after running a distance of 200 m. Then the displacement of the athlete can be indicated by the straight line AB. The magnitude of his displacement is 160 m. Its direction is 70 degrees from the north to west. What is the displacement of an athlete running a 200 m track from A to B?

Answer: The displacement is 160 m in the direction 70 Degrees from north to west.

Question: What is the refractive index of a medium?

Answer: The refractive index is the ratio of the speed of light in a vacuum to its speed in the given medium.

Question: What is the role of ADH in water balance?

Answer: ADH increases water reabsorption in the kidneys, reducing urine output and maintaining body hydration.

Question: What is the function of RNA?

Answer: RNA is responsible for protein synthesis.

Question: How does the electrolysis of copper sulfate solution demonstrate the transfer of copper ions?

Answer: The electrolysis of copper sulfate solution demonstrates the transfer of  $\text{Cu}^{2+}$  ions from the anode to the cathode, where they are reduced and deposited as copper metal.

Question: What is the molar mass of carbon dioxide ( $\text{CO}_2$ )?

Answer: The molar mass of carbon dioxide is 44 grams per mole, calculated as 12 for carbon plus  $2 \times 16$  for oxygen.

Question: What is the role of a funnel in preparing standard solutions?

Answer: A funnel helps transfer the solute into the volumetric flask without spilling, ensuring accurate measurement.

Question: How does a barograph record changes in atmospheric pressure?

Answer: A barograph records changes in atmospheric pressure using a series of aneroid cells connected to a recording mechanism, creating a continuous trace of pressure over time.

Question: What are the uses of oxygen gas in respiration?

Answer: Oxygen gas is essential for the respiration of all organisms, supporting cellular respiration and energy production.

Question: What are the primary functions of the respiratory system's main parts?

Answer: The nasal cavity filters and moistens air, the pharynx directs air to the lungs, the larynx produces sound, the trachea conducts air, bronchi and bronchioles distribute air, and alveoli facilitate gas exchange.

Question: What does the periodic law state?

Answer: The periodic law states that the properties of elements are periodic functions of their atomic number.

Question: What are the potential impacts of ocean acidification on marine life?

Answer: Ocean acidification affects the ability of marine organisms to form shells and skeletons, disrupts reproductive processes, and alters food webs. It poses significant threats to marine ecosystems.

Question: What is the resultant force of two parallel forces acting along the same direction?

Answer: The resultant force is the sum of the two forces.

Question: What is the valency of sodium?

Answer: The valency of sodium is 1.



Question: What is the significance of the angular shape of the water molecule?

Answer: The angular shape of the water molecule, caused by the two lone pairs on the oxygen atom, creates a dipole moment, making water a polar molecule with unique properties such as high surface tension and solubility.

Question: What are the environmental benefits of using electrochemical methods for wastewater treatment?

Answer: The environmental benefits of using electrochemical methods for wastewater treatment include efficient removal of contaminants, reduced chemical usage, minimal sludge production, and the ability to treat a wide range of pollutants, resulting in cleaner water and reduced environmental impact.

Question: What is the significance of trophic levels in a food chain?

Answer: Trophic levels represent the position of organisms in a food chain, with each level indicating the flow of energy and nutrients from producers to top predators.

Question: How is carbon dioxide prepared in the laboratory?

Answer: Carbon dioxide is prepared by reacting calcium carbonate with dilute hydrochloric acid and collecting the gas by downward displacement of water.

Question: What is the relationship between the speed of sound in different media and ultrasound applications?

Answer: The speed of sound varies in different media, influencing how ultrasound waves are used in applications like SONAR and medical diagnostics.

Question: What is the molar mass of glucose ( $C_6H_{12}O_6$ )?

Answer: The molar mass of glucose is 180 grams per mole, calculated as  $6 \times 12$  for carbon,  $12 \times 1$  for hydrogen, and  $6 \times 16$  for oxygen.

Question: How is mean velocity calculated for a child walking from point A to point C via point B in 5 seconds?

Answer: Mean velocity = Total displacement / Total time.

Question: What are the industrial applications of electrolysis for metal extraction?

Answer: Industrial applications include extracting metals like sodium and aluminum from their ores, refining impure metals, and producing chemicals like sodium hydroxide and chlorine.

Question: How does the amount of heat required to increase the temperature of different substances compare?

Answer: Different substances require different amounts of heat to increase their temperature due to their specific heat capacities. For the same mass and temperature change, substances with higher specific heat capacities require more heat.

Question: How do you use Fleming's left-hand rule to determine the direction of force on a conductor?

Answer: By aligning the thumb, index, and middle fingers perpendicularly, with the index finger indicating the magnetic field and the middle finger indicating the current, the thumb points in the direction of the force.

Question: How do you calculate the acceleration of a body that changes its velocity from 10 m/s to 20 m/s in 2 seconds?

Answer: Acceleration =  $(20 \text{ m/s} - 10 \text{ m/s}) / 2 \text{ s} = 5 \text{ m/s}^2$ .

Question: How do you create a combination of resistors with a resistance of 6  $\Omega$  using 20  $\Omega$  and 9  $\Omega$  resistors?

Answer: Connect the 20  $\Omega$  and 9  $\Omega$  resistors in parallel. The equivalent resistance is  $1/R = 1/20 \Omega + 1/9 \Omega$ , so  $R \approx 6\Omega$ .

Question: What are sexually transmitted diseases (STDs)?

Answer: STDs are diseases transmitted through sexual contact and sexual secretions. They can also be transmitted through blood. Common STDs include gonorrhea, syphilis, herpes, and AIDS.

Question: What are the monomers of polythene and PVC?

Answer: The monomer of polythene is ethene ( $\text{C}_2\text{H}_4$ ), and the monomer of PVC is chloroethene ( $\text{C}_2\text{H}_3\text{Cl}$ ).

Question: How are gases like oxygen and nitrogen separated from liquefied air?

Answer: By fractional distillation, where components vaporize at their respective boiling points and are collected separately.

Question: What are the features of vertebrates in the class Mammalia?

Answer: Vertebrates in the class Mammalia have skin covered by hair, mammary glands, sweat and sebaceous glands, ear lobes, a four-chambered heart, complete double circulation, biconcave red blood cells lacking a nucleus, and are warm-blooded with internal fertilization.

Question: What are the environmental impacts of using chemical fertilizers?

Answer: Chemical fertilizers contribute to soil degradation, water pollution, and greenhouse gas emissions. Their overuse can harm soil health, reduce biodiversity, and disrupt natural nutrient cycles.

Question: What are carbon footprints and food miles, and how do they relate to sustainability?

Answer: A carbon footprint measures the total amount of carbon dioxide emissions directly and indirectly caused by an individual, organization, event, or product. It includes emissions from energy use, transportation, and production processes. Reducing carbon footprints is crucial for mitigating climate change. Water Footprint: The amount of freshwater used to produce goods and services consumed by individuals or groups. For example, producing 1 kg of beef requires approximately 15,500 liters of water. Food Miles: Food miles refer to the distance food travels from where it is produced to where it is consumed. The concept highlights the environmental impact of transporting food over long distances. Examples: Locally grown rice in your paddy field has a food mile of 1 mile. Potatoes from a distant region, such as Welimada, have a food mile of 100 miles.

Imported wheat flour from America used in bread has a food mile of 9340 miles. Reducing food miles and carbon footprints enhances sustainability by lowering greenhouse gas emissions and promoting local food consumption.

Question: How do you measure the current flowing through a bulb in a circuit with two dry cells?

Answer: Connect an ammeter in series with the bulb and the dry cells to measure the current flowing through the bulb.

Question: How is the chemical formula of potassium hydroxide written?

Answer: The chemical formula of potassium hydroxide is KOH, indicating one potassium ion and one hydroxide ion.

Question: What are the properties of weak acids?

Answer: Weak acids partially ionize in water, releasing a lower concentration of hydrogen ions ( $H^+$ ).

Question: How do lenses correct vision in eyeglasses?

Answer: Eyeglasses use convex or concave lenses to adjust the focal point of light entering the eye, aiding in clear vision for various refractive errors.

Question: What is the function of the cerebellum?

Answer: It maintains body balance, controls voluntary muscle activity, and is involved in body movement.

Question: How do ribosomes translate mRNA into proteins?

Answer: Ribosomes read the mRNA sequence and assemble amino acids into polypeptides based on the genetic code, forming proteins essential for cellular functions.

Question: What is the displacement of the child in the given example?

Answer: The displacement of the child is 160 m to the east.

Question: How do you achieve equilibrium in a rod with weights at different points using the principle of moments?

Answer: Achieve equilibrium by adjusting the positions and magnitudes of the weights such that the moments on either side of the pivot are equal, resulting in no net rotation.

Question: How does the diaphragm in a moving coil microphone respond to sound?

Answer: The diaphragm vibrates in response to sound waves, moving the attached coil within a magnetic field and generating an alternating current.

Question: Differentiate between aerobic and anaerobic respiration.

Answer: Aerobic respiration requires oxygen and produces more energy by completely breaking down glucose, while anaerobic respiration occurs without oxygen and produces less energy.

Question: How is the displacement calculated for a body moving with uniform acceleration using mean velocity?

Answer: Displacement = Mean velocity  $\times$  Time, where mean velocity is calculated as (Initial velocity + Final velocity) / 2.

Question: How is the chemical formula of sodium hydroxide written?

Answer: The chemical formula of sodium hydroxide is NaOH, indicating one sodium ion and one hydroxide ion.

Question: What is the first ionisation energy of magnesium?

Answer: The first ionisation energy of magnesium is 737 kJ/mol.

Question: How does reducing the mass of an object affect its acceleration for a given force?

Answer: Reducing the mass of an object increases its acceleration for a given force, as acceleration is inversely proportional to mass.

Question: What is the purpose of the neutral wire in an electric circuit?

Answer: The neutral wire completes the electrical circuit by carrying the current back to the power source, ensuring a continuous flow of electricity.

Question: What is the optical center of a lens?

Answer: The optical center is the midpoint between the two surfaces of the lens, and any light ray traveling through it passes without bending.

Question: What is the speed of sound in air at room temperature?

Answer: The speed of sound in air at room temperature (about 20°C) is approximately 343 m/s.

Question: What are the implications of genetic testing for inherited disorders?

Answer: Genetic testing for inherited disorders can provide information about an individual's risk of developing certain diseases, guide medical management and treatment decisions, and inform family planning and reproductive choices.

Question: What is the significance of Mendel's choice of the garden pea plant for his experiments?

Answer: The garden pea plant's ease of cultivation, short generation time, and clear contrasting traits made it an ideal choice for Mendel's genetic experiments, allowing for accurate observations of inheritance patterns.

Question: What is meant by the resultant force of two collinear forces acting on a point?

Answer: The resultant force of two collinear forces acting on a point is the single force that represents the combined effect of the two forces. If the forces act in opposite directions, their magnitudes are subtracted; if in the same direction, their magnitudes are added.

Question: How is the chemical formula of ammonium phosphate written?

Answer: The chemical formula of ammonium phosphate is  $(\text{NH}_4)_3\text{PO}_4$ , indicating three ammonium ions and one phosphate ion.

Question: How do Punnett squares illustrate genetic inheritance?

Answer: Punnett squares illustrate genetic inheritance by showing all possible combinations of alleles from two parents, helping to predict the genotypes and phenotypes of their offspring.

Question: What is the significance of the turning effect of a force in practical applications?

Answer: The turning effect of a force is significant in practical applications such as opening doors, using wrenches, and rotating objects, where the ease of rotation depends on the applied moment.

Question: What is the significance of the axis of rotation in determining the moment of force?

Answer: The axis of rotation is significant because the moment of force depends on the perpendicular distance from this axis to the line of action of the force, influencing the ease of rotation.

Question: Calculate the energy consumption of a 500W air conditioner running for 6 hours daily over a month.

Answer: The energy consumption is  $(500\text{W} \times 6 \text{ hours} \times 30 \text{ days}) / 1000 = 90 \text{ kWh}$ .

Question: What is the relationship between dominant and recessive alleles?

Answer: Dominant alleles determine the trait expressed when present, while recessive alleles are expressed only when both alleles are recessive.

Question: What is the electronic configuration of a carbon atom?

Answer: The electronic configuration of a carbon atom is 2, 4.

Question: What is the acceleration of an object that increases its velocity from 0 to 15 m/s in 5 seconds?

Answer: Acceleration =  $15 \text{ m/s} / 5 \text{ s} = 3 \text{ m/s}^2$ .

Question: What is the significance of Mendel's experiments in genetics?

Answer: Mendel's experiments with pea plants established the principles of inheritance, including the concepts of dominant and recessive traits, and laid the foundation for modern genetics.

Question: What is the molar mass of sodium chloride (NaCl)?

Answer: The molar mass of sodium chloride (NaCl) is 58.5 grams per mole, calculated as 23 for sodium plus 35.5 for chlorine.

Question: How does the frequency of a sound wave affect its pitch?

Answer: Higher frequency sound waves produce higher pitches, while lower frequency waves produce lower pitches.

Question: What is a polyatomic ion?

Answer: A polyatomic ion is a group of atoms of different elements arranged in a specific way and carrying a charge.

Question: How is the frequency of sound waves related to the pitch of the sound?

Answer: Higher frequency sound waves produce higher-pitched sounds, while lower frequency waves produce lower-pitched sounds.

Question: What are the potential health risks of low potassium levels (hypokalemia) for kidney function?

Answer: Hypokalemia can cause muscle weakness, cramps, and abnormal heart rhythms, affecting kidney function and overall health.

Question: What is hercogamy?

Answer: Hercogamy is an adaptation in flowers where the stamens and stigma are positioned at a distance to avoid self-pollination and promote cross-pollination.

Question: What is the role of water as a solvent?

Answer: Water acts as a good solvent, providing a medium for biochemical reactions in cells, and facilitating the removal of excretory material and faecal matter.

Question: Describe the equilibrium of a rod resting on two supports.

Answer: The rod is in equilibrium because the weight of the rod is balanced by the perpendicular reaction forces exerted by the supports. The forces are coplanar and parallel, and their magnitudes add up to equal the weight of the rod.

Question: How do you investigate the effect of tightening a screw on the moment of force required to rotate a stick?

Answer: Investigate the effect by tightening the screw at different levels and measuring the force required to initiate rotation using a Newton balance, observing the relationship between screw tightness and required force.

Question: How does the orientation of the coil affect the induced voltage in a dynamo?

Answer: The orientation of the coil affects the induced voltage, with maximum values generated when the coil is perpendicular to the magnetic field lines.

Question: How do you achieve equilibrium in an object under the action of two equal and opposite forces?

Answer: Achieve equilibrium by ensuring that the forces have equal magnitudes, act in opposite directions, and lie along the same line of action, resulting in no net force.

Question: What is the chemical formula of magnesium oxide?

Answer: The chemical formula of magnesium oxide is  $\text{MgO}$ , indicating one magnesium ion and one oxide ion.

Question: How does atmospheric pressure change with altitude?

Answer: Atmospheric pressure decreases with altitude because there is less air above the measurement point, resulting in lower weight and pressure.

Question: What is the work done in lifting a 3.5 kg object to a height of 6 m?

Answer: The work done is 210 Joules (J).

Question: What is the work done by a machine operating at 100 W for 1 minute?

Answer: The work done is 6000 Joules (J).

Question: What is the final velocity of an object that starts from rest and accelerates at  $4 \text{ m/s}^2$  for 5 seconds?

Answer: Final velocity =  $4 \text{ m/s}^2 \times 5 \text{ s} = 20 \text{ m/s}$ .

Question: How do intercellular spaces in leaves aid in gas exchange?

Answer: Intercellular spaces allow  $\text{CO}_2$  to diffuse from the stomata to the mesophyll cells and  $\text{O}_2$  to diffuse out, facilitating efficient gas exchange.

Question: What is a number pyramid?

Answer: A number pyramid represents the number of individual organisms at each trophic level in an ecosystem.

Question: What is the dot diagram of ammonium?

Answer: The dot diagram of ammonium ( $\text{NH}_4$ ) shows nitrogen as the central atom with four hydrogen atoms bonded to it, represented by dots.

Question: How does the body eliminate excess phosphate through the kidneys?

Answer: The kidneys filter and excrete excess phosphate in urine, maintaining phosphate balance and preventing hyperphosphatemia.

Question: How is magnesium hydroxide used in the sugar industry?

Answer: Magnesium hydroxide is used to purify molasses in the sugar industry.

Question: How is the chemical formula of potassium carbonate represented?

Answer: The chemical formula of potassium carbonate is  $\text{K}_2\text{CO}_3$ , indicating two potassium ions and one carbonate ion.

Question: What is the significance of Avogadro's constant in determining the number of particles in a mole?

Answer: Avogadro's constant provides the exact number of particles (atoms, molecules, or ions) in one mole of a substance, which is  $6.022 \times 10^{23}$ , allowing for precise calculations in chemical reactions.

Question: How does the speed of light compare to the speed of sound?

Answer: The speed of light is much faster than the speed of sound; light travels at approximately  $3 \times 10^8 \text{ m/s}$ , while sound travels at about  $343 \text{ m/s}$  in air.

Question: What are non-metals?

Answer: Non-metals are elements that do not have metallic properties, are poor conductors of heat and electricity, and can exist in various states (solid, liquid, gas).

Question: What occurs when aluminum reacts with hydrochloric acid?

Answer: Aluminum reacts with hydrochloric acid, producing aluminum chloride and hydrogen gas:  $2\text{Al} + 6\text{HCl} \rightarrow 2\text{AlCl}_3 + 3\text{H}_2$ .

Question: How are images formed by concave mirrors depending on the object's position?

Answer: The position, nature, and size of the image depend on the object's distance from the mirror, with different scenarios for objects between the mirror and focal point, on the focal point, and beyond the center of curvature.

Question: What are the stages of the menstrual cycle in the ovary?

Answer: The stages of the menstrual cycle in the ovary are the follicular phase, where the primary follicle develops into a graafian follicle, and the luteal phase, where the graafian follicle releases an ovum and transforms into the corpus luteum.

Question: What is the reaction between potassium and water?

Answer: Potassium reacts vigorously with water to form potassium hydroxide and hydrogen gas:  $2\text{K} + 2\text{H}_2\text{O} \rightarrow 2\text{KOH} + \text{H}_2$ .

Question: What is the role of compressions and rarefactions in sound waves?

Answer: Compressions and rarefactions represent regions of high and low pressure, respectively, and are essential for sound wave propagation.

Question: How does water scarcity impact the environment and human populations?

Answer: Water scarcity impacts the environment by reducing water availability for ecosystems and affects human populations by limiting access to clean water for drinking, agriculture, and sanitation.

Question: What is the wavelength of electromagnetic waves with a frequency of  $3 \times 10^8$  Hz in a vacuum?

Answer: The wavelength is 1 meter, calculated using the formula  $\lambda = c/f$ .

Question: What is the result of the reaction between potassium hydroxide and hydrochloric acid?

Answer: Potassium hydroxide reacts with hydrochloric acid to form potassium chloride and water ( $\text{KOH} + \text{HCl} \rightarrow \text{KCl} + \text{H}_2\text{O}$ ).

Question: What are the primary components of pancreatic juice, and what do they digest?

Answer: Pancreatic juice contains trypsin (digests proteins), amylase (digests starch), and lipase (digests lipids), aiding in the breakdown of food in the small intestine.

Question: What are the environmental impacts of using synthetic fertilizers in agriculture?

Answer: The environmental impacts of using synthetic fertilizers in agriculture include soil degradation, water pollution from nutrient runoff, and the disruption of natural nutrient cycles.

Question: What are the melting and boiling points of water?



Answer: The melting point of water is  $0^{\circ}\text{C}$ , and the boiling point is  $100^{\circ}\text{C}$ .

Question: What is the working principle of a solenoid in electromechanical systems?

Answer: A solenoid converts electrical energy into mechanical movement by using an electromagnet to move a metal plunger, providing linear actuation for various applications.

Question: What is the weight of an object of mass 3 kg on Earth?

Answer: The weight of an object of mass 3 kg on Earth is  $3 \times 9.8 = 29.4 \text{ N}$ .

Question: What is the role of epigenetics in development and disease?

Answer: Epigenetics studies how chemical modifications to DNA and histones affect gene expression, playing a crucial role in development, cellular differentiation, and the regulation of genes involved in diseases such as cancer.

Question: What is electroplating?

Answer: Electroplating is the process of coating an object with a thin layer of metal using electrolysis to improve its properties.

Question: What is the resultant force if two forces of 10 N and 6 N act in opposite directions?

Answer: The resultant force is 4 N in the direction of the 10 N force.

Question: How does the electronic configuration of chlorine influence the formation of hydrogen chloride?

Answer: The electronic configuration of chlorine (2, 8, 7) allows it to share a pair of electrons with a hydrogen atom, forming hydrogen chloride (HCl) with a stable configuration.

Question: What is the significance of periodic trends in predicting the behavior of elements?

Answer: Periodic trends are significant in predicting the behavior of elements by providing patterns that indicate changes in properties such as reactivity, ionisation energy, and electronegativity.

Question: What observations are made when manganese dioxide is added to hydrogen peroxide?

Answer: The speed of gas bubble evolution increases significantly, demonstrating the catalytic effect of manganese dioxide.

Question: What is the valency of nitrogen?

Answer: The valency of nitrogen is 3.

Question: How did Mendel's experiments demonstrate the concept of dominant and recessive traits?

Answer: Mendel's experiments demonstrated that dominant traits mask recessive traits in the F1 generation, but recessive traits reappear in the F2 generation, showing the principles of dominance and recessiveness.

Question: What is the resultant force if two forces of 10 N and 6 N act in the same direction?

Answer: The resultant force is 16 N in the same direction.

Question: What are the symptoms and treatment of tuberculosis?

Answer: Symptoms of tuberculosis include coughing blood, fever, tiredness, weight loss, and loss of appetite. It can be treated with proper medical intervention and prevented with vaccines.

Question: What are the steps involved in tissue culture?

Answer: The steps include introducing vegetative tissue into the culture medium, developing callus, separating plantlets, and adapting them to natural conditions.

Question: How does atmospheric pressure affect the height of a liquid column in a barometer?

Answer: Atmospheric pressure supports the height of the liquid column in a barometer; higher atmospheric pressure results in a taller column, while lower pressure results in a shorter column.

Question: How does the density of water factor into heat change calculations?

Answer: It is used to determine the mass of the solution, which is necessary for calculating heat change.

Question: Describe the function of an electric generator.

Answer: An electric generator converts mechanical energy into electrical energy, typically using a rotating coil within a magnetic field.

Question: How is potassium nitrate decomposed to produce oxygen gas?

Answer: Heating potassium nitrate decomposes it into potassium nitrite and oxygen gas:  $2\text{KNO}_3 \rightarrow 2\text{KNO}_2 + \text{O}_2$ .

Question: What is the significance of measuring the surface area in chemical reactions?

Answer: Measuring surface area helps understand the rate at which a solid reactant interacts with a liquid or gas, influencing the overall reaction rate.

Question: How can the solubility of a solute be experimentally determined?

Answer: Solubility can be determined by adding the solute to the solvent in small increments until no more dissolves, then measuring the amount dissolved at a specific temperature.

Question: What is the absolute zero temperature in the Kelvin scale?

Answer: Absolute zero temperature in the Kelvin scale is 0 K, corresponding to  $-273.15^\circ\text{C}$ , where the kinetic energy of particles is zero.

Question: How is the speed of a wave calculated?

Answer: The speed of a wave is calculated using the formula  $v = f\lambda$ , where  $v$  is speed,  $f$  is frequency, and  $\lambda$  is wavelength.

Question: How does the latent heat of vaporization affect the cooling effect of sweating?

Answer: The latent heat of vaporization allows sweat to absorb a large amount of heat from the body as it evaporates, providing a cooling effect.

and helping to regulate body temperature.

Question: What is the significance of boiling points in separating components by distillation?

Answer: Components with different boiling points vaporize at different temperatures, allowing for their separation.

Question: What is the significance of the magnetic effect observed by Oersted?

Answer: Oersted's observation demonstrated the connection between electricity and magnetism, leading to the development of electromagnetism.

Question: What are the benefits of using electrochemical methods for carbon capture and utilization?

Answer: Electrochemical methods for carbon capture and utilization offer benefits like high efficiency, selective conversion of CO<sub>2</sub> to valuable products, integration with renewable energy sources, and reduced environmental impact compared to traditional methods.

Question: How do plants balance the need for CO<sub>2</sub> intake and water conservation?

Answer: Plants regulate stomatal opening based on environmental conditions, balancing CO<sub>2</sub> intake for photosynthesis and minimizing water loss through transpiration.

Question: How does chemical digestion differ from mechanical digestion?

Answer: Chemical digestion involves breaking down complex molecules into simpler ones through enzymatic action, making them absorbable by the body.

Question: What is the significance of the latent heat of fusion in phase change processes?

Answer: The latent heat of fusion is significant in phase change processes because it quantifies the energy required to convert a solid into a liquid at its melting point, providing insight into the energy dynamics of phase transitions.

Question: Explain the importance of using the appropriate cross-sectional area for connecting wires.

Answer: Using the appropriate cross-sectional area for connecting wires ensures they can safely carry the required current without overheating or causing electrical faults.

Question: What is seed germination?

Answer: Seed germination is the activation of the embryo in a seed and its development into a seedling, requiring viability, air (oxygen), water (moisture), and optimum temperature.

Question: How is the chemical formula of ammonia written?

Answer: The chemical formula of ammonia is NH<sub>3</sub>, indicating one nitrogen atom and three hydrogen atoms.

Question: How are components with close boiling points separated by fractional distillation?

Answer: By using a fractionating column to provide multiple stages of condensation and vaporization, enhancing separation.

Question: How do bones grow and remodel?

Answer: Bones grow through the activity of osteoblasts and osteoclasts, which build and break down bone tissue, respectively, allowing for growth and remodeling.

Question: Describe the behavior of a silicon lattice at 0 K and at temperatures above 0 K.

Answer: At 0 K, all the covalent bonds in a silicon lattice are complete with no free electrons. At temperatures above 0 K, some covalent bonds break due to thermal energy, releasing free electrons and creating holes.

Question: What is the momentum of a 500 g object moving at 10 m/s?

Answer: The momentum is  $p = m \times v = 0.5 \times 10 = 5 \text{ kg m/s}$ .

Question: How does pressure affect the rate of reaction in gases, as shown in Fig. 17.1?

Answer: Higher pressure increases the number of collisions per unit time, resulting in a higher rate of reaction.

Question: How is oxygen gas prepared from hydrogen peroxide?

Answer: Oxygen gas is prepared by the decomposition of hydrogen peroxide, producing water and oxygen:  $2\text{H}_2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{O}_2$ .

Question: What are the effects of plastic waste on marine life?

Answer: Plastic waste in oceans causes ingestion and entanglement in marine life, leading to injury, starvation, and death. It also introduces toxic substances into the marine food web, affecting the entire ecosystem.

Question: What is the role of the large central vacuole in plant cells?

Answer: The large central vacuole in plant cells stores water, nutrients, and waste products, helps maintain turgor pressure, and supports cell structure and growth.

Question: What is the importance of photosynthetic pigments other than chlorophyll in plants?

Answer: Photosynthetic pigments like carotenoids and phycobilins absorb additional wavelengths of light, enhancing the efficiency of photosynthesis.

Question: What is the historical significance of Hans Christian Oersted's discovery?

Answer: Oersted's discovery of the magnetic effect of a current paved the way for the development of electromagnetism and its numerous applications.

Question: What occurs during the proliferation phase of the uterine cycle?

Answer: During the proliferation phase, the uterine lining rebuilds under the influence of estrogen, forming a new cell layer and blood capillaries, typically lasting about ten days.

Question: What is Archimedes' principle and its significance?

Answer: Archimedes' principle states that when an object is partially or completely submerged in a fluid, the upthrust acting on it is equal to the weight of the fluid displaced by the object. It explains why objects float or sink.

Question: What are the effects of habitat loss on ecosystem services?

Answer: Habitat loss reduces the availability of ecosystem services such as pollination, water purification, and climate regulation. It affects human well-being and environmental sustainability.

Question: What is the significance of the Nyquist sampling theorem in digital signal processing?

Answer: The Nyquist sampling theorem states that to accurately reconstruct a signal, it must be sampled at least twice the frequency of its highest component, preventing aliasing and ensuring faithful signal representation.

Question: What is the mass of  $100 \text{ cm}^3$  of water assumed in the calculation?

Answer: 100 g.

Question: How does the specific heat capacity of mercury make it suitable for use in thermometers?

Answer: Mercury's specific heat capacity allows it to respond quickly to temperature changes, making it suitable for accurate and rapid temperature measurements in thermometers.

Question: How do environmental factors such as temperature and light intensity affect photosynthesis?

Answer: Photosynthesis rates increase with optimal light intensity and temperature but can be inhibited by extreme conditions, affecting plant growth and productivity.

Question: What is the valency of chlorine?

Answer: The valency of chlorine is 7 and 1.

Question: What is full-wave rectification and how is it achieved?

Answer: Full-wave rectification converts both halves of the AC waveform into pulsating DC. It is achieved using a bridge rectifier circuit with four diodes that direct both positive and negative half-cycles to flow in the same direction.

Question: How does the decomposition reaction of silver oxide occur?

Answer: Silver oxide decomposes upon heating to form silver and oxygen gas:  $2\text{Ag}_2\text{O} \rightarrow 4\text{Ag} + \text{O}_2$ .

Question: What are the features of vertebrates in the class Amphibia?

Answer: Vertebrates in the class Amphibia have eyes without eyelids, require water to complete their life cycle, undergo metamorphosis, have thin mucous skin with glands, pentadactyle limbs, a three-chambered heart, and respire through lungs, moist skin, and buccal cavity.

Question: What is the role of chromosomes in inheritance?

Answer: Chromosomes carry genetic material (genes) that determine an organism's traits and transmit them from one generation to the next during reproduction.

Question: How is a methane (CH<sub>4</sub>) molecule formed through covalent bonding?

Answer: A methane (CH<sub>4</sub>) molecule is formed when a carbon atom shares four pairs of electrons with four hydrogen atoms, resulting in covalent bonds

Question: Calculate the power consumed by an electric oven operating at 230V with a current of 8.69A.

Answer: The power consumed is  $P = VI = 230V \times 8.69A \approx 2000W$ .

Question: What materials are required to examine how bases affect rusting?

Answer: Two boiling tubes, two cleaned iron nails, and sodium hydroxide (NaOH) solution.

Question: What is the emergent ray in refraction?

Answer: The emergent ray is the ray that leaves the second medium after refraction.

Question: How does a bicycle dynamo generate electricity?

Answer: A bicycle dynamo generates electricity by rotating a coil in a magnetic field when the dynamo's head touches the rotating tire, inducing an electromotive force.

Question: How do Punnett squares help geneticists visualize genetic crosses?

Answer: Punnett squares help geneticists visualize genetic crosses by showing all possible combinations of alleles from two parents, allowing predictions of genotypes and phenotypes in offspring.

Question: What are the melting and boiling points of potassium chloride (KCl)?

Answer: The melting point of potassium chloride (KCl) is 776°C, and its boiling point is 1500°C.

Question: How does the RCCB protect against electric shocks?

Answer: The RCCB detects current leaks to the ground and automatically disconnects the power supply, preventing electric shocks and potential injuries.

Question: How does the structure of water molecules contribute to its high specific heat capacity?

Answer: The structure of water molecules, with hydrogen bonds between them, allows water to absorb and retain a large amount of heat without a significant change in temperature, contributing to its high specific heat capacity.

Question: How do you calculate the current passing through a resistor in a parallel circuit with a known total voltage?

Answer: Use Ohm's Law:  $I = V/R$ , where  $V$  is the total voltage and  $R$  is the resistance of the resistor.

Question: How does reducing the mass of an object affect its acceleration for a constant force?

Answer: Reducing the mass of an object increases its acceleration for a constant force, as acceleration is inversely proportional to mass.

Question: What are some uses of boron?

Answer: Boron is used in welding metals, making skin creams, and producing glass that can withstand high temperatures.

Question: How can sexually transmitted diseases be prevented?

Answer: Sexually transmitted diseases can be prevented by avoiding risky sexual activities, using protection during intercourse, and avoiding blood transmission from infected individuals.

Question: How do you calculate the number of atoms in a given mass of an element?

Answer: The number of atoms in a given mass of an element is calculated by dividing the mass by the molar mass to find the number of moles, then multiplying by Avogadro's constant.

Question: What is the specific heat capacity of rubber?

Answer: The specific heat capacity of rubber is  $1700 \text{ J kg}^{-1} \text{ K}^{-1}$ .

Question: What is the relationship between current and magnetic field strength in a solenoid?

Answer: The field strength is directly proportional to the current and the number of coil windings, increasing with higher current and more windings.

Question: How does the activity series help in metal extraction?

Answer: The activity series helps determine suitable extraction methods, such as using electrolysis for highly reactive metals and simpler physical methods for less reactive metals.

Question: How do ribosomes contribute to protein synthesis?

Answer: Ribosomes translate mRNA into polypeptides, assembling amino acids into proteins based on the genetic code, essential for cellular functions.

Question: What happens to the induced current when the coil in a dynamo is vertical?

Answer: When the coil is vertical, the induced current becomes zero as the conductors do not intersect the magnetic field lines.

Question: How does a loudspeaker work?

Answer: A loudspeaker generates sound by passing a time-varying current through a coil, creating a magnetic force that vibrates the coil and the attached cone, producing sound waves.

Question: What are the potential benefits and risks of gene editing in agriculture?

Answer: Potential benefits of gene editing in agriculture include improved crop yields, resistance to pests and diseases, and enhanced nutritional content. Risks include environmental impacts, the potential for unintended genetic changes, and ethical concerns about altering the genetic makeup of organisms.

Question: What are heavy metals?

Answer: Heavy metals are metallic elements with high densities that are toxic at low concentrations, such as lead, mercury, and cadmium.

Question: What is the significance of Michael Faraday's experiments on electromagnetic induction?

Answer: Faraday's experiments established the principles of electromagnetic induction, leading to the development of electrical generators and transformers.

Question: How does a compressed gas exert pressure?

Answer: A compressed gas exerts pressure due to the force of the gas molecules colliding with the walls of the container. The more the gas is compressed, the higher the pressure.

Question: What is the significance of the human immune system?

Answer: The human immune system protects the body from infections and diseases by recognizing and attacking pathogens such as bacteria, viruses, and other foreign invaders.

Question: How does the choice of electrode material affect the selectivity of electrochemical reactions?

Answer: The choice of electrode material affects the selectivity of electrochemical reactions by influencing the adsorption of reactants, reaction pathways, and product formation. Suitable electrode materials enhance the desired reactions while minimizing side reactions.

Question: How does a domestic electric circuit distribute electricity?

Answer: A domestic electric circuit distributes electricity through lighting and plug circuits, each connected in parallel to ensure consistent voltage and independent operation.

Question: What are some examples of Osteichthyes?

Answer: Examples of Osteichthyes include Seer fish, Tilapia, and Sea horse.

Question: What are some examples of polysaccharides?

Answer: Examples of polysaccharides include cellulose, starch, and glycogen.

Question: What factors determine the magnitude of induced voltage in a coil?

Answer: Factors determining the magnitude of induced voltage include the number of coil turns, magnetic field strength, and speed of motion.

Question: How does a gas pressure regulator maintain constant pressure?



Answer: A gas pressure regulator maintains constant pressure by adjusting the flow of gas through a valve, balancing the pressure on both sides to keep it steady.

Question: Experimental determination of the heat change of the reaction between sodium hydroxide (NaOH) and hydrochloric acid (HCl) Materials required : - 50 cm<sup>3</sup> of 2 mol dm<sup>-3</sup> sodium hydroxide solution, 50 cm<sup>3</sup> of 2 mol dm<sup>-3</sup> hydrochloric acid solution, two 100 cm<sup>3</sup> beakers, a thermometer of range 0-100 °C, a polystyrene cup, a glass rod Method : - To two beakers, measure 50 cm<sup>3</sup> of the sodium hydroxide solution and 50 cm<sup>3</sup> of the hydrochloric acid solution separately using the measuring cylinder. With the thermometer, measure the initial temperatures of the two solutions. (After measuring the temperature of the solution of the base, wash the thermometer before measuring the temperature of the acid solution . Mix these two solutions in a polystyrene cup, stir with the glass rod and record the maximum temperature. How is the heat of reaction calculated in the Activity for 1 mol of NaOH reacting with 1 mol of HCl? Answer: By calculating the heat change for 0.1 mol of NaOH reacting with 0.1 mol of HCl and then scaling up to 1 mol, resulting in 42 kJ mol<sup>-1</sup>.

Question: How does the speed of a rotating coil influence the dynamo's output?

Answer: A faster rotating coil increases the rate of change of the magnetic field, generating higher voltage and more electrical power.

Question: How did Mendel ensure the accuracy of his experimental results?

Answer: Mendel used large sample sizes and repeated his experiments multiple times to confirm the consistency and reliability of his results.

Question: What is an environmental impact assessment (EIA)?

Answer: An environmental impact assessment (EIA) is a process that evaluates the potential environmental effects of proposed projects or activities before they are carried out.

Question: Why is it important to follow safety measures when using electric appliances?

Answer: Following safety measures prevents electric shocks, fires, and other accidents, ensuring the safe and efficient operation of electric appliances.

Question: How do lenses aid in the function of telescopes?

Answer: Telescopes use lenses to gather and focus light from distant objects, enabling detailed observation of celestial bodies.

Question: What is the significance of the central vacuole in plant cells?

Answer: The central vacuole stores nutrients, waste products, and pigments, maintains turgor pressure for structural support, and contributes to cell growth by expanding.

Question: How do ammonium and nitrate ions combine to form ammonium nitrate?

Answer: Ammonium ions (NH<sub>4</sub><sup>+</sup>) and nitrate ions (NO<sub>3</sub><sup>-</sup>) combine through electrostatic attraction to form ammonium nitrate (NH<sub>4</sub>NO<sub>3</sub>) with ionic

bonds.

Question: What is the significance of Michael Faraday's experiments on electromagnetic induction?

Answer: Faraday's experiments established the principles of electromagnetic induction, leading to the development of electrical generators and transformers.

Question: What is self-pollination?

Answer: Self-pollination occurs when pollen from a flower is deposited on the stigma of the same flower, resulting in fertilization within the same flower.

Question: What is the balanced chemical equation for the reaction between sodium and hydrochloric acid?

Answer: The balanced chemical equation for sodium reacting with hydrochloric acid is:  $2\text{Na} + 2\text{HCl} \rightarrow 2\text{NaCl} + \text{H}_2$ .

Question: What is hydrostatic pressure?

Answer: Hydrostatic pressure is the pressure exerted by a liquid at any given point within the liquid. It depends on the height of the liquid column above that point.

Question: What is meant by the term refraction of light?

Answer: Refraction of light is the bending of light rays when they pass from one medium to another with different optical densities.

Question: What is a base, and how does it affect hydroxyl ion concentration?

Answer: A base is a chemical compound that increases the hydroxyl ion ( $\text{OH}^-$ ) concentration in an aqueous solution.

Question: What are the effects of deforestation on the carbon cycle?

Answer: The effects of deforestation on the carbon cycle include increased carbon dioxide ( $\text{CO}_2$ ) emissions, reduced carbon sequestration by trees, and the disruption of the balance between carbon sources and sinks.

Question: What is the result of the reaction between nitric acid and magnesium hydroxide?

Answer: Nitric acid reacts with magnesium hydroxide to form magnesium nitrate and water ( $\text{Mg}(\text{OH})_2 + 2\text{HNO}_3 \rightarrow \text{Mg}(\text{NO}_3)_2 + 2\text{H}_2\text{O}$ ).

Question: How do hydrogen bonds contribute to the high boiling point of water?

Answer: Hydrogen bonds in water require a significant amount of energy to break, contributing to water's high boiling point compared to other covalent compounds.

Question: How do you calculate the moment of a force applied to a stick with a loop and Newton balance?

Answer: Calculate the moment by multiplying the applied force by the perpendicular distance from the axis of rotation to the line of action of the force, measured using the loop and Newton balance.

Question: How do geneticists determine the inheritance of traits in organisms?

Answer: Geneticists determine inheritance by studying the genotypes and phenotypes of parents and offspring, analyzing patterns of trait inheritance over generations.

Question: What are the features of vertebrates in the class Reptilia?

Answer: Vertebrates in the class Reptilia have dry skin with scales, pentadactyle limbs, a heart with two atria and an incompletely divided ventricle, lungs for respiration, and are cold-blooded with internal fertilization.

Question: What is cathodic protection or sacrificial protection?

Answer: It is a method where a more reactive metal is kept in contact with iron, making iron the cathode and preventing its corrosion.

Question: What is the work done in lifting a 4 kg bag to a height of 1.5 m?

Answer: The work done is 60 Joules (J).

Question: What is the reaction between calcium carbonate and hydrochloric acid?

Answer: Calcium carbonate reacts with hydrochloric acid to form calcium chloride, water, and carbon dioxide:  $\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$ .

Question: What is the relationship between relative atomic mass and molar mass?

Answer: The relative atomic mass is a dimensionless quantity, while the molar mass is the mass of one mole of the element, expressed in grams per mole. They are numerically equal but have different units.

Question: What is pollination?

Answer: Pollination is the process of depositing matured pollen on the stigma of a flower of the same species, which can occur through self-pollination or cross-pollination.

Question: How are metals of low reactivity like silver, gold, and platinum found in nature?

Answer: Metals of low reactivity such as silver, gold, and platinum occur in nature as native metals mixed with other compounds and are extracted using physical methods to separate the mixtures.

Question: How does the reaction of iron with sulfur form iron sulfide?

Answer: Iron reacts with sulfur to form iron sulfide:  $\text{Fe} + \text{S} \rightarrow \text{FeS}$ , a compound formed by the combination of the two elements.

Question: What observations can be made when varying the concentration of hydrochloric acid in reactions with magnesium ribbon?

Answer: Higher concentrations of hydrochloric acid lead to faster gas evolution, indicating an increased reaction rate.

Question: How do nucleic acids control cellular activities?

Answer: The information to control cellular activities is present in DNA.

Question: How does atmospheric pressure influence the functioning of a straw?

Answer: Atmospheric pressure pushes liquid up a straw when the pressure inside the straw is reduced by sucking, allowing the liquid to rise against gravity.

Question: What is the significance of the Kelvin scale in measuring temperature?

Answer: The Kelvin scale is significant for scientific measurements because it starts at absolute zero, providing a direct relationship between temperature and thermal energy.

Question: What is the reaction between calcium and hydrochloric acid?

Answer: Calcium reacts with hydrochloric acid to form calcium chloride and hydrogen gas:  $\text{Ca} + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2$ .

Question: What is the significance of Avogadro's Law in gas behavior?

Answer: Avogadro's Law states that equal volumes of gases at the same temperature and pressure contain an equal number of molecules, crucial for understanding gas mixtures and reactions.

Question: What are periods in the Periodic Table?

Answer: Periods are horizontal rows in the Periodic Table.

Question: How does the electrochemical series help in predicting the feasibility of redox reactions?

Answer: The electrochemical series lists elements and their standard electrode potentials, helping predict the feasibility of redox reactions by indicating which species are more likely to be reduced or oxidized. A reaction is feasible if the cell potential is positive.

Question: What is the function of a salt bridge in an electrochemical cell?

Answer: A salt bridge in an electrochemical cell allows the flow of ions between the two half-cells to maintain electrical neutrality and complete the electrical circuit without mixing the different solutions.

Question: What are the products of the reaction between calcium carbonate and hydrochloric acid?

Answer: The reaction between calcium carbonate and hydrochloric acid produces calcium chloride, water, and carbon dioxide:  $\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$ .

Question: How does the magnetic effect of a current explain compass needle deflection?

Answer: The magnetic effect creates a field around the conductor, influencing the compass needle and causing it to deflect in the field's direction.

Question: How do mitochondria regulate cellular metabolism?

Answer: Mitochondria regulate cellular metabolism by producing ATP through aerobic respiration, controlling energy production, and modulating metabolic pathways.

Question: What are some examples of organisms in the Domain Archaea?  
Answer: Examples include Methanogens and Halophiles.

Question: What are the conventions adopted in electrolysis regarding the electrodes?

Answer: In electrolysis, the electrode connected to the positive terminal of the power supply is the anode (positive electrode), and the electrode connected to the negative terminal is the cathode (negative electrode). Positive ions migrate towards the cathode and undergo reduction, while negative ions migrate towards the anode and undergo oxidation.

Question: Give examples of rare inherited characteristics in humans.

Answer: Rare inherited characteristics include straight or curved thumbs, widow's peak, syndactyly, polydactyly, albinism, and variations in eye color.

Question: What adaptations do alveoli have for efficient gas exchange?

Answer: Alveoli have thin walls, moist surfaces, a rich blood supply, and a large number of sacs to maximize the surface area for gas exchange.

Question: What are the potential applications of synthetic biology?

Answer: Synthetic biology involves designing and constructing new biological parts, devices, and systems, with potential applications in medicine, agriculture, energy production, and environmental conservation.

Question: Describe the structure and function of the plasma membrane.

Answer: The plasma membrane is a phospholipid bilayer with embedded proteins, controlling the movement of substances in and out of the cell, and facilitating cell communication.

Question: What are the functions of intermediate filaments in a cell?

Answer: Intermediate filaments provide mechanical support, maintain cell shape, and stabilize the positions of organelles within the cell.

Question: What is the role of electrostatic attraction in the formation of ionic compounds?

Answer: Electrostatic attraction between oppositely charged ions is the driving force behind the formation of ionic compounds, holding the ions together in a stable structure.

Question: What is the relationship between current and magnetic field strength in a solenoid?

Answer: The field strength is directly proportional to the current and the number of coil windings, increasing with higher current and more windings.

Question: Why are energy pyramids always upright?

Answer: Energy pyramids are always upright because only 10% of the energy in a trophic level passes to the upper trophic level, with 90% of the energy dissipated to the environment.

Question: What is the chemical formula for sodium chloride?

Answer: The chemical formula for sodium chloride is NaCl.

Question: How is a nitrogen molecule (N<sub>2</sub>) formed through covalent bonding?

Answer: A nitrogen molecule (N<sub>2</sub>) is formed when two nitrogen atoms share three pairs of electrons, resulting in a triple bond that gives each atom a stable electronic configuration.

Question: What causes syphilis, and what are its symptoms?

Answer: Syphilis is caused by the bacterium *Treponema pallidum* and presents with painless blisters, fever, and throat pain. It can spread to other organs if untreated.

Question: What are gamma rays, and where do they originate?

Answer: Gamma rays are high-energy waves emitted by radioactive elements. They have extremely high frequencies and energies capable of penetrating thick steel and concrete.

Question: How do geneticists predict the outcomes of genetic crosses?

Answer: Geneticists use Punnett squares and probability calculations to predict the outcomes of genetic crosses, estimating the likelihood of different genotypes and phenotypes in offspring.

Question: What is the relative formula mass of sodium chloride (NaCl)?

Answer: The relative formula mass of sodium chloride is 58.5, calculated as 23 for sodium plus 35.5 for chlorine.

Question: What is the significance of the small intestine in digestion and absorption?

Answer: The small intestine is the primary site for nutrient digestion and absorption, facilitated by enzymes and villi that increase surface area.

Question: How do mitochondria produce ATP?

Answer: Mitochondria produce ATP through oxidative phosphorylation, where electrons are transferred through the electron transport chain, creating a proton gradient that drives ATP synthesis.

Question: What are pesticides?

Answer: Pesticides include weedicides, insecticides, and fungicides used to control pests in agriculture.

Question: What causes the sound of crickets?

Answer: Crickets produce sound by rubbing their wings together.

Question: How does a dimmer switch control the brightness of a light bulb?

Answer: A dimmer switch adjusts the voltage supplied to the light bulb, thereby controlling the amount of light emitted.

Question: What are the environmental benefits of using public transportation?

Answer: Public transportation reduces greenhouse gas emissions, lowers air pollution, decreases traffic congestion, and supports sustainable urban development. It contributes to environmental sustainability.

Question: What is fertilization in plants?

Answer: Fertilization in plants occurs when the male gamete in the pollen fuses with the ovum in the ovary, leading to the formation of a zygote.

Question: How do you investigate the equilibrium of a meter ruler under the action of three coplanar parallel forces?

Answer: Suspend the meter ruler horizontally using two rubber bands and spring balances at either end. Measure the forces exerted by the balances and compare them to the weight of the ruler to ensure they balance and maintain equilibrium.

Question: Explain the process of electrochemical polymerization and its applications.

Answer: Electrochemical polymerization involves the formation of conductive polymers on an electrode surface through the electrochemical oxidation or reduction of monomers. Applications include sensors, batteries, supercapacitors, and corrosion-resistant coatings.

Question: What is the chemical formula for calcium carbonate?

Answer: The chemical formula for calcium carbonate is  $\text{CaCO}_3$ .

Question: What is the role of calcium in the human body?

Answer: Calcium is essential for the growth of bones and teeth, blood clotting, proper function of nerves, and milk production.

Question: What are the features of invertebrates in the phylum Annelida?

Answer: Invertebrates in the phylum Annelida are triploblastic, have segmented bodies, bilateral symmetry, a coelom, and reproduce both asexually and sexually.

Question: What is the importance of dispersal of fruits and seeds?

Answer: Dispersal minimizes competition for resources, finds new habitats, increases diversity, and provides protection from pests and diseases.

Question: How does urbanization contribute to the urban heat island effect?

Answer: Urbanization increases heat absorption and retention due to concrete and asphalt surfaces, reducing vegetation, and higher energy consumption. It leads to higher temperatures in urban areas compared to surrounding rural areas.

Question: What is the principal focus of a convex mirror, and where is it located?

Answer: The principal focus of a convex mirror is the point from which reflected rays appear to diverge, located behind the mirror.

Question: Why does the rate of reaction differ under high and low pressure conditions for gases?

Answer: Higher pressure conditions result in more frequent collisions between reactant particles, increasing the rate of reaction.

Question: What is the formula for the moment of a couple of forces in a given scenario?

Answer: The formula for the moment of a couple of forces is  $\text{Moment} = \text{Force} \times \text{Perpendicular distance between the lines of action of the two forces}$ .

Question: Describe the equilibrium of a sphere suspended by a string in terms of forces.

Answer: The sphere is in equilibrium because the tension in the string balances the weight of the sphere. The forces are equal in magnitude, opposite in direction, and their lines of action are along the same line, resulting in no net force.

Question: What is the role of lysosomes in animal cells?

Answer: Lysosomes contain digestive enzymes that break down waste materials, cellular debris, and foreign invaders, playing a key role in cellular waste management.

Question: What is the principle "like dissolves like" in solubility?

Answer: The principle states that solutes dissolve best in solvents with similar polarity, meaning polar solutes dissolve in polar solvents, and non-polar solutes dissolve in non-polar solvents.

Question: What happens when two forces of equal magnitude act on an object in opposite directions?

Answer: The object remains in equilibrium and does not move.

Question: What are some examples of gymnosperms?

Answer: Examples of gymnosperms include Cycas and Pinus.

Question: Describe the structure of blood tissue.

Answer: Blood tissue consists of a fluid matrix called plasma, which contains red blood cells (erythrocytes), white blood cells (leucocytes), and cellular fragments called platelets.

Question: How can the heat change of a neutralization reaction be experimentally determined?

Answer: By mixing known concentrations of an acid and base, measuring the temperature change, and calculating the heat change using  $Q = mc\theta$ .

Question: How does the force on a current-carrying conductor change with magnetic field strength?

Answer: The force increases with stronger magnetic fields, as it is directly proportional to the magnetic field strength.

Question: How does the body maintain blood glucose levels?

Answer: Blood glucose levels are maintained by insulin and glucagon, which regulate the conversion of glucose to glycogen and vice versa.

Question: How do you balance a uniform rod with different weights using the principle of moments?

Answer: Balance the rod by adjusting the positions and magnitudes of the weights such that the moments on either side of the pivot are equal, resulting in equilibrium.



Question: What is the specific heat capacity of zinc?

Answer: The specific heat capacity of zinc is  $380 \text{ J kg}^{-1} \text{ K}^{-1}$ .

Question: What is the electronic configuration of boron?

Answer: The electronic configuration of boron is 2, 3.

Question: What is the role of a power amplifier in audio systems?

Answer: A power amplifier increases the power of audio signals, driving speakers to produce sound at higher volumes and with better clarity.

Question: What is the effect of temperature on the speed of sound?

Answer: As temperature increases, the speed of sound also increases due to faster movement of particles in the medium.

Question: How does temperature affect the kinetic energy of reactants?

Answer: Higher temperatures increase the kinetic energy of reactants, resulting in more frequent and energetic collisions, and a faster reaction rate.

Question: What is the function of platelets in blood?

Answer: Platelets aid in blood clotting by releasing thromboplastin, which helps form blood clots to prevent excessive bleeding.

Question: What is the difference between the mature part and the growing part of a root?

Answer: The mature part of a root is rough and dark-colored due to the presence of permanent tissues, while the growing part is soft and light-colored due to meristematic tissues.

Question: What happens when a zinc metal strip is placed in dilute sulfuric acid?

Answer: When a zinc metal strip is placed in dilute sulfuric acid, gas bubbles are liberated near the zinc strip, and the strip gradually dissolves as zinc atoms (Zn) go into solution as zinc ions ( $\text{Zn}^{2+}$ ), leaving electrons on the metal.

Question: What are the conditions for maintaining equilibrium in a system of forces acting on an object?

Answer: The conditions for maintaining equilibrium are that the forces must be coplanar, their lines of action must intersect at a common point, and the resultant of any two forces must be equal in magnitude and opposite in direction to the third force.

Question: How does the rate of change of the magnetic field affect the induced voltage?

Answer: A faster rate of change of the magnetic field induces a higher voltage, as the induced electromotive force is directly proportional to the rate of change.

Question: What is the electronic configuration of hydrogen?

Answer: The electronic configuration of hydrogen is 1.

Question: How is the total displacement of an object calculated if it undergoes multiple segments of motion in the same direction?

Answer: Total displacement is the sum of the magnitudes of all the segments.

Question: Describe how energy conservation applies to a pendulum.

Answer: In a pendulum, energy conservation means that the total mechanical energy (sum of potential and kinetic energy) remains constant, with energy transforming between kinetic and potential forms during the swing.

Question: What are the effects of biomagnification?

Answer: The effects of biomagnification include inborn defects, cancers, mental defects, and weakened immunity and reproductive systems in organisms.

Question: What is an ecological pyramid?

Answer: An ecological pyramid is a graphical representation of the number of organisms, biomass, or energy relationships in different trophic levels of an ecosystem.

Question: What are the features of vertebrates in the class Aves?

Answer: Vertebrates in the class Aves have a light bony endoskeleton, streamlined bodies, feathers covering their skin, beaks adapted for different modes of nutrition, eyes with eyelids, pentadactyle limbs (forelimbs converted into wings), a four-chambered heart, and are warm-blooded.

Question: What is the principle of operation of a liquid manometer in measuring pressure?

Answer: A liquid manometer measures pressure by comparing the heights of liquid columns in its two arms, with the difference indicating the pressure difference between the two points.

Question: Describe the reaction of aluminum with hydrochloric acid.

Answer: Aluminum reacts with hydrochloric acid to form aluminum chloride and hydrogen gas:  $2\text{Al} + 6\text{HCl} \rightarrow 2\text{AlCl}_3 + 3\text{H}_2$ .

Question: What is the surface area of one side of a small marble cube with a side of 1 cm?

Answer: The surface area of one side is  $1 \text{ cm}^2$  ( $1 \text{ cm} \times 1 \text{ cm}$ ).

Question: What are some common household bases and their uses?

Answer: Common household bases include baking soda (sodium bicarbonate) for baking and cleaning, and ammonia for cleaning.

Question: What are some instruments based on electromagnetic induction?

Answer: Instruments based on electromagnetic induction include the bicycle dynamo, moving coil microphone, and transformer.

Question: How is the growth of a multicellular organism measured?

Answer: The growth of a multicellular organism is measured by the increase in the number and size of cells, which is often quantified as an

irreversible increase in dry mass.

Question: What is the significance of sterilized conditions in tissue culture?

Answer: Sterilized conditions prevent contamination and ensure the successful growth of plant tissues in the culture medium.

Question: What is the principal axis in the context of a convex lens?

Answer: The principal axis is the line joining the centers of the spherical surfaces that form the convex lens.

Question: What are the features of invertebrates in the phylum Mollusca?

Answer: Invertebrates in the phylum Mollusca are triploblastic, soft-bodied animals with a body divided into head, visceral mass, and muscular foot, and some have internal and external shells made of  $\text{CaCO}_3$ .

Question: What is the current passing through a  $12\ \Omega$  resistor in a parallel circuit with a 6 V power supply?

Answer: The current is  $I = V/R = 6\text{ V}/12\ \Omega = 0.5\text{ A}$ .

Question: What is the significance of using three-pin plug sockets in modern electric circuits?

Answer: Three-pin plug sockets provide an earth connection, enhancing safety by preventing electric shocks and ensuring proper grounding of appliances.

Question: How is oxygen gas prepared by heating potassium nitrate?

Answer: Heating potassium nitrate decomposes it into potassium nitrite and oxygen gas:  $2\text{KNO}_3 \rightarrow 2\text{KNO}_2 + \text{O}_2$ .

Question: How does the specific heat capacity of a substance determine its use in thermal applications?

Answer: The specific heat capacity of a substance determines its use in thermal applications by indicating how much heat it can absorb or release, influencing its suitability for heating, cooling, and thermal storage purposes.

Question: What are some traditional varieties of paddy, and their benefits?

Answer: Traditional varieties of paddy include 'Kuruluthuda' (induces spermatogenesis, strengthens the body, reduces joint pain), 'Kahawanu' (facilitates digestion, prevents carcinogenic properties), 'Rathhal' (cures lung diseases, cleans urine and bile), and 'Madathawalu' (removes toxic metals, prevents diabetes, enhances immunity).

Question: Describe sustainable agricultural practices and their benefits for environmental management.

Answer: Sustainable agriculture focuses on using farming techniques that protect the environment, public health, human communities, and animal welfare. These practices aim to meet current food needs without compromising the ability of future generations to meet theirs. Here are some key sustainable agricultural practices: Multiple Cropping: This involves growing different crops on the same land rather than a single crop. It reduces the risk of total crop failure due to pests or diseases and improves pest resistance. Benefits: Enhances biodiversity, reduces pest

infestation, and improves soil health. Biological Pest Control: This method uses natural predators or parasites to control pests instead of chemical pesticides. For instance, the coconut caterpillar pest was controlled using a larval parasitoid. Benefits: Reduces chemical pesticide use, minimizes environmental pollution, and protects beneficial insects. Use of Organic Fertilizers: Organic fertilizers are made from decomposed plant and animal matter. They improve soil structure and enhance the activity of soil organisms. Benefits: Promotes healthy soil, reduces chemical runoff, and supports sustainable farming systems. Reforestation: Planting trees in deforested areas helps restore ecological balance. Reforestation is crucial for maintaining biodiversity, regulating the water cycle, and mitigating climate change. Benefits: Enhances carbon sequestration, restores habitats, and prevents soil erosion

Question: What factors affect gravitational potential energy?

Answer: Gravitational potential energy is affected by the mass of the object, gravitational acceleration, and the height of the object.

Question: What is the pressure at a depth of 1.5 m in a lake with a water density of  $1000 \text{ kg/m}^3$  and  $g = 10 \text{ m/s}^2$ ?

Answer: The pressure is 15,000 Pa, calculated as  $1.5 \text{ m} * 1000 \text{ kg/m}^3 * 10 \text{ m/s}^2$ .

Question: Explain the significance of carbon in organic compounds and describe the basic types of hydrocarbons.

Answer: Carbon is a fundamental element in organic chemistry due to its unique ability to form stable bonds with other carbon atoms and a variety of other elements such as hydrogen, oxygen, nitrogen, halogens, phosphorus, and sulfur. This versatility allows carbon to form a vast array of compounds, making it the backbone of organic chemistry. Organic compounds are primarily made up of carbon atoms in combination with these other elements, excluding carbon dioxide, carbon monoxide, carbonates, and bicarbonates, which are not considered organic. Hydrocarbons are the simplest organic compounds, consisting only of carbon and hydrogen atoms. They are classified into three main types based on the types of bonds between the carbon atoms: Alkanes: Alkanes are saturated hydrocarbons, meaning all the carbon-carbon bonds are single covalent bonds. This makes them relatively stable and less reactive compared to other hydrocarbons. The general formula for alkanes is  $\text{C}_n\text{H}_{2n+2}$ , where 'n' is the number of carbon atoms. Examples include methane ( $\text{CH}_4$ ), ethane ( $\text{C}_2\text{H}_6$ ), propane ( $\text{C}_3\text{H}_8$ ), butane ( $\text{C}_4\text{H}_{10}$ ), and pentane ( $\text{C}_5\text{H}_{12}$ ). Alkenes: Alkenes are unsaturated hydrocarbons containing at least one carbon-carbon double bond. This double bond makes them more reactive than alkanes. The simplest alkene is ethene ( $\text{C}_2\text{H}_4$ ), also known as ethylene, which has a double bond between its two carbon atoms. Alkynes: Alkynes are unsaturated hydrocarbons with at least one carbon-carbon triple bond. This triple bond imparts even more reactivity compared to alkenes. An example of an alkyne is ethyne ( $\text{C}_2\text{H}_2$ ), commonly known as acetylene, which is used in welding torches due to its high flame temperature.

Question: How does air pollution affect ecosystems?

Answer: Air pollution damages vegetation, reduces biodiversity, and disrupts nutrient cycles. It affects soil health, water quality, and overall ecosystem stability.

Question: How do you calculate the resistance of a bulb connected to a 12 V power supply with a current of 0.5 A?

Answer: Using Ohm's Law,  $R = V/I$ , the resistance is  $R = 12 \text{ V} / 0.5 \text{ A} = 24 \Omega$ .

Question: How do gene mutations lead to genetic disorders?

Answer: Gene mutations can alter the normal function of genes, leading to genetic disorders. These mutations can be inherited or occur spontaneously and may result in a variety of health conditions.

Question: What is the role of intercellular spaces in collenchyma tissue?

Answer: Intercellular spaces in collenchyma tissue, when present, allow for gas exchange and contribute to the tissue's flexibility and support functions.

Question: How is the Kingdom Animalia divided?

Answer: The Kingdom Animalia is divided into invertebrates (without a vertebral column) and vertebrates (with a vertebral column).

Question: What are reflex actions, and what are their types?

Answer: Reflex actions are sudden, involuntary responses to stimuli. They can be spinal reflexes (e.g., moving a hand from a hot surface) or cranial reflexes (e.g., sneezing).

Question: What is the specific heat capacity of aluminium?

Answer: The specific heat capacity of aluminium is  $900 \text{ J kg}^{-1} \text{ K}^{-1}$ .

Question: How is the equilibrium of a framed picture hanging on a wall achieved?

Answer: The equilibrium of a framed picture hanging on a wall is achieved by the tensions in the two strings ( $F_1$  and  $F_2$ ) balancing the weight of the picture ( $W$ ). These three forces are coplanar but not parallel, and their lines of action meet at a common point.

Question: What is the significance of cyclic and non-cyclic electron flow in the light reactions of photosynthesis?

Answer: Cyclic electron flow generates additional ATP without producing NADPH, while non-cyclic electron flow produces both ATP and NADPH, balancing energy requirements.

Question: How does the strength of the magnetic field affect the performance of a dynamo?

Answer: A stronger magnetic field increases the induced electromotive force, improving the dynamo's performance and electricity generation.

Question: What type of carriers conduct electricity in semiconductors?

Answer: In semiconductors, both electrons and holes act as carriers that conduct electricity.

Question: How is electromagnetic induction demonstrated?

Answer: Electromagnetic induction can be demonstrated by moving a magnet through a coil and observing the deflection in a connected galvanometer.

Question: What is the role of a radio telescope in astronomy?

Answer: A radio telescope receives radio waves emitted by distant stars and other celestial objects, helping astronomers study the universe.

Question: What happens when two groups pull a rope with equal forces in opposite directions?

Answer: When two groups pull a rope with equal forces in opposite directions, the rope remains at rest and does not move in either direction. This situation is known as equilibrium, where the sum of the forces is zero.

Question: What is the importance of the electromagnetic spectrum in remote sensing?

Answer: The electromagnetic spectrum allows remote sensing instruments to detect and measure various environmental and atmospheric parameters.

Question: How does the resistance of a conductor depend on its cross-sectional area?

Answer: The resistance of a conductor is inversely proportional to its cross-sectional area; a larger cross-sectional area results in lower resistance.

Question: What are monoecious plants?

Answer: Monoecious plants bear both staminate (male) and pistillate (female) flowers on the same plant, allowing for cross-pollination within the same plant.

Question: What are step-up and step-down transformers?

Answer: Step-up transformers increase the output voltage compared to the input voltage and have more turns in the secondary coil than the primary coil. Step-down transformers decrease the output voltage compared to the input voltage and have fewer turns in the secondary coil than the primary coil.

Question: How does the high specific heat capacity of water influence its use in cooling systems?

Answer: The high specific heat capacity of water allows it to absorb and store large amounts of heat energy, making it effective for use in cooling systems.

Question: What is the height fallen by a body in 4 seconds if it falls vertically down from rest?

Answer:  $\text{Height} = \frac{1}{2} \times (\text{Initial velocity} + \text{Final velocity}) \times \text{Time} = \frac{1}{2} \times (0 + 39.2 \text{ m/s}) \times 4 \text{ s} = 78.4 \text{ meters.}$

Question: What is the role of a watch glass in the extraction of plant compounds for chromatography?

Answer: A watch glass is used to collect and apply the plant extract to the chromatography paper accurately.

Question: How does the reaction of magnesium with hydrochloric acid demonstrate a single displacement reaction?

Answer: Magnesium displaces hydrogen from hydrochloric acid, forming magnesium chloride and hydrogen gas:  $\text{Mg} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$ .

Question: How is the displacement of particles in a transverse wave depicted?

Answer: The displacement of particles in a transverse wave is depicted as perpendicular to the direction of wave propagation, with crests and troughs indicating maximum and minimum displacements.

Question: What is the purpose of the galvanometer in demonstrating electromagnetic induction?

Answer: The galvanometer measures the induced current, indicating the presence and magnitude of electromagnetic induction in a circuit.

Question: How does epithelial tissue protect internal organs?

Answer: Epithelial tissue protects internal organs from pressure, friction, and microbial invasion by forming a protective barrier.

Question: How do you determine the direction of the moment of force?

Answer: The direction of the moment of force is determined by the direction of rotation it causes. A clockwise moment causes clockwise rotation, while an anti-clockwise moment causes anti-clockwise rotation.

Question: What is the valency of sulphur?

Answer: The valency of sulphur is 6 and 2.

Question: How is the chemical formula of ammonium phosphate written?

Answer: The chemical formula of ammonium phosphate is  $(\text{NH}_4)_3\text{PO}_4$ , indicating three ammonium ions and one phosphate ion.

Question: Explain the function of a transistor in electronic circuits.

Answer: A transistor functions as a switch or amplifier in electronic circuits by controlling the flow of current between its terminals using a small input current or voltage.

Question: How does velocity influence the kinetic energy of an object?

Answer: Velocity influences kinetic energy quadratically; increasing velocity increases kinetic energy by the square of the velocity.

Question: What is the significance of gene-environment interactions in health and disease?

Answer: Gene-environment interactions highlight how genetic factors and environmental influences work together to affect health and disease, demonstrating that both genetics and the environment play crucial roles in the development of traits and conditions.

Question: How much heat is required to increase the temperature of 500 g of glass from 25°C to 100°C?

Answer: The heat required is 31,500 J, calculated using the formula  $Q = mc\Delta T = 0.5 \times 840 \times (100 - 25)$ .

Question: How is aerial layering performed?

Answer: Aerial layering involves removing a ring of bark from a twig high above the ground, placing a mixture of compost and coir dust around the area, and tying it with polythene until roots develop.

Question: How does a loudspeaker convert electrical signals into sound waves?

Answer: A loudspeaker converts signals into sound by vibrating a coil and cone, generating sound waves that correspond to the electrical signal.

Question: What is the role of carbon brushes in an alternating current dynamo?

Answer: Carbon brushes maintain contact with the rotating brushing rings, allowing current to flow to the external circuit without wearing out quickly.

Question: How does the diaphragm contribute to the process of breathing?

Answer: The diaphragm contracts and flattens during inhalation, increasing the thoracic cavity's volume and drawing air into the lungs; it relaxes during exhalation, decreasing the volume and expelling air.

Question: Explain how a simple electrochemical cell can be constructed using zinc and copper strips, including the reactions at each electrode.

Answer: A simple electrochemical cell can be constructed using zinc and copper strips immersed in dilute sulfuric acid, connected by an external circuit. Construction: Materials Required: Beaker, zinc and copper strips, dilute sulfuric acid, connecting wires, ammeter. Method: Connect the zinc strip and the copper strip to the ammeter using connecting wires. Immerse the strips in the beaker containing dilute sulfuric acid. Observations: The ammeter shows a deflection, indicating an electric current. Zinc strip dissolves, and gas bubbles evolve at the copper strip. Reactions: At the Zinc Strip (Anode): Oxidation:  $\text{Zn(s)} \rightarrow \text{Zn}^{2+}(\text{aq}) + 2\text{e}^-$  Zinc atoms lose electrons and dissolve into the solution as zinc ions, making the zinc strip the negative terminal. At the Copper Strip (Cathode): Reduction:  $2\text{H}^+(\text{aq}) + 2\text{e}^- \rightarrow \text{H}_2(\text{g})$  Hydrogen ions gain electrons at the copper strip, forming hydrogen gas bubbles, making the copper strip the positive terminal. Overall Cell Reaction:  $\text{Zn(s)} + 2\text{H}^+(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{H}_2(\text{g})$  Conclusion: The flow of electrons from the zinc strip (anode) to the copper strip (cathode) through the external circuit generates an electric current. This setup demonstrates the basic operation of an electrochemical cell, where a chemical reaction produces electricity.

Question: How is the chemical formula of calcium hydroxide written?

Answer: The chemical formula of calcium hydroxide is  $\text{Ca(OH)}_2$ , indicating one calcium ion and two hydroxide ions.

Question: How does body temperature change during the menstrual cycle?

Answer: Body temperature slightly increases during the secretory phase of the menstrual cycle due to the influence of progesterone.

Question: What is the valency of hydrogen?



Answer: The valency of hydrogen is 1.

Question: How does the sharing of electrons result in the formation of a covalent bond?

Answer: The sharing of electrons allows atoms to achieve a stable electronic configuration, resulting in the formation of a covalent bond that holds the atoms together.

Question: How does the use of renewable energy sources reduce environmental impact?

Answer: Renewable energy sources generate electricity with minimal greenhouse gas emissions, reduce air and water pollution, and decrease dependency on fossil fuels. They support sustainable energy development.

Question: How does the efficiency of electric appliances impact energy consumption?

Answer: Efficient electric appliances convert more of the supplied energy into useful work, reducing overall energy consumption and lowering electricity bills.

Question: What is the principle behind the operation of a hydraulic press?

Answer: The principle behind a hydraulic press is that pressure applied to a confined fluid is transmitted undiminished in all directions, allowing a small force applied to a small piston to generate a larger force on a larger piston.

Question: Discuss the process of polymerization and describe the formation of polythene, including its properties and uses.

Answer: Polymerization is the chemical process in which small molecules called monomers link together to form large, chain-like molecules known as polymers. This process can occur through various mechanisms, including addition polymerization and condensation polymerization. Formation of Polythene: Polythene, also known as polyethylene, is formed through the addition polymerization of ethene (ethylene) molecules. In this process, the double bond in ethene molecules breaks, allowing multiple ethene molecules to link together, forming long chains. The polymerization reaction can be summarized as follows:  $n\text{CH}_2 = \text{CH}_2 \rightarrow [-\text{CH}_2-\text{CH}_2-]_n$ . Here, 'n' represents the number of ethene molecules that have polymerized to form the polythene chain. Properties of Polythene: Electrical insulator Impervious to water and air Light and durable Can withstand tensions Uses of Polythene: Making plastic bottles, toys, and polythene bags Producing garbage bins and hard plastic fibers Manufacturing various types of polythene tissues Polythene's versatility and durability make it a popular material in many everyday applications. However, its resistance to biodegradation poses environmental challenges, leading to efforts in developing biodegradable alternatives.

Question: How does high blood pressure affect the kidneys?

Answer: High blood pressure can damage blood vessels in the kidneys, impairing their ability to filter blood and leading to kidney disease.

Question: How does a phototransistor amplify light signals in optoelectronic applications?

Answer: A phototransistor amplifies light signals by converting light into an electrical current and using the transistor action to amplify the current, enhancing the sensitivity and response of optoelectronic applications.

Question: What is the speed of sound in water compared to air?

Answer: The speed of sound in water is about four times faster, approximately 1400 m/s, compared to 330 m/s in air.

Question: How does the amount of heat required to increase the temperature of different substances compare?

Answer: Different substances require different amounts of heat to increase their temperature due to their specific heat capacities. For the same mass and temperature change, substances with higher specific heat capacities require more heat.

Question: What are agrochemicals?

Answer: Agrochemicals are artificially synthesized chemicals used in agricultural practices, such as chemical fertilizers, weedicides, insecticides, and fungicides.

Question: What is the principle behind the operation of a hydraulic press?

Answer: The principle behind a hydraulic press is that pressure applied to a confined fluid is transmitted undiminished in all directions, allowing a small force applied to a small piston to generate a larger force on a larger piston.

Question: What is the venation pattern in monocot leaves?

Answer: Monocot leaves possess parallel venation.

Question: What is the role of a pivot point in the formation of a force couple in practical applications?

Answer: The pivot point provides a fixed point around which the object can rotate due to the action and reaction forces according to Newton's third law, facilitating the formation of a force couple.

Question: What is the importance of catalysts in everyday life?

Answer: Catalysts play a crucial role in various processes, such as food digestion, pollution control, and manufacturing of chemicals.

Question: How do covalent bonds contribute to the diversity of chemical compounds?

Answer: Covalent bonds contribute to the diversity of chemical compounds by allowing atoms to combine in various ways through electron sharing, forming a wide range of molecular structures.

Question: What is the relationship between force magnitude and the moment of force in rotational motion?

Answer: The moment of force in rotational motion is directly proportional to the magnitude of the applied force. An increase in force results in a larger moment, making it easier to rotate the object.

Question: What is the Nernst equation, and how is it used in electrochemistry?

Answer: The Nernst equation relates the cell potential to the concentrations of reactants and products, allowing the calculation of cell potential under non-standard conditions. It is given by  $E = E^\circ - (RT/nF) \ln(Q)$ , where  $E$  is the cell potential,  $E^\circ$  is the standard cell potential,  $R$  is the gas constant,  $T$  is the temperature,  $n$  is the number of electrons,  $F$  is the Faraday constant, and  $Q$  is the reaction quotient.

Question: What is the role of proteins as antibodies?

Answer: Antibodies produced in the body to protect against microorganisms are proteins.

Question: Describe the process of electroless plating and its applications.

Answer: Electroless plating is a chemical process that deposits a metal coating on a substrate without using an external electric current. It relies on a chemical reducing agent in the plating solution. Applications include corrosion protection, wear resistance, and improved conductivity in electronics.

Question: How does water contribute to the regulation of body temperature?

Answer: Water helps regulate body temperature through its high specific heat capacity, which allows it to absorb and release heat slowly, preventing rapid temperature fluctuations.

Question: What are semiconductors and which elements are commonly used as semiconductors?

Answer: Semiconductors are materials that have conductivity between conductors and insulators. Commonly used semiconductors are silicon (Si) and germanium (Ge).

Question: How does the water cycle contribute to the biosphere?

Answer: The water cycle distributes water, a vital resource, throughout the biosphere, supporting all forms of life.

Question: How do sound waves travel through air?

Answer: Sound waves travel through air as longitudinal waves, with particles oscillating back and forth in the direction of wave propagation.

Question: How do percussion instruments produce sound through vibrations?

Answer: Percussion instruments generate sound when their membranes, rods, or metal plates are struck, causing them to vibrate and produce sound waves.

Question: What role does the magnetic field play in the operation of a bicycle dynamo?

Answer: The magnetic field interacts with the rotating coil, inducing an electromotive force that generates electrical power for the bicycle's lights.

Question: What happens to the flower after fertilization?

Answer: After fertilization, the ovary develops into a fruit, the ovary wall becomes the pericarp, and the fertilized ovule develops into a seed.

Question: How does the use of pesticides affect soil health?

Answer: The use of pesticides affects soil health by killing beneficial soil microorganisms, disrupting soil nutrient cycles, and reducing soil fertility.

Question: How does the principle of pressure transmission apply to a hydraulic jack?

Answer: A hydraulic jack operates on the principle of pressure transmission, where a small force applied to a small piston generates pressure in the oil, which is transmitted to a larger piston, lifting the vehicle.

Question: Why does the temperature decrease when solid ammonium chloride dissolves in water?

Answer: The temperature decreases because of the absorption of heat, indicating an endothermic reaction.

Question: How are visible light waves used in everyday life?

Answer: Visible light waves are used for illumination, vision, photography, and various optical devices such as microscopes and telescopes.

Question: Where are protons and neutrons located in an atom?

Answer: Protons and neutrons are located in the nucleus at the center of an atom.

Question: What happens to the induced current when the coil in a dynamo is parallel to the magnetic field?

Answer: When the coil is parallel to the magnetic field, the induced current becomes zero as there is no intersection of field lines.

Question: How does the electronic configuration of chlorine influence its ability to form ionic and covalent bonds?

Answer: The electronic configuration of chlorine (2, 8, 7) makes it highly reactive, allowing it to gain an electron to form ionic bonds or share electrons to form covalent bonds, achieving a stable configuration.

Question: State Newton's first law of motion.

Answer: Newton's first law of motion states that a body at rest remains stationary, and a body in motion continues to move at a uniform velocity unless acted upon by an unbalanced force.

Question: How do the afferent and efferent arterioles regulate blood pressure in the glomerulus?

Answer: The afferent arteriole brings blood to the glomerulus, while the efferent arteriole carries it away, creating high pressure for ultrafiltration due to the smaller diameter of the efferent arteriole.

Question: Calculate the gravitational potential energy of a 7.5 kg object at a height of 4 m.

Answer: The potential energy is 300 Joules (J).

Question: How does the specific heat capacity of mercury make it suitable for use in thermometers?

Answer: Mercury's specific heat capacity allows it to respond quickly to temperature changes, making it suitable for accurate and rapid temperature measurements in thermometers.

Question: What are the kingdoms in the Domain Eukarya?

Answer: The kingdoms in the Domain Eukarya are Protista, Fungi, Plantae, and Animalia.

Question: What is the mean speed of an object that has traveled 45 km in 1.5 hours?

Answer: Mean speed =  $45 \text{ km} / 1.5 \text{ hours} = 30 \text{ km/h}$ .

Question: How does the efficiency of an electric iron affect energy consumption?

Answer: The efficiency of an electric iron affects energy consumption by determining how much of the supplied electric energy is converted into useful heat for ironing clothes.

Question: What are the functions of the endocrine system?

Answer: The endocrine system regulates metabolism, growth, reproduction, and stress responses through hormone secretion.

Question: What are the deficiency symptoms of vitamin B?

Answer: Deficiency symptoms of vitamin B include beriberi, anemia, dryness of skin, change in complexion, and reduced antibody production.

Question: How does Newton's third law apply to the motion of a jet plane?

Answer: In a jet plane, the expulsion of exhaust gases (action) generates a force that propels the plane forward (reaction) due to the equal and opposite force exerted by the gases.

Question: What is the electronic configuration of an element with atomic number 16?

Answer: The electronic configuration is 2, 8, 6 for an element with atomic number 16 (Sulfur).

Question: How does the weight of an object in water compare to its weight in air?

Answer: The weight of an object in water is less than its weight in air because the upthrust exerted by the water reduces the apparent weight of the object.

Question: What occurs when zinc reacts with copper sulfate solution?

Answer: Zinc displaces copper from copper sulfate, forming zinc sulfate and copper:  $\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$ .

Question: What is the specific heat capacity of aluminium?

Answer: The specific heat capacity of aluminium is  $900 \text{ J kg}^{-1} \text{ K}^{-1}$ .

Question: How does muscle tissue respond to nervous stimuli?

Answer: Muscle tissue contracts in response to nervous stimuli, enabling movement, posture maintenance, and involuntary actions like heartbeat and digestion.

Question: What is the importance of cleanliness in preparing standard solutions?

Answer: Clean equipment prevents contamination and ensures the accuracy of the solution's concentration.

Question: Describe the nucleus according to Rutherford's model.

Answer: The nucleus is a very small, positively charged area at the center of the atom, containing protons and neutrons.

Question: What is the role of the heart in blood circulation?

Answer: The heart pumps blood throughout the body, ensuring oxygen and nutrients reach tissues while removing waste products.

Question: What are the features of invertebrates in the phylum Cnidaria?

Answer: Invertebrates in the phylum Cnidaria are aquatic, mostly marine, diploblastic with a coelenteron, have radial symmetry, and are predators with nematocysts.

Question: What is the resultant force if two forces of 10 N and 6 N act in opposite directions?

Answer: The resultant force is 4 N in the direction of the 10 N force.

Question: How do you prepare a 1 mol/dm<sup>3</sup> solution of calcium chloride?

Answer: Weigh the required mass of CaCl<sub>2</sub>, dissolve it in water, and adjust the final volume in a volumetric flask.

Question: How do mitochondria produce ATP?

Answer: Mitochondria produce ATP through oxidative phosphorylation, where electrons are transferred through the electron transport chain, creating a proton gradient that drives ATP synthesis.

Question: How do covalent bonds contribute to the diversity of chemical compounds?

Answer: Covalent bonds contribute to the diversity of chemical compounds by allowing atoms to combine in various ways through electron sharing, forming a wide range of molecular structures.

Question: How can pH papers be used to determine the strength of acids and bases?

Answer: By dipping pH paper in a solution and comparing the color change to a reference chart, one can estimate the pH and strength of the solution.

Question: What is the electronic configuration of silicon?

Answer: The electronic configuration of silicon is 2, 8, 4.

Question: What is the function of mucus in the digestive tract?

Answer: Mucus lubricates food, eases its passage, and protects the inner lining of the digestive tract from digestive enzymes.

Question: What are some examples of amphibians?

Answer: Examples of amphibians include Toad, Frog, and Salamander.

Question: What is the atomic number of sulphur?

Answer: The atomic number of sulphur is 16.

Question: How do potassium and fluorine atoms achieve a stable electronic configuration in potassium fluoride?

Answer: Potassium atoms lose electrons to form  $K^+$  ions, and fluorine atoms gain electrons to form  $F^-$  ions. The electrostatic attraction between these ions forms potassium fluoride (KF).

Question: What type of image is formed by a concave mirror when the object is placed at the center of curvature?

Answer: The image is real, inverted, and the same size as the object, formed at the center of curvature.

Question: How is the Kingdom Animalia divided?

Answer: The Kingdom Animalia is divided into invertebrates (without a vertebral column) and vertebrates (with a vertebral column).

Question: What is the purpose of a solar cell in renewable energy systems?

Answer: A solar cell converts sunlight into electrical energy through the photovoltaic effect, providing a renewable and sustainable source of electricity for various applications.

Question: Provide an example to illustrate Newton's second law.

Answer: If a 5 kg mass is given an acceleration of  $2 \text{ m/s}^2$ , the required force is  $F=ma=5 \times 2=10 \text{ N}$ .

Question: What is the chemical formula for potassium fluoride?

Answer: The chemical formula for potassium fluoride is KF.

Question: What are the environmental impacts of using synthetic fertilizers in agriculture?

Answer: The environmental impacts of using synthetic fertilizers in agriculture include soil degradation, water pollution from nutrient runoff, and the disruption of natural nutrient cycles.

Question: Items required: three segments of nichrome wire of length 1 m having different cross-sectional areas, a copper wire segment and several segments of iron wires with the same length as the nichrome wires and having a cross-sectional area equal to the nichrome wire with the lowest cross-sectional area, two dry cells, an ammeter, a switch, a board of wood with a length of about 1 m and a breadth of about 20 cm. Connect the circuit shown in Figure 19.19 using the items above. Connect the terminal X to the end of each conductor and record the current passing through each conductor. How do you set up the circuit for Activity 19.4 to study factors affecting resistance?

Answer: Connect the terminals of different conductors to the circuit, measure the current passing through each conductor, and observe the effects of different cross-sectional areas and lengths.

Question: What is the chemical formula for calcium carbonate?

Answer: The chemical formula for calcium carbonate is  $\text{CaCO}_3$ .

Question: What is the relationship between frequency and pitch?

Answer: Higher frequencies result in higher pitches, while lower frequencies produce lower pitches.

Question: Describe the function of an electric timer switch.

Answer: An electric timer switch controls the operation of appliances by turning them on or off at pre-set times, improving energy efficiency and convenience.

Question: How can the ring in the provided diagram be brought to rest when the resultant force of the two spring balances is known?

Answer: To bring the ring to rest, adjust the forces applied by the spring balances so that their magnitudes are equal and opposite in direction, resulting in a zero resultant force.

Question: What causes herpes, and what are its symptoms?

Answer: Herpes is caused by the virus Herpes simplex and is characterized by painful blisters on sex organs and nervous system inactivation.

Question: How do calcium and carbonate ions combine to form calcium carbonate?

Answer: Calcium ions ( $\text{Ca}^{2+}$ ) and carbonate ions ( $\text{CO}_3^{2-}$ ) combine through electrostatic attraction to form calcium carbonate ( $\text{CaCO}_3$ ) with ionic bonds.

Question: How do vaccines work?

Answer: Vaccines stimulate the immune system to produce memory cells and antibodies against specific pathogens, providing immunity.

Question: What are the effects of the parasympathetic nervous system?

Answer: It counteracts the sympathetic system by reducing heart rate, constricting pupils, and increasing digestion, among other effects.

Question: How do percussion instruments generate sound through vibrations?

Answer: Percussion instruments produce sound when their membranes, rods, or metal plates are struck, causing them to vibrate and generate sound waves.

Question: What is the principle behind the operation of a bicycle dynamo?

Answer: The principle behind a bicycle dynamo is electromagnetic induction, where mechanical rotation induces an electromotive force in the coil.

Question: Describe the concept of instantaneous velocity.

Answer: Instantaneous velocity is the velocity of an object at a specific point in time, measured as the rate of change of displacement at that instant.

Question: What is the role of the retina in the human eye?

Answer: The retina detects light and converts it into electrical signals sent to the brain for visual perception.



Question: How does a proximity sensor detect the presence of objects?

Answer: A proximity sensor detects the presence of objects by emitting an electromagnetic field or light beam and sensing changes when an object enters the field or reflects the light.

Question: What is the significance of the electromagnetic spectrum in modern technology?

Answer: The electromagnetic spectrum enables various technologies, including communication, medical imaging, and remote sensing.

Question: What is the significance of removing insulation from only one side of the coil in a simple DC motor?

Answer: Removing insulation from only one side ensures that current flows in one direction during half a cycle, preventing the coil from rotating in the opposite direction during the second half of the cycle.

Question: How is the chemical formula of sodium oxide written?

Answer: The chemical formula of sodium oxide is  $\text{Na}_2\text{O}$ , indicating two sodium ions and one oxide ion.

Question: How is carbon dioxide prepared in the laboratory?

Answer: Carbon dioxide is prepared by reacting calcium carbonate with dilute hydrochloric acid and collecting the gas by downward displacement of water.

Question: How does water scarcity impact the environment and human populations?

Answer: Water scarcity impacts the environment by reducing water availability for ecosystems and affects human populations by limiting access to clean water for drinking, agriculture, and sanitation.

Question: How do you calculate the moment of a force applied to a stick with a loop and Newton balance?

Answer: Calculate the moment by multiplying the applied force by the perpendicular distance from the axis of rotation to the line of action of the force, measured using the loop and Newton balance.

Question: What is the tolerance of a resistor?

Answer: The tolerance of a resistor indicates the range within which the actual resistance value can vary from the nominal value. It is expressed as a percentage and is indicated by the fourth color band.

Question: What are the characteristics of organisms in the Domain Bacteria?

Answer: Organisms in the Domain Bacteria are prokaryotes, sensitive to antibiotics, and can be pathogenic. They are found everywhere in the environment.

Question: How does the presence of impurities affect the performance of an electrochemical cell?

Answer: The presence of impurities can affect the performance of an electrochemical cell by interfering with electrode reactions, causing side reactions, reducing conductivity, and leading to electrode degradation.

Purity of materials is crucial for optimal cell performance.

Question: What are the distinguishing features of xylem tracheids compared to vessel elements?

Answer: Xylem tracheids are elongated, spindle-shaped cells with tapered ends, providing support and water transport, while vessel elements are cylindrical cells forming continuous tubes for water transport

Question: What factors contribute to the efficiency of modern electric cookers?

Answer: Factors contributing to the efficiency of modern electric cookers include better heat transfer, reduced heat loss, and advanced technologies like induction heating.

Question: What is the resultant force when two forces of 8 N and 16 N act on a trolley?

Answer: The resultant force is 24 N.

Question: What changes occur in the fetus during the fourth month of development?

Answer: During the fourth month, the fetus starts developing a skeleton and hair begins to grow.

Question: What is the function of the collecting duct in the nephron?

Answer: The collecting duct transports urine from the nephrons to the renal pelvis, where it is collected before being transported to the bladder.

Question: How do you calculate the moment of a force applied to a stick pivoted at one end?

Answer: Calculate the moment by multiplying the applied force by the perpendicular distance from the pivot point to the line of action of the force (Moment = Force  $\times$  Perpendicular distance).

Question: What is the kinetic energy of a 4 kg object moving at 2 m/s?

Answer: The kinetic energy is 8 Joules (J).

Question: How do you determine the equilibrium of an object under the action of two forces using a ring and spring balances?

Answer: Attach the spring balances to the ring and pull in opposite directions with varying forces. The object remains in equilibrium when the forces are equal in magnitude and opposite in direction, resulting in no net movement.

Question: What is the distance traveled by an object moving at 4 m/s for 10 seconds?

Answer: The distance is 40 m.

Question: Describe the function of a thermistor in temperature control circuits.

Answer: A thermistor is a temperature-sensitive resistor whose resistance changes significantly with temperature, used in temperature control and sensing applications.

Question: How does the electrochemical reduction of nitrogen to ammonia contribute to sustainable agriculture?

Answer: The electrochemical reduction of nitrogen to ammonia provides a sustainable alternative to the Haber-Bosch process by using renewable electricity to produce ammonia, reducing greenhouse gas emissions and energy consumption associated with conventional ammonia production.

Question: How do the structural characteristics of collenchyma cells support their function?

Answer: The thickened cell walls of collenchyma cells provide mechanical strength and flexibility, supporting the plant body during growth and development.

Question: Describe the function of alveoli in the lungs.

Answer: Alveoli are tiny air sacs where gas exchange occurs, with oxygen diffusing into blood capillaries and carbon dioxide diffusing out to be exhaled.

Question: What is an environmental impact assessment (EIA)?

Answer: An environmental impact assessment (EIA) is a process that evaluates the potential environmental effects of proposed projects or activities before they are carried out.

Question: How do you investigate the effect of perpendicular distance on the moment of force using a stick and Newton balance?

Answer: Investigate the effect by attaching a loop and Newton balance to different points on the stick, applying a constant force, and measuring the distance required to initiate rotation.

Question: Who discovered cells and in what year?

Answer: Robert Hooke discovered cells in 1665 when he observed a section of cork using a microscope.

Question: What is the function of the cytoplasm in cells?

Answer: The cytoplasm is the gel-like substance within the cell that houses organelles and facilitates the movement of materials and biochemical reactions.

Question: What components are essential for the operation of a bicycle dynamo?

Answer: Essential components of a bicycle dynamo include the rotating coil, magnetic field, mechanical connection to the tire, and electrical circuit.

Question: What factors affect the resistance of a conductor?

Answer: The resistance of a conductor depends on the area of cross-section, length, and material composition of the conductor.

Question: What are vitamins and their types?

Answer: Vitamins are organic compounds important in bio-chemical reactions, classified into water-soluble (B and C) and fat-soluble (A, D, E, and K) vitamins.

Question: What is the role of a potentiostat in conducting electrochemical experiments?

Answer: A potentiostat controls the potential of the working electrode relative to a reference electrode while measuring the current flow, allowing precise control and analysis of electrochemical reactions, kinetics, and mechanisms.

Question: How do ionic compounds behave in water?

Answer: Ionic compounds dissolve in water by dissociating into their constituent ions, which are then surrounded by water molecules, allowing the solution to conduct electricity.

Question: What is the balanced chemical equation for the reaction between sodium and oxygen?

Answer: The balanced chemical equation for sodium reacting with oxygen is:  $4\text{Na} + \text{O}_2 \rightarrow 2\text{Na}_2\text{O}$ .

Question: What is the role of the placenta?

Answer: The placenta facilitates the exchange of nutrients, oxygen, and waste products between the mother and the developing fetus through the umbilical cord.

Question: How do you find the total resistance of a circuit with a combination of series and parallel resistors?

Answer: Calculate the equivalent resistance of the parallel components first, then add the series resistances to find the total resistance of the circuit.

Question: How is the relative molecular mass of a compound calculated?

Answer: The relative molecular mass of a compound is calculated by summing the relative atomic masses of all the atoms in the molecule.

Question: How does an ion-selective electrode work?

Answer: An ion-selective electrode measures the concentration of specific ions in a solution by generating a potential difference that is proportional to the ion concentration, providing selective and sensitive detection.

Question: Write the balanced chemical equation for the complete combustion of butane.

Answer: The balanced chemical equation for the complete combustion of butane is  $2\text{C}_4\text{H}_{10} + 13\text{O}_2 \rightarrow 8\text{CO}_2 + 10\text{H}_2\text{O}$ .

Question: How many chromosomes are present in human cells?

Answer: Human cells contain 46 chromosomes, or 23 pairs. Out of these, 22 pairs are autosomal chromosomes, and the remaining pair consists of sex chromosomes.

Question: How is the resultant force of two parallel forces acting along the same direction demonstrated?

Answer: It is demonstrated by using Newton balances and a strip of wood to show that the sum of the forces from two balances is equal to the force measured by a third balance.

Question: What is the significance of the resultant force in practical applications?

Answer: The resultant force allows the effective use of multiple small forces to achieve the effect of a single large force.

Question: Describe the operation of a photodiode in optical sensing.

Answer: A photodiode converts light into an electrical current by generating electron-hole pairs when exposed to light, used in optical sensing and communication applications.

Question: What is the chemical formula for magnesium sulfide?

Answer: The chemical formula for magnesium sulfide is  $\text{MgS}$ .

Question: What is the purpose of a pressure transducer in industrial applications?

Answer: A pressure transducer converts pressure into an electrical signal, allowing for precise monitoring and control of pressure in industrial systems.

Question: How do you measure the resistance of a resistor using a multimeter?

Answer: Set the multimeter to the resistance ( $\Omega$ ) mode, connect the probes to the resistor's terminals, and read the resistance value displayed on the multimeter.

Question: How do you calculate the mean velocity of an object with varying displacements over time?

Answer: Mean velocity = Total displacement / Total time.

Question: What are inherited characteristics?

Answer: Inherited characteristics are features that are transmitted from one generation to the next, allowing species to be identified separately.

Question: What is the purpose of an energy meter in households?

Answer: An energy meter measures the amount of electrical energy consumed by household appliances, providing data for billing and energy management.

Question: Explain the function of an operational amplifier (op-amp) in analog signal processing.

Answer: An op-amp amplifies the difference between two input voltages, providing high gain and stability for various analog signal processing applications.

Question: What is the function of the renal artery in the urinary system?

Answer: The renal artery supplies oxygenated blood to the kidneys, which is filtered to form urine.

Question: Explain the process of mitosis.

Answer: Mitosis is a type of cell division that produces two identical daughter cells with the same number of chromosomes as the parent cell, involving stages like prophase, metaphase, anaphase, and telophase.

Question: What is the principle behind the operation of a hydraulic press?

Answer: The principle behind a hydraulic press is that pressure applied to a confined fluid is transmitted undiminished in all directions, allowing a small force applied to a small piston to generate a larger force on a larger piston.

Question: How does potential energy change when an object is moved vertically?

Answer: Potential energy increases when an object is moved vertically upwards, as work is done against gravity.

Question: What is the importance of indicating the physical state of reactants and products in heat change calculations?

Answer: It ensures accuracy, as the heat change can vary with different physical states of the substances involved.

Question: How does the electronic configuration of chlorine influence its bonding behavior?

Answer: The electronic configuration of chlorine (2, 8, 7) makes it highly reactive, as it needs to gain one electron to achieve a stable configuration, readily forming bonds with other elements.

Question: What are the characteristics of organisms in the Kingdom Fungi?

Answer: Organisms in the Kingdom Fungi have chitinous cell walls, eukaryotic cellular organization, and can be unicellular or multicellular. They contribute to decomposing organic matter and form symbiotic associations.

Question: How do you apply a couple of forces to rotate a steering wheel?

Answer: Apply a couple of forces by using both hands to exert equal and opposite forces on opposite sides of the steering wheel, creating a moment that rotates the wheel.

Question: What hormones regulate chemical coordination in the body?

Answer: Hormones secreted into the blood from endocrine glands regulate chemical coordination.

Question: How do lenses aid in the function of telescopes?

Answer: Telescopes use lenses to gather and focus light from distant objects, enabling detailed observation of celestial bodies.

Question: How is the energy level diagram for an endothermic reaction represented?

Answer: Reactants at a lower energy level than products, with energy absorbed.

Question: Place the trolley on a table and fix two pieces of string to the two ends of the trolley. Allow the other ends of the pieces of string to pass over the two pulleys and attach two Newton balances A and B. Record your observations on the motion of the trolley after applying a 4 N force on each balance. Record your observations on the motion of the trolley after applying a 4 N force on the balance A and a 6 N force on balance B. Repeat the above step. How is the resultant of two collinear forces acting in opposite directions demonstrated in this Activity?

Answer: It is demonstrated by using Newton balances and a trolley to show that the resultant force is the difference between the two forces.

Question: How does the use of renewable energy sources enhance the sustainability of electrochemical processes?

Answer: The use of renewable energy sources enhances the sustainability of electrochemical processes by providing clean and abundant energy, reducing reliance on fossil fuels, lowering carbon emissions, and enabling the development of environmentally friendly technologies.

Question: How do lenses in cameras focus light?

Answer: Camera lenses adjust their curvature and position to focus light on the film or sensor, capturing clear images.

Question: How does the periodic table help in predicting the types of bonds an element will form?

Answer: The periodic table helps in predicting the types of bonds an element will form based on its position, which indicates its valence electrons and reactivity.

Question: How do you safely disconnect a power source from a circuit?

Answer: Safely disconnect a power source by turning off the power switch or unplugging the power supply before handling the circuit.

Question: How much heat is required to increase the temperature of 6 kg of copper by 20 K?

Answer: The heat required is 48,000 J, calculated using the formula  $Q = mc\Delta T = 6 \times 400 \times 20$ .

Question: What is the relationship between specific heat capacity and thermal inertia?

Answer: Specific heat capacity and thermal inertia are related; substances with high specific heat capacities have high thermal inertia, meaning they resist temperature changes and require more heat to alter their temperature.

Question: What is the resultant force of two parallel forces acting along the same direction?

Answer: The resultant force is the sum of the two forces.

Question: What is the principle behind the operation of a hydraulic press?

Answer: The principle behind a hydraulic press is that pressure applied to a confined fluid is transmitted undiminished in all directions, allowing a small force applied to a small piston to generate a larger force on a larger piston.

Question: Describe the function of dendrites in a neuron.

Answer: Dendrites receive signals from other neurons or sensory receptors and transmit these signals to the neuron's cell body.

Question: What is observed when solid ammonium chloride dissolves in water?

Answer: The temperature falls due to the absorption of heat, indicating an endothermic reaction.

Question: What is fossilization in the context of the carbon cycle?

Answer: Fossilization is the process by which carbon in dead plants and animals converts into fossil fuels over millions of years.

Question: How do corrective lenses work for nearsightedness?

Answer: Corrective lenses for nearsightedness use concave lenses to diverge light rays before they enter the eye, aiding in clear vision of distant objects.

Question: What are the effects of chronic kidney disease (CKD) on the cardiovascular system?

Answer: CKD can lead to hypertension, increased risk of heart attack and stroke, and vascular calcification due to impaired kidney function.

Question: What is the displacement of an object that moves 5 m/s for 3 seconds?

Answer: The displacement is 15 m.

Question: How does electromagnetic induction enable the operation of a moving coil microphone?

Answer: Electromagnetic induction enables the microphone to convert sound waves into electrical signals by inducing a current in the vibrating coil.

Question: How do you express the composition of a solution in terms of mass/volume (m/v)?

Answer:  $m/v = \text{Mass of solute} / \text{Volume of solution}$ .

Question: What is the purpose of the galvanometer in demonstrating electromagnetic induction?

Answer: The galvanometer measures the induced current, indicating the presence and magnitude of electromagnetic induction in a circuit.

Question: Describe the structure and function of the plasma membrane.

Answer: The plasma membrane is a phospholipid bilayer with embedded proteins, controlling the movement of substances in and out of the cell and facilitating cell communication.

Question: What is the role of ultrasound in the communication and navigation of dolphins?

Answer: Dolphins use ultrasound waves to communicate, locate prey, and avoid predators by emitting and receiving ultrasound signals.

Question: Explain the function of the central vacuole in plant cells.

Answer: The central vacuole stores nutrients, waste products, and pigments, maintains turgor pressure for structural support, and contributes to cell growth by expanding.

Question: How do intermolecular forces influence the properties of substances like water and ethanol?

Answer: Intermolecular forces influence properties like boiling point, surface tension, and solubility in substances like water and ethanol by



determining the strength of attraction between molecules.

Question: What is the principle behind the operation of a bicycle dynamo?

Answer: The principle behind a bicycle dynamo is electromagnetic induction, where mechanical rotation induces an electromotive force in the coil.

Question: How does the release of nitrogen oxides (NO<sub>x</sub>) contribute to ground-level ozone formation?

Answer: Nitrogen oxides react with volatile organic compounds (VOCs) in the presence of sunlight to form ground-level ozone, a harmful pollutant that affects human health and the environment.

Question: What is the chemical formula for calcium carbonate?

Answer: The chemical formula for calcium carbonate is CaCO<sub>3</sub>.

Question: How does the wavelength of a sound wave affect its propagation?

Answer: Longer wavelengths can travel further and around obstacles more easily, while shorter wavelengths are more directional.

Question: What is the difference between evaporation and boiling in the process of vaporization?

Answer: Evaporation is the gradual conversion of a liquid to gas at temperatures below the boiling point, occurring only at the liquid's surface, while boiling is the rapid conversion of a liquid to gas at its boiling point, occurring throughout the liquid.

Question: What occurs when iron reacts with copper sulfate solution?

Answer: Iron displaces copper from copper sulfate, forming iron sulfate and copper:  $\text{Fe} + \text{CuSO}_4 \rightarrow \text{FeSO}_4 + \text{Cu}$ . The solution changes color, and a brown copper deposit forms.

Question: How is salt produced in salterns?

Answer: By evaporating seawater in tanks, causing dissolved salts to precipitate at different stages based on their solubility.

Question: What is the equivalent resistance of a circuit with resistors of 10 Ω, 15 Ω, and 20 Ω connected in series?

Answer: The equivalent resistance is  $R = 10\ \Omega + 15\ \Omega + 20\ \Omega = 45\ \Omega$ .

Question: What is the specific heat capacity of aluminium?

Answer: The specific heat capacity of aluminium is  $900\ \text{J kg}^{-1}\ \text{K}^{-1}$ .

Question: How do you determine the direction of the moment of force in a given scenario?

Answer: Determine the direction of the moment of force by observing whether the applied force causes clockwise or anti-clockwise rotation and classifying the moment accordingly.

Question: Describe the function of the endoplasmic reticulum in lipid synthesis.

Answer: The smooth endoplasmic reticulum synthesizes lipids, including phospholipids and steroids, and transports them within the cell, contributing to membrane formation and maintenance.

Question: What is exocytosis, and why is it important?

Answer: Exocytosis is the process by which cells expel materials in vesicles, merging with the plasma membrane to release their contents outside the cell, essential for secretion of hormones and waste removal.

Question: What is fertilization in plants?

Answer: Fertilization in plants occurs when the male gamete in the pollen fuses with the ovum in the ovary, resulting in the formation of a zygote that develops into an embryo.

Question: What is the role of the pole in spherical mirrors?

Answer: The pole is the midpoint of the mirror's surface and serves as the reference point for measuring distances along the principal axis.

Question: How do hydrogen bonds affect the behavior of water at different temperatures?

Answer: Hydrogen bonds affect the behavior of water at different temperatures by requiring significant energy to break, influencing water's high boiling point and specific heat capacity, and the expansion of water when it freezes into ice.

Question: How does temperature affect the conductivity of intrinsic semiconductors?

Answer: In intrinsic semiconductors, an increase in temperature increases the number of free electrons and holes by breaking more covalent bonds, thereby increasing the conductivity.

Question: How does the speed of electromagnetic waves change in different materials?

Answer: The speed of electromagnetic waves decreases in materials compared to a vacuum, depending on the material's refractive index.

Question: How do fungi obtain energy?

Answer: Fungi obtain energy by decomposing organic matter and absorbing nutrients through their hyphae, often forming symbiotic relationships with other organisms.

Question: What is the historical importance of Oersted's discovery of the magnetic effect of current?

Answer: Oersted's discovery established the relationship between electricity and magnetism, leading to the development of electromagnetic theory and technology.

Question: What is the role of solubility in environmental science?

Answer: Solubility determines the distribution, mobility, and impact of pollutants and nutrients in the environment, influencing ecosystem health.

Question: How is an exothermic reaction represented in a simple equation?

Answer:  $\text{Reactants} \rightarrow \text{Products} + \text{Heat}$ .

Question: How does the electronic configuration of carbon influence the formation of covalent bonds?

Answer: The electronic configuration of carbon (2, 4) allows it to form four covalent bonds by sharing its electrons with other atoms, enabling the formation of various organic compounds.

Question: How can the heat of reaction for solid sodium hydroxide be different from its aqueous solution?

Answer: The physical state affects the heat change, resulting in different values for solid and aqueous sodium hydroxide.

Question: What does a horizontal line on a displacement-time graph represent?

Answer: It represents that the object is at rest.

Question: What does the equation  $Q = mc\theta$  represent in the context of heat changes in reactions?

Answer: It represents the calculation of heat change ( $Q$ ) based on mass ( $m$ ), specific heat capacity ( $c$ ), and temperature change ( $\theta$ ).

Question: How is a hydrogen chloride (HCl) molecule formed?

Answer: A hydrogen chloride (HCl) molecule is formed when a chlorine atom shares a pair of electrons with a hydrogen atom.

Question: What is the relationship between mass and heat capacity?

Answer: The heat capacity of an object is directly proportional to its mass. Larger masses have higher heat capacities if they are made of the same substance.

Question: What is a solar panel?

Answer: A solar panel is an arrangement of multiple solar cells in series and parallel to produce larger voltages and currents, such as 12 V or 15 V.

Question: How does the density of elements change down a group?

Answer: The density of elements generally increases down a group.

Question: What are some examples of weak acids?

Answer: Examples include Acetic acid ( $\text{CH}_3\text{COOH}$ ), Carbonic acid ( $\text{H}_2\text{CO}_3$ ), and Phosphoric acid ( $\text{H}_3\text{PO}_4$ ).

Question: How does the efficiency of an electric iron affect energy consumption?

Answer: The efficiency of an electric iron affects energy consumption by determining how much of the supplied electric energy is converted into useful heat for ironing clothes.

Question: What are the factors that affect seed dormancy?

Answer: The factors that affect seed dormancy include the embryo being not matured and the impermeability of the testa for water or oxygen.

Question: How does the specific heat capacity of water compare to other substances?

Answer: Water has a high specific heat capacity ( $4200 \text{ J kg}^{-1} \text{ K}^{-1}$ ) compared to many other substances, meaning it requires more heat to increase its temperature by one degree.

Question: What is the purpose of tissue culture in plant propagation?

Answer: Tissue culture produces a large number of genetically identical plants quickly and efficiently, using vegetative tissues in a controlled culture medium.

Question: What is the first ionisation energy of carbon?

Answer: The first ionisation energy of carbon is  $1086 \text{ kJ/mol}$ .

Question: How does an electric motor utilize electric energy?

Answer: An electric motor converts electric energy into kinetic energy, which is used to perform mechanical work.

Question: What is the significance of the genetic material in viruses?

Answer: The genetic material in viruses (DNA or RNA) carries the information necessary for replication and the production of new viral particles within a host cell.

Question: What is the color change observed when a base is added to red litmus paper?

Answer: Bases turn red litmus paper blue.

Question: What is a moment in the context of rotational forces?

Answer: A moment is the tendency of an object to rotate around a given point as a result of a force acting on it. It depends on the magnitude of the force and the perpendicular distance from the rotation axis.

Question: Conduct an experiment to demonstrate the force acting on a current-carrying conductor placed in a magnetic field.

Answer: To demonstrate the force acting on a current-carrying conductor placed in a magnetic field, an experiment can be set up using a U-magnet, a conductor, brass rods, dry cells, and a switch. Setup: Place the U-magnet on a table with its poles facing upwards. Insert two brass rods through holes in a thick cardboard piece and position them between the poles of the magnet. Connect the brass rods to the dry cells and switch using connecting wires. Place the conductor (BC) on the brass rods between the north and south poles of the magnet. Procedure: Close the switch to allow current to flow from the dry cells through the brass rods and the conductor. Observe the movement of the conductor. It will move along the brass rods away from the magnet. Change the direction of the current by reversing the terminals of the dry cells and observe the movement of the conductor again. It will move in the opposite direction. Repeat the experiment by reversing the magnetic poles and observe the changes in the direction of the conductor's movement. Observations: The conductor moves when a current flows through it, indicating a force acting on it due to the magnetic field. The direction of the force depends on the direction of the current and the orientation of the magnetic field. This demonstrates that a magnetic field exerts a force on a current-carrying conductor, and the force's direction can be predicted using Fleming's left-hand rule. Conclusion: The experiment confirms that a force acts on a current-carrying conductor

placed in a magnetic field, and this force causes the conductor to move in a direction perpendicular to both the current and the magnetic field.

Question: How does the density of a fluid affect the buoyant force on a submerged object?

Answer: The density of a fluid affects the buoyant force, with denser fluids exerting greater buoyant force on a submerged object, making it more buoyant.

Question: What is the significance of genetic mutations?

Answer: Genetic mutations introduce variations in the genetic code, which can lead to new traits, provide material for evolution, and sometimes cause genetic disorders or diseases.

Question: How is the brightness of a bulb affected by different resistors in a circuit?

Answer: The brightness of a bulb decreases as the resistance value of the resistor increases because the current flow through the bulb decreases.

Question: What is the molar mass of glucose ( $C_6H_{12}O_6$ )?

Answer: The molar mass of glucose is 180 grams per mole, calculated as  $6 \times 12$  for carbon,  $12 \times 1$  for hydrogen, and  $6 \times 16$  for oxygen.

Question: What is the significance of electromagnetic waves traveling without a medium?

Answer: Electromagnetic waves can travel through space, allowing light and heat from the sun to reach Earth even through the vacuum of space.

Question: What are the main features of epithelial tissues?

Answer: Epithelial tissues have tightly packed cells, are placed on a basement membrane, possess a nerve supply but lack a blood supply, and may be composed of single or multiple cell layers.

Question: What is the role of an electrolyte in a lithium-ion battery?

Answer: The electrolyte in a lithium-ion battery facilitates the movement of lithium ions between the anode and cathode during charging and discharging, enabling the electrochemical reactions that store and release energy.

Question: How do geneticists study the genetic basis of complex diseases?

Answer: Geneticists study the genetic basis of complex diseases by identifying genetic variants associated with disease risk, conducting genome-wide association studies, and investigating gene-environment interactions that contribute to disease development.

Question: What is the mean speed of an object that traveled 100 km in 2 hours?

Answer: Mean speed =  $100 \text{ km} / 2 \text{ hours} = 50 \text{ km/h}$ .

Question: How does the body manage calcium levels through kidney function?

Answer: The kidneys regulate calcium levels by filtering and reabsorbing calcium, influenced by parathyroid hormone (PTH).

Question: What is the role of catalysts in biological systems?

Answer: Catalysts, often enzymes, accelerate biochemical reactions, ensuring efficient metabolic processes in living organisms.

Question: How do you achieve equilibrium in a rod with weights at different points using the principle of moments?

Answer: Achieve equilibrium by adjusting the positions and magnitudes of the weights such that the moments on either side of the pivot are equal, resulting in no net rotation.

Question: Describe the process of electrochemical synthesis of ammonia and its importance.

Answer: The electrochemical synthesis of ammonia involves the reduction of nitrogen gas and hydrogen gas using an electrochemical cell, providing a sustainable and energy-efficient alternative to the traditional Haber-Bosch process. It is important for producing ammonia, a key ingredient in fertilizers, with lower energy consumption and reduced carbon footprint.

Question: What is matter?

Answer: Matter is anything that occupies space and has mass.

Question: What is the balanced chemical equation for the reaction between sodium and oxygen?

Answer: The balanced chemical equation for the reaction between sodium and oxygen is:  $4\text{Na} + \text{O}_2 \rightarrow 2\text{Na}_2\text{O}$ .

Question: What is the function of mucus in the digestive tract?

Answer: Mucus lubricates food, eases its passage, and protects the inner lining of the digestive tract from digestive enzymes.

Question: What is the Kingdom Animalia?

Answer: The Kingdom Animalia includes multicellular animals that are unable to produce their own food and are heterotrophic. There are about 1,260,000 species in this kingdom.

Question: How do noble gases achieve a stable electronic configuration?

Answer: Noble gases achieve a stable electronic configuration by having a full valence shell, typically with eight electrons, making them chemically inert.

Question: What is climate change, and what are its main drivers?

Answer: Climate change refers to long-term changes in temperature, precipitation, and other atmospheric conditions on Earth. Its main drivers include the burning of fossil fuels, deforestation, industrial processes, and agricultural practices.

Question: How does the pancreas regulate blood sugar levels?

Answer: The pancreas secretes insulin to lower blood sugar levels and glucagon to raise them, maintaining glucose homeostasis.

Question: What are lipids and how are they classified?

Answer: Lipids include fats and oils, with fats being solid at room temperature and oils being liquid.

Question: What are vitamins and their types?

Answer: Vitamins are organic compounds important in bio-chemical reactions, classified into water-soluble (B and C) and fat-soluble (A, D, E, and K) vitamins.

Question: How does the electronic configuration of chlorine influence its bonding behavior?

Answer: The electronic configuration of chlorine (2, 8, 7) makes it highly reactive, as it needs to gain one electron to achieve a stable configuration, readily forming bonds with other elements.

Question: What is the force required to give an acceleration of  $2 \text{ m/s}^2$  to a 5 kg mass?

Answer: The force required is  $F=ma=5 \times 2=10 \text{ N}$ .

Question: How is the electronic configuration of a hydrogen atom related to its ability to form covalent bonds?

Answer: The electronic configuration of a hydrogen atom (1 electron) allows it to form covalent bonds by sharing its electron with another atom to achieve a stable configuration.

Question: How do plants contribute to the carbon cycle?

Answer: Plants contribute to the carbon cycle by absorbing carbon dioxide during photosynthesis and converting it into organic compounds.

Question: What are the physical properties of diamond and graphite?

Answer: Diamond has high density, high refractive index, and hardness but is a poor conductor of electricity. Graphite is a good conductor of electricity.

Question: How does the pH scale help in understanding the strength of acids and bases?

Answer: The pH scale provides a numerical value to indicate the acidity or basicity of a solution, helping to compare their strengths.

Question: What is the role of calcium in muscle contraction?

Answer: Calcium ions trigger muscle contraction by binding to regulatory proteins on muscle filaments, allowing actin and myosin to interact.

Question: How do the physical states of metals and non-metals generally differ at room temperature?

Answer: Metals are generally solid at room temperature, except for mercury, while non-metals can exist in solid, liquid, or gaseous states.

Question: What hormone is secreted by the adrenal glands, and what is its function?

Answer: The adrenal glands secrete adrenaline, which prepares the body for emergency action.

Question: What is the significance of the right-hand grip rule in electromagnetism?

Answer: The right-hand grip rule helps visualize and determine the direction of the magnetic field around a current-carrying conductor.

Question: What is the function of the corolla?

Answer: The corolla, comprised of petals, protects the inner flower parts in the bud stage and attracts insects for pollination when the flower blooms.

Question: How do scientists study the genetic basis of inherited traits?

Answer: Scientists study the genetic basis of inherited traits through experiments, genetic crosses, and analysis of DNA sequences to understand how traits are passed down.

Question: What are intermolecular bonds?

Answer: Intermolecular bonds are attractive forces between molecules, such as hydrogen bonds in water, which are not as strong as covalent bonds but contribute to the unique properties of the substance.

Question: What is the importance of genetic diversity in a population?

Answer: Genetic diversity is crucial for the survival and adaptability of a species. It provides a population with the ability to adapt to changing environments and resist diseases.

Question: What is the significance of the rate of reaction in chemical processes?

Answer: The rate of reaction determines how quickly products are formed, affecting the efficiency and feasibility of chemical processes.

Question: How does the density of an object affect its ability to float?

Answer: An object will float if its density is less than the density of the fluid it is submerged in, as the buoyant force will be greater than the object's weight.

Question: What are the four kingdoms in the Domain Eukarya?

Answer: The four kingdoms in the Domain Eukarya are Protista, Fungi, Plantae, and Animalia.

Question: Calculate the electricity consumption of four 100W bulbs used for 3 hours daily over a month.

Answer: The electricity consumption is  $(100\text{W} \times 4 \text{ bulbs} \times 3 \text{ hours} \times 30 \text{ days}) / 1000 = 36 \text{ kWh}$ .

Question: How is the chemical formula of phosphoric acid written?

Answer: The chemical formula of phosphoric acid is  $\text{H}_3\text{PO}_4$ , indicating three hydrogen atoms, one phosphorus atom, and four oxygen atoms.

Question: What is the role of chromosomes in genetic inheritance?

Answer: Chromosomes carry genes that determine traits and transmit genetic information from one generation to the next, playing a crucial role in inheritance.



Question: What happens to the induced current in a dynamo when the coil is parallel to the magnetic field?

Answer: When the coil is parallel to the magnetic field, the induced current becomes zero, as there is no intersection of field lines.

Question: What is the potential difference between the terminals of a power supply connected to a nichrome wire coil with a resistance of  $10\ \Omega$  and a current of  $0.6\text{ A}$ ?

Answer: Using Ohm's Law,  $V = IR$ , the potential difference is  $V = 0.6\text{ A} \times 10\ \Omega = 6\text{ V}$ .

Question: What experiment can demonstrate changes in pitch?

Answer: Vibrating a hacksaw blade clamped at one end shows that increasing the length of the blade lowers the frequency and pitch of the sound.

Question: What is the role of blood in transporting materials within the body?

Answer: Blood transports digested nutrients, respiratory gases, excretory byproducts, hormones, mineral ions, and proteins to and from cells.

Question: Define kinetic energy.

Answer: Kinetic energy is the energy possessed by an object due to its motion.

Question: What is the reaction between aluminum and hydrochloric acid?

Answer: Aluminum reacts with hydrochloric acid to form aluminum chloride and hydrogen gas:  $2\text{Al} + 6\text{HCl} \rightarrow 2\text{AlCl}_3 + 3\text{H}_2$ .

Question: What is the function of the corpus luteum in the menstrual cycle?

Answer: The corpus luteum forms from the remains of the graafian follicle after ovulation and secretes progesterone to maintain the uterine lining for potential pregnancy.

Question: What is the purpose of using a carbon rod as the anode in electroplating?

Answer: A carbon rod serves as an inert anode that does not participate in the electrochemical reactions, ensuring that only the desired metal ions are involved in the plating process and preventing contamination.

Question: What are the five groups of vertebrates mentioned in the document?

Answer: The five groups of vertebrates are Pisces (fish), Amphibia (amphibians), Reptilia (reptiles), Aves (birds), and Mammalia (mammals).

Question: How do you find the resultant force when two collinear forces act in opposite directions?

Answer: The resultant force is found by subtracting the smaller force from the larger force, in the direction of the larger force.

Question: How is the chemical formula of phosphorus pentoxide written?

Answer: The chemical formula of phosphorus pentoxide is  $\text{P}_2\text{O}_5$ , indicating two phosphorus atoms and five oxygen atoms.

Question: Calculate the number of molecules in 0.2 moles of carbon dioxide (CO<sub>2</sub>).

Answer: The number of molecules in 0.2 moles of carbon dioxide is  $1.204 \times 10^{23}$ , calculated as  $0.2 \times 6.022 \times 10^{23}$ .

Question: How does the thermal conductivity of a material affect its ability to conduct heat?

Answer: The thermal conductivity of a material determines its ability to conduct heat. Materials with high thermal conductivity, like metals, transfer heat efficiently, while materials with low thermal conductivity, like insulators, transfer heat poorly.

Question: Why does a box placed on a table remain at rest despite the gravitational force acting on it?

Answer: A box placed on a table remains at rest because the gravitational force acting downwards is balanced by the perpendicular reaction force exerted upwards by the table, resulting in equilibrium.

Question: How is the relative atomic mass of an element defined?

Answer: The relative atomic mass of an element is defined as the weighted average mass of the atoms in a naturally occurring sample of the element, compared to 1/12 of the mass of a carbon-12 atom.

Question: How do geneticists study the inheritance of quantitative traits?

Answer: Geneticists study the inheritance of quantitative traits by analyzing the contributions of multiple genes and environmental factors, using statistical methods to identify genetic loci associated with the variation in these traits.

Question: How do epithelial tissues contribute to sensory perception?

Answer: Epithelial tissues in the tongue and nose contain specialized cells that detect taste and smell stimuli, transmitting sensory information to the brain.

Question: What is the menstrual phase in the uterus?

Answer: The menstrual phase is when the uterine lining degrades and is expelled from the body as menstrual flow, typically lasting about four days.

Question: What are the environmental benefits of using electrochemical methods for wastewater treatment?

Answer: The environmental benefits of using electrochemical methods for wastewater treatment include efficient removal of contaminants, reduced chemical usage, minimal sludge production, and the ability to treat a wide range of pollutants, resulting in cleaner water and reduced environmental impact.

Question: How does atmospheric pressure affect the boiling point of liquids?

Answer: Atmospheric pressure affects the boiling point of liquids; higher pressure increases the boiling point, while lower pressure decreases it, as seen at high altitudes.

Question: What is the significance of the cell wall in plants?

Answer: The cell wall in plants, made of cellulose, provides structural support and protection.

Question: What is the equation for the production of slaked lime, and what type of reaction is it?

Answer:  $\text{CaO (s)} + \text{H}_2\text{O (l)} \rightarrow \text{Ca(OH)}_2 \text{ (s)}$ , an exothermic reaction.

Question: What are the advantages of sexual reproduction in plants?

Answer: Sexual reproduction produces genetic variation, leading to offspring with mixed characteristics of both parents, and enables the evolution of new plant varieties.

Question: What is the significance of ecological pyramids?

Answer: Ecological pyramids illustrate the relationships between different trophic levels and the efficiency of energy transfer in ecosystems.

Question: Describe the principle of a redox flow battery.

Answer: A redox flow battery stores energy in liquid electrolyte solutions containing redox-active species. The electrolytes flow through electrochemical cells where redox reactions occur, generating or storing electrical energy, and can be easily scaled for large energy storage applications.

Question: How do geneticists study the function of non-coding DNA?

Answer: Geneticists study the function of non-coding DNA by analyzing its role in regulating gene expression, investigating its involvement in chromatin structure, and identifying non-coding RNAs that play crucial roles in cellular processes.

Question: What is the significance of the moment of a couple of forces in practical applications?

Answer: The moment of a couple of forces is significant in practical applications such as turning a tap, unscrewing a nail, and rotating a steering wheel, where equal and opposite forces are applied to create rotation.

Question: How do you investigate the dependence of the moment on the perpendicular distance using a stick and Newton balance?

Answer: Investigate the dependence by attaching a loop and Newton balance to different points on the stick, applying a constant force, and measuring the distance required to initiate rotation.

Question: What is the significance of a constant ratio of voltage to current in a conductor?

Answer: A constant ratio of voltage to current indicates that the conductor follows Ohm's Law, with a fixed resistance at constant temperature.

Question: What are the physical quantities associated with wave motion?

Answer: The physical quantities associated with wave motion include amplitude, wavelength, period, frequency, and speed.

Question: What is the effect of acids on litmus paper?

Answer: Acids turn blue litmus paper red.

Question: What is the role of sulfuric acid in acidulated water for electrolysis?

Answer: Sulfuric acid increases the concentration of  $H^+$  ions, enhancing the conductivity of the solution and facilitating the electrolysis process by providing additional ions for the reactions.

Question: Describe the motion of an object with zero acceleration.

Answer: An object with zero acceleration moves at a constant velocity, meaning there is no change in its speed or direction.

Question: What are the benefits of using CFL and LED bulbs over incandescent bulbs?

Answer: CFL and LED bulbs consume less power, have longer lifespans, and generate less heat compared to incandescent bulbs, making them more energy-efficient and environmentally friendly.

Question: What is the significance of hydrogen gas in industry?

Answer: Hydrogen gas is used as a fuel, in producing ammonia for fertilizers, in hydrogenation of oils, and in reducing organic compounds.

Question: What is the structure of a sperm?

Answer: A sperm consists of three parts: the head, which contains the nucleus; the body, which contains mitochondria for energy; and the tail, which aids in motility.

Question: How does the reduction of  $Cu^{2+}$  ions at the cathode affect the copper sulfate solution?

Answer: The reduction of  $Cu^{2+}$  ions at the cathode removes these ions from the solution, decreasing the intensity of the blue color and resulting in the deposition of copper metal.

Question: Why is diamond the hardest natural substance?

Answer: Diamond is the hardest natural substance because of its three-dimensional lattice structure, where each carbon atom forms four strong covalent bonds with other carbon atoms.

Question: What is the significance of the speed of electromagnetic waves being constant in a vacuum?

Answer: The constant speed of electromagnetic waves in a vacuum allows for precise calculations in physics, astronomy, and telecommunications.

Question: How is the chemical formula of carbon dioxide written?

Answer: The chemical formula of carbon dioxide is  $CO_2$ , indicating one carbon atom and two oxygen atoms.

Question: What is the effect of amplitude on the perception of sound?

Answer: Higher amplitude sound waves are perceived as louder, while lower amplitude waves are perceived as softer.

Question: What is the relationship between force magnitude and the moment of force in practical applications?

Answer: The moment of force in practical applications is directly proportional to the magnitude of the applied force. An increase in force results in a larger moment, making it easier to rotate the object.

Question: What is the significance of the electrochemical series in predicting the outcome of electrolysis?

Answer: The electrochemical series ranks elements based on their tendency to lose or gain electrons, helping predict which ions will be reduced or oxidized.

Question: What is the significance of cellulose in the human diet?

Answer: Cellulose is not digested in the human digestive system, but it helps to avoid constipation by adding bulk to the stool.

Question: How is hydrogen gas collected by downward displacement of air?

Answer: Hydrogen gas, less dense than air, is collected by displacing air downwards in an inverted gas jar, a method known as downward displacement of air.

Question: What are some applications of neutralization reactions?

Answer: Applications include using antacids to relieve stomach acidity, adding basic substances to acidic soil, and treating bee and wasp stings.

Question: What is the significance of the periodic trends in predicting the behavior of elements?

Answer: Periodic trends help predict the behavior of elements in chemical reactions, physical properties, and their general characteristics.

Question: How is pure water obtained through simple distillation?

Answer: By heating the water to produce vapor, which is then condensed and collected as distilled water.

Question: How can mixtures be separated by physical methods?

Answer: Mixtures can be separated by physical methods such as filtration, distillation, and centrifugation, depending on the properties of the components.

Question: What is the difference between transverse and longitudinal waves in terms of particle motion?

Answer: In transverse waves, particles move perpendicular to the wave direction, while in longitudinal waves, particles move parallel to the wave direction.

Question: What occurs when light rays come through the center of curvature towards a concave mirror?

Answer: They reflect back through the center of curvature, as any line from the center of curvature to the mirror is perpendicular to the mirror's surface.

Question: What are the sources of nitrogen oxides (NO<sub>x</sub>) emissions?

Answer: Sources of nitrogen oxides (NO<sub>x</sub>) emissions include lightning, combustion inside vehicle engines, and industrial processes.

Question: How do you calculate the moment of a force applied to a stick pivoted at one end?

Answer: Calculate the moment by multiplying the applied force by the perpendicular distance from the pivot point to the line of action of the force (Moment = Force  $\times$  Perpendicular distance).

Question: What is the function of the plasma membrane in maintaining cellular homeostasis?

Answer: The plasma membrane regulates the movement of substances in and out of the cell, maintaining cellular homeostasis by controlling the internal environment.

Question: What is the function of the corolla?

Answer: The corolla, comprised of petals, protects the inner flower parts in the bud stage and attracts insects for pollination when the flower blooms.

Question: Why does graphite behave as a lubricant?

Answer: Graphite behaves as a lubricant because its layers of carbon atoms can easily slide over one another due to weak forces holding the layers together.

Question: How is the chemical formula of sulphuric acid written?

Answer: The chemical formula of sulphuric acid is  $\text{H}_2\text{SO}_4$ , indicating two hydrogen atoms, one sulphur atom, and four oxygen atoms.

Question: What is the significance of controlling the temperature in a fractionating tower during crude oil refining?

Answer: Controlling the temperature ensures the efficient separation of different hydrocarbon fractions based on their boiling points.

Question: What is the relationship between solubility and temperature for gases in liquids?

Answer: The solubility of gases in liquids decreases with increasing temperature, leading to the release of dissolved gases at higher temperatures.

Question: How do geneticists identify carriers of genetic disorders?

Answer: Geneticists identify carriers through genetic testing, which can detect the presence of recessive genes for specific disorders. Carrier screening is often done for couples planning to have children.

Question: How does conduction transfer heat in solids?

Answer: In solids, heat transfer by conduction occurs through the vibrational kinetic energy of atoms and the motion of free electrons, transferring thermal energy from high-temperature regions to low-temperature regions.

Question: What is anemia, and what causes it?

Answer: Anemia is a condition characterized by a deficiency of red blood cells or hemoglobin, caused by factors such as iron deficiency, blood loss, or bone marrow disorders.

Question: How do you measure the voltage across a bulb in a circuit with two dry cells?

Answer: Connect a voltmeter in parallel with the bulb and read the voltage value displayed on the voltmeter.

Question: Materials required ; - Two small beakers about 100 cm<sup>3</sup> , A thermometer, a glass rod, solid sodium hydroxide (NaOH), solid ammonium chloride (NH<sub>4</sub>Cl) Method; - Add about half full of water to a beaker, measure its temperature and note it down. Add a little amount of solid sodium hydroxide to the same beaker, stir with the glass rod and again measure and record the temperature. State your observations. Fill half of a beaker with water and record its temperature. Add a little amount of solid ammonium chloride to this beaker. Stir with the glass rod and record the temperature again. State your observations. What happens to the temperature when solid ammonium chloride dissolves in water in Activity?

Answer: The temperature falls.

Question: What is the function of the endoplasmic reticulum in cells?

Answer: The endoplasmic reticulum (ER) is involved in protein and lipid synthesis, with the rough ER studded with ribosomes for protein production and the smooth ER involved in lipid metabolism and detoxification.

Question: What is the role of peroxisomes in detoxifying harmful substances?

Answer: Peroxisomes contain enzymes that detoxify harmful substances like hydrogen peroxide, converting them into water and oxygen, protecting the cell from oxidative damage.

Question: What is a cell?

Answer: A cell is the smallest structural unit of the organization of the living body, performing various functions in the body.

Question: What is the role of vacuoles in plant cells?

Answer: Vacuoles in plant cells maintain water balance, provide support, and store pigments that give color to the cell.

Question: How are essential oils used in the production of toothpaste?

Answer: Essential oils are added to toothpaste for their aromatic properties and potential medicinal benefits, such as antibacterial effects.

Question: What are the advantages of using DC motors in transportation?

Answer: DC motors provide efficient, controllable, and reliable power for various transportation applications, including cars and trains.

Question: What are the ethical considerations of using CRISPR for gene editing?

Answer: Ethical considerations of using CRISPR for gene editing include the potential for unintended consequences, the impact on future generations, concerns about "designer babies," and the need for regulatory oversight and ethical guidelines.

Question: What is the relationship between the speed of coil rotation and the output voltage of a dynamo?

Answer: The output voltage of a dynamo increases with the speed of coil rotation, as a higher speed induces a greater electromotive force.

Question: What is Archimedes' principle and its significance?

Answer: Archimedes' principle states that when an object is partially or completely submerged in a fluid, the upthrust acting on it is equal to the weight of the fluid displaced by the object. It explains why objects float or sink.

Question: What is the role of lenses in optical instruments?

Answer: Lenses in optical instruments like microscopes and telescopes magnify and focus light, enabling detailed observation of small or distant objects.

Question: What is the principle of reversibility of light in optical fibers?

Answer: Light rays follow the same path backward when their direction is reversed, even after multiple reflections and refractions.

Question: What components are essential for the operation of a bicycle dynamo?

Answer: Essential components of a bicycle dynamo include the rotating coil, magnetic field, mechanical connection to the tire, and electrical circuit.

Question: What are the benefits of using table fans over ceiling fans for cooling?

Answer: Table fans are more efficient than ceiling fans because they provide targeted cooling and consume less power.

Question: What causes AIDS, and what are its symptoms?

Answer: AIDS is caused by the Human Immunodeficiency Virus (HIV) and can be fatal. Symptoms may appear 2-15 years after infection.

Question: How do geneticists use probability to study inheritance patterns?

Answer: Geneticists use probability to study inheritance patterns by calculating the likelihood of certain traits appearing in offspring, based on the known genotypes of the parents and the rules of inheritance.

Question: What is the chemical formula of magnesium oxide?

Answer: The chemical formula of magnesium oxide is  $\text{MgO}$ , indicating one magnesium ion and one oxide ion.

Question: What is the equivalent resistance of resistors connected in series?

Answer: The equivalent resistance of resistors connected in series is the sum of their individual resistances:  $R = R_1 + R_2 + R_3 + \dots$

Question: How much heat is required to increase the temperature of 2 kg of water by 10 K?

Answer: The heat required is 84,000 J, calculated using the formula  $Q = mc\Delta T = 2 \times 4200 \times 10$ .

Question: What are the applications of electrochemical sensors in food quality testing?



Answer: Electrochemical sensors in food quality testing are used to detect contaminants, pesticides, pathogens, and nutrient levels, ensuring food safety and quality by providing rapid and accurate analysis.

Question: What is the significance of the center of gravity in maintaining equilibrium of a lamina suspended by two strings?

Answer: The center of gravity is significant because it is the point where the weight of the lamina acts. When the lamina is suspended by two strings and in equilibrium, the lines of action of the strings and the vertical line through the center of gravity all lie in the same plane and intersect at a common point.

Question: How does the specific heat capacity of a substance affect its temperature change?

Answer: Substances with higher specific heat capacities experience smaller temperature changes when the same amount of heat is supplied compared to substances with lower specific heat capacities.

Question: Why is RNA important in some viruses?

Answer: RNA stores genetic information in some viruses.

Question: What happens to mothballs when left exposed to air?

Answer: Mothballs, which are made of naphthalene, gradually become smaller when exposed to air as they sublime, turning directly from a solid to a gas without passing through the liquid phase.

Question: What is the significance of sterilized conditions in tissue culture?

Answer: Sterilized conditions prevent contamination and ensure the successful growth of plant tissues in the culture medium.

Question: What is the reaction between aluminum and hydrochloric acid?

Answer: Aluminum reacts with hydrochloric acid to form aluminum chloride and hydrogen gas:  $2\text{Al} + 6\text{HCl} \rightarrow 2\text{AlCl}_3 + 3\text{H}_2$ .

Question: How does the specific heat capacity of mercury make it suitable for use in thermometers?

Answer: Mercury's specific heat capacity allows it to respond quickly to temperature changes, making it suitable for accurate and rapid temperature measurements in thermometers.

Question: What are the key features of birds (Aves)?

Answer: Birds have a light bony endoskeleton, streamlined bodies, feathers covering their skin, beaks adapted for different modes of nutrition, eyes with eyelids, pentadactyl limbs (forelimbs converted into wings), a four-chambered heart, and are warm-blooded.

Question: How does the diaphragm movement in a microphone relate to sound waves?

Answer: The diaphragm moves in response to sound waves, causing the attached coil to move within a magnetic field and generate an alternating current corresponding to the sound.

Question: What is the principle of differential expansion in bimetallic strips?

Answer: Differential expansion in bimetallic strips occurs because two metals with different expansion rates bend when heated, allowing the strip to make or break electrical contacts, regulating temperature in devices like thermostats.

Question: What is biodiversity?

Answer: Biodiversity is the variety of life in all its forms and levels of organization, including genetic diversity, species diversity, and ecosystem diversity.

Question: What are some common inherited traits observed in plants?

Answer: Common inherited traits in plants include flower color, seed shape, pod shape, and plant height, which can vary among different varieties of the same species.

Question: What is the relationship between force magnitude and the moment of force in practical applications?

Answer: The moment of force in practical applications is directly proportional to the magnitude of the applied force. An increase in force results in a larger moment, making it easier to rotate the object.

Question: What role does the axle play in an alternating current dynamo?

Answer: The axle rotates the coil within the magnetic field, enabling continuous induction of electromotive force and generation of alternating current.

Question: How does a nichrome wire coil behave when connected to a power supply?

Answer: A nichrome wire coil exhibits resistance and allows current to flow through it when connected to a power supply, producing heat.

Question: How does friction affect the motion of a sliding object on an inclined plane?

Answer: Friction opposes the motion of a sliding object on an inclined plane, causing it to slow down and eventually stop unless an external force is applied to maintain motion.

Question: What is the effect of temperature on the volume of a liquid in a thermometer?

Answer: As temperature increases, the liquid in a thermometer expands, causing it to rise in the capillary tube. Conversely, as temperature decreases, the liquid contracts and the level drops, indicating the temperature change.

Question: What happens during the process of peristalsis in the esophagus?

Answer: Peristalsis involves rhythmic contractions and relaxations of the esophageal muscles, propelling the food bolus forward to the stomach.

Question: How do plants respond to light intensity and duration (photoperiod) for optimal photosynthesis?

Answer: Plants adjust chloroplast movement, leaf orientation, and metabolic activities based on light intensity and photoperiod, optimizing

photosynthesis and growth.

Question: What is the resultant force when two forces of 4 N and 6 N act in opposite directions?

Answer: The resultant force is 2 N in the direction of the 6 N force.

Question: What is the importance of pH in environmental science?

Answer: pH is crucial in environmental science for monitoring soil and water quality, determining the health of ecosystems, and managing pollution.

Question: What is a convergent light beam?

Answer: A convergent light beam is a bundle of rays that meet at a certain point after reflection or refraction.

Question: How do you convert a temperature from Celsius to Kelvin?

Answer: To convert a temperature from Celsius to Kelvin, add 273 to the Celsius temperature.

Question: What are the environmental impacts of mining activities?

Answer: Mining activities cause habitat destruction, soil erosion, water contamination, and air pollution. They lead to long-term environmental degradation and pose health risks to nearby communities.

Question: What is the nature of the image formed by a convex mirror for an object at infinity?

Answer: The image is virtual, upright, and significantly smaller than the object, formed at the focal point behind the mirror.

Question: What does the term "monohybrid cross" mean in Mendel's experiments?

Answer: A monohybrid cross involves breeding plants that differ in one specific trait to observe how that trait is inherited.

Question: Why is it important to use energy-efficient lighting in households?

Answer: Using energy-efficient lighting reduces electricity consumption, lowers utility bills, and decreases the environmental impact of energy production.

Question: How do you investigate the effect of tightening a screw on the moment of force required to rotate a stick?

Answer: Investigate the effect by tightening the screw at different levels and measuring the force required to initiate rotation using a Newton balance, observing the relationship between screw tightness and required force.

Question: What is the principle behind the magnifying glass?

Answer: A magnifying glass uses a convex lens to enlarge the appearance of small objects by converging light rays to a focal point.

Question: What effect does cigarette smoke have on the cilia in the respiratory tract?

Answer: Cigarette smoke destroys cilia, causing bronchioles to swell and become inflamed, which can lead to difficulty in breathing and an increased risk of cancer.

Question: What is the role of heat in the production of slaked lime from quicklime?

Answer: The reaction releases a significant amount of heat, indicating it is exothermic.

Question: What is the relationship between relative atomic mass and molar mass?

Answer: The relative atomic mass is a dimensionless quantity, while the molar mass is the mass of one mole of the element, expressed in grams per mole. They are numerically equal but have different units.

Question: Who was the first scientist to show that oxygen diffuses from green plants in the presence of sunlight?

Answer: Lavoisier was the first scientist to show that oxygen diffuses from green plants in the presence of sunlight.

Question: What is the role of an inductor in an electronic circuit?

Answer: An inductor stores energy in a magnetic field when current flows through it, and it resists changes in current, making it useful in filtering and energy storage applications.

Question: How does the expansion of gases demonstrate the principles of thermal expansion and contraction?

Answer: The expansion of gases demonstrates thermal expansion and contraction by showing how gas volume increases with temperature and decreases when cooled, as seen in experiments with balloons and plastic bottles.

Question: How do transport vesicles function in the cell?

Answer: Transport vesicles carry proteins and lipids from the ER to the Golgi apparatus for modification and then to their final destinations, including secretion outside the cell.

Question: What is the atomic number of sodium?

Answer: The atomic number of sodium is 11.

Question: How does solubility influence the efficiency of extraction processes?

Answer: Solubility determines the efficiency of extraction processes by affecting the dissolution and separation of target compounds from complex mixtures.

Question: What is the significance of the atria and ventricles in heart function?

Answer: Atria receive blood from the body and lungs, while ventricles pump blood out to the lungs and the rest of the body, ensuring continuous blood circulation.

Question: How does the specific latent heat of fusion relate to the melting process of a substance?

Answer: The specific latent heat of fusion quantifies the energy required to convert a solid into a liquid at its melting point, providing insight into the energy dynamics of the melting process.

Question: What is the effect of increasing the length of a nichrome wire on its resistance?

Answer: Increasing the length of a nichrome wire increases its resistance.

Question: How does the volume of a gas change with pressure according to Boyle's Law?

Answer: According to Boyle's Law, the volume of a gas decreases as the pressure increases, provided the temperature remains constant.

Question: Describe the process of electrolysis.

Answer: Electrolysis is a process where an electric current is passed through a solution or molten liquid containing ions, causing chemical reactions at the electrodes and resulting in the decomposition of the substance.

Question: How are metals of moderate reactivity like iron, tin, zinc, and lead extracted?

Answer: Metals of moderate reactivity such as iron, tin, zinc, and lead are extracted by reducing their compounds using other elements or compounds.

Question: What is the difference between series and parallel circuits?

Answer: In a series circuit, components are connected end-to-end, and the same current flows through each component. In a parallel circuit, components are connected across the same voltage source, and the total current is the sum of the currents through each component.

Question: What are monoecious plants?

Answer: Monoecious plants bear both staminate (male) and pistillate (female) flowers on the same plant, allowing for cross-pollination within the same plant.

Question: What factors influence the pitch of percussion instruments?

Answer: The pitch of percussion instruments depends on the area and tension of the vibrating membrane or metal plate.

Question: What is the outer covering of a plant cell made of?

Answer: The outer covering of a plant cell is the cell wall, made up of cellulose.

Question: How is acetic acid used in the textile industry?

Answer: Acetic acid is used in the production of synthetic threads and fibers in the textile industry.

Question: What are the consequences of eutrophication?

Answer: Consequences of eutrophication include the death of aquatic life due to oxygen depletion and the disruption of ecosystems.

Question: Describe the role of ribosomes in gene expression.

Answer: Ribosomes translate mRNA into proteins, essential for expressing genetic information and carrying out cellular functions.

Question: How does temperature affect the resistance of a nichrome wire coil?

Answer: The resistance of a nichrome wire coil increases with temperature. It is essential to maintain a constant temperature to accurately measure resistance.

Question: What are the structural differences between the three types of muscle tissue?

Answer: Smooth muscle cells are spindle-shaped and unbranched, skeletal muscle fibers are long and cylindrical with striations, and cardiac muscle cells are short, striated, and connected by intercalated discs.

Question: Discuss the methods to prevent rusting of iron and the concept of cathodic protection, including experimental evidence.

Answer: Rusting of iron can be prevented by various methods that inhibit the exposure of iron to oxygen and moisture. Methods to Prevent Rusting: Applying Paint, Grease, or Oil: Coating iron with paint, grease, or oil creates a barrier that prevents contact with oxygen and moisture. Coating with Tin: Tin plating provides a protective layer that shields iron from environmental exposure. Galvanizing: Iron objects are coated with a layer of zinc. Zinc being more reactive than iron, undergoes oxidation, protecting the iron beneath. Concept of Cathodic Protection: Cathodic protection involves making iron the cathode of an electrochemical cell to prevent its corrosion. Experiment to Demonstrate Cathodic Protection: Materials Required: Five cleaned iron nails Agar jelly Sodium chloride Phenolphthalein indicator Potassium ferricyanide Petri dishes Strips of magnesium, zinc, copper, and lead Water Method: Prepare a solution of water with sodium chloride, phenolphthalein, and potassium ferricyanide. Boil the solution and add agar jelly. Place an iron nail in each petri dish. Attach strips of magnesium, zinc, copper, and lead to four nails. Pour the hot gel medium into the petri dishes, covering the nails. Allow to cool and observe after an hour. Observations: Pink color around the nails indicates the presence of hydroxide ions ( $\text{OH}^-$ ). Blue color indicates the presence of iron ions ( $\text{Fe}^{2+}$ ). Petri dishes with magnesium and zinc show pink color but no blue color, indicating no formation of  $\text{Fe}^{2+}$  ions. Petri dishes with copper and lead show blue color, indicating corrosion of iron. Conclusion: Metals higher than iron in the activity series (magnesium, zinc) protect iron by acting as sacrificial anodes. Metals lower than iron (copper, lead) do not provide protection and may even accelerate corrosion. This demonstrates cathodic protection, where a more reactive metal (e.g., zinc in galvanizing) corrodes in place of iron.

Question: How do animals, wind, and water contribute to pollination?

Answer: Animals, wind, and water contribute to pollination by transferring pollen from one flower to another, facilitating fertilization.

Question: What is the role of a watch glass in the extraction of chlorophyll for paper chromatography?

Answer: The watch glass is used to collect the chlorophyll extract after crushing and squeezing spinach leaves.

Question: What is the mass fraction of a solute in a solution containing 10g of solute in 100g of solution?

Answer: The mass fraction is 0.1 or 10%.

Question: Explain the importance of using energy-efficient appliances in reducing carbon footprint.

Answer: Energy-efficient appliances consume less power, reducing overall energy demand and the associated greenhouse gas emissions, thereby lowering the carbon footprint.

Question: How do you prepare a 1 mol/dm<sup>3</sup> solution of magnesium chloride?

Answer: Weigh the required mass of MgCl<sub>2</sub>, dissolve it in water, and adjust the final volume in a volumetric flask.

Question: How does the electrolysis of copper sulfate solution demonstrate the transfer of copper ions?

Answer: The electrolysis of copper sulfate solution demonstrates the transfer of Cu<sup>2+</sup> ions from the anode to the cathode, where they are reduced and deposited as copper metal, illustrating the movement of ions and the deposition process.

Question: How does the length of a vibrating string affect the frequency of sound in string instruments?

Answer: The length of the vibrating string determines the frequency, with shorter strings producing higher frequencies and longer strings producing lower frequencies.

Question: How does a relay function in an electrical circuit?

Answer: A relay functions as an electrically operated switch that uses a small control current to open or close a larger load circuit, providing isolation and control in various applications.

Question: How does the material composition of a conductor affect its resistance?

Answer: Different materials have different resistivities, which affect the resistance of the conductor; materials with lower resistivity have lower resistance.

Question: How do acceptor atoms contribute to the formation of p-type semiconductors?

Answer: Acceptor atoms in p-type semiconductors create holes by accepting electrons from neighboring atoms, increasing the material's conductivity. These atoms typically come from group III elements like boron.

Question: What are the deficiency symptoms of vitamin D?

Answer: Deficiency symptoms of vitamin D include rickets, which is the deforming of bones.

Question: How does the high specific heat capacity of water influence weather and climate?

Answer: Water's high specific heat capacity influences weather and climate by moderating temperature changes, storing heat during the day and releasing it at night, leading to more stable and mild climates.

Question: What is the chemical formula for copper sulfate?

Answer: The chemical formula for copper sulfate is  $\text{CuSO}_4$ .

Question: What is the relationship between mass and heat capacity?

Answer: The heat capacity of an object is directly proportional to its mass. Larger masses have higher heat capacities if they are made of the same substance.

Question: How does temperature affect the resistance of a nichrome wire coil?

Answer: The resistance of a nichrome wire coil increases with temperature. It is essential to maintain a constant temperature to accurately measure resistance.

Question: What is the role of hydrogen bonds in the high specific heat capacity of water?

Answer: Hydrogen bonds in water require significant energy to break, allowing water to absorb and retain heat without a rapid increase in temperature, contributing to its high specific heat capacity.

Question: What is the electronic configuration of a chlorine atom?

Answer: The electronic configuration of a chlorine atom is 2, 8, 7.

Question: How does temperature affect the solubility of solids in liquids?

Answer: The solubility of solids in liquids generally increases with an increase in temperature.

Question: What observations are made when a piece of magnesium ribbon is added to dilute sulfuric acid?

Answer: When a piece of magnesium ribbon is added to dilute sulfuric acid, the ribbon dissolves, liberating gas bubbles, and the beaker gets heated.

Question: How do ribosomes translate mRNA into proteins?

Answer: Ribosomes read the mRNA sequence and assemble amino acids into polypeptides based on the genetic code, forming proteins essential for cellular functions.

Question: How does a loudspeaker's cone amplify sound waves?

Answer: The cone vibrates in response to the coil's movement, amplifying the sound waves produced by the varying electric current.

Question: What happens when the incident angle inside a denser medium is gradually increased?

Answer: The refracted ray bends further away from the normal, and at a certain angle, it travels along the interface between the two media (critical angle).



Question: What is the significance of the constant value in Ohm's Law?

Answer: The constant value in Ohm's Law represents the electrical resistance of the conductor.

Question: What is the significance of red blood cells in the circulatory system?

Answer: Red blood cells contain hemoglobin that binds to oxygen and transports it from the lungs to tissues, and carries carbon dioxide back to the lungs for exhalation.

Question: How do sound waves create the sensation of hearing?

Answer: Sound waves cause the eardrum and inner ear structures to vibrate, converting mechanical energy into electrical signals perceived as sound.

Question: How do you find the gradient of a displacement-time graph?

Answer: Gradient = (Change in displacement) / (Change in time).

Question: What is the chemical formula for hydrogen chloride?

Answer: The chemical formula for hydrogen chloride is HCl.

Question: What is the boiling point of water under one atmosphere of pressure?

Answer: The boiling point of water under one atmosphere of pressure is 100°C.

Question: What is the formula for calculating the moment of a force applied to a pivoted rod?

Answer: The formula for calculating the moment of a force applied to a pivoted rod is Moment = Force × Perpendicular distance from the pivot point to the line of action of the force.

Question: What is the atomic number of magnesium?

Answer: The atomic number of magnesium is 12.

Question: How much heat is required to increase the temperature of 2 kg of water by 10 K?

Answer: The heat required is 84,000 J, calculated using the formula  $Q = mc\Delta T = 2 \times 4200 \times 10$ .

Question: What are the advantages of cross-pollination?

Answer: Cross-pollination promotes genetic diversity, leading to stronger offspring with mixed characteristics and improved adaptation to environmental conditions.

Question: What is the specific heat capacity of concrete?

Answer: The specific heat capacity of concrete is  $3000 \text{ J kg}^{-1} \text{ K}^{-1}$ .

Question: What are the environmental impacts of mercury in electronic waste?

Answer: The environmental impacts of mercury in electronic waste include water pollution and bioaccumulation in aquatic organisms, leading to health issues in wildlife and humans.

Question: How is the chemical formula of silicon dioxide represented?

Answer: The chemical formula of silicon dioxide is  $\text{SiO}_2$ , indicating one silicon atom and two oxygen atoms.

Question: How can thrombosis be controlled from childhood?

Answer: By avoiding alcohol and smoking, reducing saturated fatty acids and salt intake, consuming more fiber, maintaining proper food habits, exercising regularly, and maintaining a peaceful mental state.

Question: What is the unit for measuring electrical resistance?

Answer: The unit for measuring electrical resistance is the Ohm ( $\Omega$ ).

Question: How is the distance traveled by a body calculated from the velocity-time graph during uniform acceleration?

Answer: Distance = Area under the velocity-time graph.

Question: Calculate the amount of sulfuric acid ( $\text{H}_2\text{SO}_4$ ) in moles in 49 grams.

Answer: The amount of sulfuric acid in 49 grams is 0.5 moles, calculated as  $49/98 = 0.5$  moles.

Question: Why are plug circuits often used in kitchens?

Answer: Plug circuits are used in kitchens to accommodate high-power appliances like electric ovens and heaters, which require circuits that can handle larger currents.

Question: What is the specific heat capacity of water used in the calculation in Activity 8.4?

Answer:  $4200 \text{ J kg}^{-1}\text{C}^{-1}$ .

Question: What is the resultant force if two forces of 10 N and 6 N act in the same direction?

Answer: The resultant force is 16 N in the same direction.

Question: What materials are required for examining whether water is essential for rusting?

Answer: The materials required include four cleaned iron nails, two boiling tubes, two stoppers, anhydrous calcium chloride ( $\text{CaCl}_2$ ), or silica gel.

Question: What are the features of invertebrates in the phylum Annelida?

Answer: Invertebrates in the phylum Annelida are triploblastic, have segmented bodies, bilateral symmetry, a coelom, and reproduce both asexually and sexually.

Question: What is the typical forward voltage for silicon and germanium diodes?

Answer: The typical forward voltage for silicon diodes is about 0.7 V, while for germanium diodes, it is about 0.3 V.

Question: What are the features of invertebrates in the phylum Annelida?

Answer: Invertebrates in the phylum Annelida are triploblastic, have segmented bodies, bilateral symmetry, a coelom, and reproduce both

asexually and sexually.

Question: What are the main drivers of climate change?

Answer: The main drivers of climate change include the burning of fossil fuels, deforestation, industrial processes, and agricultural practices.

Question: How does the coil's orientation affect the output of an alternating current dynamo?

Answer: The coil's orientation affects the output, with maximum voltage generated when the coil is perpendicular to the magnetic field lines.

Question: How can you observe unicellular organisms?

Answer: Unicellular organisms can be observed using a light microscope by examining water samples from ponds or hay extracts.

Question: How is force related to acceleration and mass?

Answer: Force is the product of mass and acceleration ( $F=ma$ ). An increase in force results in an increase in acceleration if the mass remains constant.

Question: Describe the process of exocytosis in cells.

Answer: Exocytosis involves vesicles fusing with the plasma membrane to release their contents outside the cell, essential for secretion of hormones, neurotransmitters, and waste products.

Question: What is the effect of increasing the resistance of a circuit on the current flow?

Answer: Increasing the resistance of a circuit decreases the current flow, as described by Ohm's Law:  $I = V/R$ .

Question: What is the principle behind sonar technology?

Answer: Sonar technology uses sound waves to detect objects underwater by emitting sound pulses and measuring their reflection.

Question: What are the advantages of cross-pollination?

Answer: Cross-pollination promotes genetic diversity, leading to stronger offspring with mixed characteristics and improved adaptation to environmental conditions.

Question: How are organisms classified into groups?

Answer: Organisms are classified into groups to make it easier to study them, identify specific characteristics, understand the biosphere, reveal relationships between groups, and identify organisms with economic uses.

Question: What is the role of the hypothalamus in temperature regulation?

Answer: The hypothalamus regulates body temperature by adjusting blood flow, sweat production, and heat generation.

Question: How is the chemical formula of methane written?

Answer: The chemical formula of methane is  $\text{CH}_4$ , indicating one carbon atom and four hydrogen atoms.

Question: What happens when a current flows through a conductor placed in a magnetic field?

Answer: When a current flows through a conductor in a magnetic field, a force acts on the conductor, causing it to move.

Question: How does the use of efficient electric appliances contribute to energy conservation?

Answer: Efficient electric appliances consume less energy for the same output, reducing overall energy demand, lowering electricity bills, and decreasing environmental impact.

Question: What are some harmful effects of fungi?

Answer: Harmful effects of fungi include causing diseases in plants and animals and spoiling food.

Question: What is the relationship between wavelength and frequency in sound waves?

Answer: Wavelength and frequency are inversely related; as frequency increases, wavelength decreases, and vice versa.

Question: Explain the role of a logic analyzer in digital circuit debugging.

Answer: A logic analyzer captures and displays multiple digital signals, allowing engineers to analyze and debug the behavior of digital circuits by observing timing and logic states.

Question: How is power related to the rate of energy transfer?

Answer: Power is the rate at which energy is transferred or converted; higher power indicates faster energy transfer.

Question: What are the effects of air pollution on human health?

Answer: The effects of air pollution on human health include respiratory problems, cardiovascular diseases, lung cancer, and increased mortality rates.

Question: What are some applications of the force on a current-carrying conductor in daily life?

Answer: Applications include electric motors, loudspeakers, galvanometers, voltmeters, and ammeters.

Question: What are the causes of water scarcity?

Answer: Causes of water scarcity include over-extraction, pollution, climate change, population growth, and inefficient water management practices.

Question: How do chloroplasts contribute to the carbon cycle?

Answer: Chloroplasts convert carbon dioxide into organic compounds through photosynthesis, contributing to the carbon cycle by producing oxygen and glucose.

Question: What is the role of compressions and rarefactions in sound waves?

Answer: Compressions and rarefactions represent regions of high and low pressure, respectively, and are essential for the propagation of sound waves.

Question: What are the two types of layering in vegetative propagation?

Answer: The two types of layering are ground layering and aerial layering.

Question: What factor increases when a large log of wood is split into small splints?

Answer: The surface area of the reactants increases, allowing the reaction to occur more efficiently on the surface of the wood.

Question: Explain the operation of a piezoelectric sensor.

Answer: A piezoelectric sensor generates an electrical charge in response to mechanical stress, converting physical vibrations or pressure into an electrical signal for sensing and measurement.

Question: What is the function of the gynoecium?

Answer: The gynoecium, the female reproductive structure, contains ovules in the ovary, which are the female gamete cells of the flower.

Question: How does an electrochemical gradient drive active transport in biological systems?

Answer: An electrochemical gradient, created by the difference in ion concentration and electrical potential across a membrane, drives active transport in biological systems by providing the energy needed to move ions and molecules against their concentration gradient.

Question: What are the advantages of using electrochemical sensors for medical diagnostics?

Answer: Electrochemical sensors for medical diagnostics offer advantages like high sensitivity, rapid response, portability, and the ability to detect a wide range of biomolecules, enabling point-of-care testing and continuous monitoring of health conditions.

Question: What is the molar mass of potassium carbonate ( $K_2CO_3$ )?

Answer: The molar mass of  $K_2CO_3$  is 138 g/mol.

Question: How is the blast furnace operated in iron extraction?

Answer: The blast furnace is operated by feeding raw materials from the top, blowing hot air from the bottom, and maintaining high temperatures to facilitate the reduction reactions that produce liquid iron.

Question: How does the induced voltage waveform in an alternating current dynamo look?

Answer: The induced voltage waveform in an alternating current dynamo is sinusoidal, alternating between positive and negative values.

Question: What happens to the induced current when the coil in a dynamo is vertical?

Answer: When the coil is vertical, the induced current becomes zero as the conductors do not intersect the magnetic field lines.

Question: How does copper's lack of reactivity with hydrochloric acid demonstrate its position in the reactivity series?

Answer: Copper's lack of reactivity with hydrochloric acid shows it is less reactive than metals like magnesium and zinc, positioning it lower in the reactivity series.

Question: Explain the principle of a direct current (DC) motor, including its construction and working mechanism.

Answer: A direct current (DC) motor converts electrical energy into mechanical energy using the principles of electromagnetism. The main components and working mechanism are as follows: Construction: Armature: A coil of wire wrapped around a core, usually made of iron or steel, to enhance magnetic effects. The armature is placed within a magnetic field created by permanent magnets or electromagnets. Magnetic Poles: Permanent magnets or electromagnets that create a magnetic field around the armature. Commutator: A rotary switch that reverses the direction of current flow through the armature windings, ensuring continuous rotation in one direction. Brushes: Conductive material that maintains electrical contact with the rotating commutator. Working Mechanism: When current flows through the armature, it creates a magnetic field around the coil. This magnetic field interacts with the external magnetic field from the magnetic poles, producing a force on the armature due to the Lorentz force. According to Fleming's left-hand rule, the direction of the force is perpendicular to both the magnetic field and the current, causing the armature to rotate. The commutator periodically reverses the direction of the current in the armature windings, maintaining the torque in a consistent direction and ensuring continuous rotation. The brushes maintain electrical contact with the rotating commutator, allowing the current to flow through the armature. Application: DC motors are used in various applications, including toy cars, electric vehicles, trains, and household appliances, due to their ability to provide precise control over speed and torque.

Question: What is the purpose of filtration in separation processes?

Answer: Filtration separates suspended solid particles from a liquid, using a filter to retain larger particles and allow smaller particles to pass through.

Question: How does the rate of change of the magnetic field affect the induced voltage?

Answer: A faster rate of change of the magnetic field induces a higher voltage, as the induced electromotive force is directly proportional to the rate of change.

Question: How does water aid in plant functions?

Answer: Water aids in plant functions by transporting water to upper parts of the plant due to its cohesive and adhesive forces.

Question: What is the relationship between pressure and the rate of reaction for gases?

Answer: Higher pressure increases the concentration of gas molecules, leading to more frequent collisions and a faster reaction rate.

Question: How does a compressed gas exert pressure?

Answer: A compressed gas exerts pressure due to the force of the gas molecules colliding with the walls of the container. The more the gas is compressed, the higher the pressure.

Question: What is the significance of magnetic field lines around a conductor?

Answer: Magnetic field lines represent the direction and strength of the magnetic field, helping visualize the field's influence on other objects.

Question: Describe the observations when zinc reacts with hydrochloric acid.

Answer: When zinc reacts with hydrochloric acid, bubbles of hydrogen gas form, and zinc dissolves, forming zinc chloride:  $\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$ .

Question: How is the molar mass of sulfuric acid ( $\text{H}_2\text{SO}_4$ ) calculated?

Answer: The molar mass of sulfuric acid is calculated by summing the molar masses of its constituent atoms:  $2 \times 1$  for hydrogen, 32 for sulfur, and  $4 \times 16$  for oxygen, resulting in 98 grams per mole.

Question: What are the effects of ozone layer depletion?

Answer: The effects of ozone layer depletion include increased UV radiation reaching the Earth's surface, leading to cataracts, skin cancer, and reduced immunity.

Question: What is the relationship between pressure and temperature in gases according to the Ideal Gas Law?

Answer: According to the Ideal Gas Law ( $PV = nRT$ ), pressure is directly proportional to temperature when volume and the number of moles are constant.

Question: What are some examples of gymnosperms?

Answer: Examples of gymnosperms include *Cycas* and *Pinus*.

Question: How does industrialization contribute to environmental pollution?

Answer: Industrialization contributes to environmental pollution through the release of pollutants, such as hydrocarbons, greenhouse gases, heavy metals, and industrial waste, into the air, water, and soil.

Question: What is the tension of a string in the context of an object suspended by it?

Answer: The tension of a string is the upward force exerted by the string to balance the weight of the suspended object, keeping it in equilibrium.

Question: How does xylem parenchyma contribute to xylem tissue?

Answer: Xylem parenchyma are living cells with thin cell walls that store food within the xylem tissue.

Question: What are the features of vertebrates in the class Pisces?

Answer: Vertebrates in the class Pisces have a bony or cartilaginous endoskeleton, streamlined bodies, scales, fins for swimming, a lateral line system for detecting vibrations, a two-chambered heart, gills for respiration, and are cold-blooded.

Question: How does the material composition of a conductor affect its resistance?

Answer: Different materials have different resistivities, which affect the resistance of the conductor; materials with lower resistivity have lower

resistance.

Question: What are the two laws of reflection of light?

Answer: The first law states that the incident ray, reflected ray, and normal all lie in the same plane. The second law states that the angle of incidence is equal to the angle of reflection.

Question: What is the trend in ionisation energy within Group II elements?

Answer: The trend in ionisation energy within Group II elements is a decrease from top to bottom.

Question: What hormones are secreted by the thyroid gland, and what are their functions?

Answer: The thyroid gland secretes calcitonin, which reduces calcium levels in the blood, and thyroxine, which controls metabolic rate.

Question: What are unicellular and multicellular organisms?

Answer: Unicellular organisms are composed of a single cell, while multicellular organisms are composed of many cells.

Question: How does the design of an electrochemical cell impact its performance?

Answer: The design of an electrochemical cell impacts its performance by influencing factors like electrode configuration, electrolyte composition, ion transport, and heat management. Optimal design ensures efficient reactions, high power output, and long cell life.

Question: What is the relationship between the speed of coil rotation and the output voltage of a dynamo?

Answer: The output voltage of a dynamo increases with the speed of coil rotation, as a higher speed induces a greater electromotive force.

Question: What is required for the car to move when multiple people are pushing it?

Answer: For the car to move, all the forces must be applied in the direction that the car needs to be moved.

Question: How is the efficiency of a transformer calculated?

Answer: Efficiency is calculated using the formula  $\text{Efficiency} = (\text{Power output} / \text{Power input}) * 100\%$ .

Question: How does the depth of a liquid column relate to the hydrostatic pressure it exerts?

Answer: The hydrostatic pressure exerted by a liquid column is directly proportional to its depth, calculated using the formula  $P = h\rho g$ .

Question: How does the conductivity of an electrolyte influence the performance of an electrochemical cell?

Answer: The conductivity of an electrolyte influences the performance of an electrochemical cell by affecting ion transport and reaction rates. High conductivity ensures efficient ion migration, reducing internal resistance and improving cell efficiency and power output.



Question: What is the role of cilia and flagella in unicellular organisms?

Answer: Cilia and flagella are used by unicellular organisms for movement, helping them to navigate their environment and fulfill their requirements.

Question: How do you balance a uniform rod with different weights suspended at varying distances from the pivot?

Answer: Balance the rod by ensuring that the clockwise moments due to the weights on one side equal the anti-clockwise moments due to the weights on the other side, achieving equilibrium.

Question: What is the primary function of epithelial tissue in the vertebrate body?

Answer: Epithelial tissue lines the free surfaces (internal and external) of the vertebrate body, providing protection, absorption, perception of stimuli, secretion, and filtration functions.

Question: What is the significance of glycogen storage in the liver?

Answer: The liver stores glucose as glycogen, which can be converted back to glucose and released into the blood when energy is needed.

Question: What is the reaction between calcium oxide and water?

Answer: Calcium oxide reacts with water to form calcium hydroxide:  $\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2$ .

Question: What is a divergent light beam?

Answer: A divergent light beam is a bundle of rays that spread out from a common point.

Question: How do hormones like aldosterone and ADH affect kidney function?

Answer: Aldosterone increases sodium reabsorption and potassium secretion, while ADH increases water reabsorption, both affecting urine concentration and volume.

Question: What is the specific heat capacity of mercury?

Answer: The specific heat capacity of mercury is  $140 \text{ J kg}^{-1} \text{ K}^{-1}$ .

Question: What is the role of a microphone in studying sound waves?

Answer: A microphone converts sound waves into electrical signals, which can be visualized using an oscilloscope to study their characteristics.

Question: How are transformers used in power distribution?

Answer: Transformers step up the voltage for efficient long-distance transmission and step it down for safe distribution to homes and industries.

Question: What is the significance of Michael Faraday's contribution to electromagnetism?

Answer: Michael Faraday's discovery of electromagnetic induction revolutionized the generation of electricity and led to the development of various electrical devices.

Question: What is the role of the extracellular matrix in multicellular organisms?

Answer: The extracellular matrix provides structural support, facilitates cell adhesion, and regulates intercellular communication, playing a crucial role in tissue organization and function.

Question: How do you investigate the effect of tightening a screw on the moment of force required to rotate a stick?

Answer: Investigate the effect by tightening the screw at different levels and measuring the force required to initiate rotation using a Newton balance, observing the relationship between screw tightness and required force.

Question: Describe the function of the Golgi apparatus in protein trafficking.

Answer: The Golgi apparatus processes and sorts proteins, directing them to their appropriate destinations, such as lysosomes, the plasma membrane, or for secretion outside the cell.

Question: How does the weight of an object in water compare to its weight in air?

Answer: The weight of an object in water is less than its weight in air because the upthrust exerted by the water reduces the apparent weight of the object.

Question: How does a digital oscilloscope display electrical signals?

Answer: A digital oscilloscope samples electrical signals, converts them to digital data, and displays the waveform on a screen, allowing analysis of signal characteristics.

Question: What is the principle behind the operation of a bimetallic strip in temperature regulation?

Answer: A bimetallic strip operates on the principle of differential thermal expansion, where two metals with different expansion rates bend when heated, making or breaking electrical contacts to regulate temperature in devices like thermostats.

Question: What is the effect of connecting two dry cells in series on the potential difference in a circuit?

Answer: Connecting two dry cells in series increases the potential difference, which can increase the current in the circuit if the resistance remains constant.

Question: How is carbon dioxide used in the production of fizzy drinks?

Answer: Carbon dioxide dissolves in water to form carbonic acid, giving fizzy drinks their characteristic effervescence and taste.

Question: How is the chemical formula of methane represented?

Answer: The chemical formula of methane is  $\text{CH}_4$ , indicating one carbon atom and four hydrogen atoms.

Question: Describe an experiment to demonstrate the behavior of a p-n junction diode in forward and reverse bias configurations, including observations and conclusions.

Answer: To demonstrate the behavior of a p-n junction diode in forward and reverse bias, an experiment can be conducted using a diode, a torch bulb, batteries, a switch, and connecting wires. Materials Required: IN 4001 diode, 2.5 V torch bulb, two 1.5 V dry cell batteries, switch, circuit board, connecting wires. Procedure: Forward Bias Configuration: Connect the circuit as follows: positive terminal of the battery to the anode of the diode, cathode of the diode to one terminal of the torch bulb, the other terminal of the torch bulb to the negative terminal of the battery. Close the switch and observe the torch bulb. Reverse Bias Configuration: Reconnect the circuit: positive terminal of the battery to the cathode of the diode, anode of the diode to one terminal of the torch bulb, the other terminal of the torch bulb to the negative terminal of the battery. Close the switch and observe the torch bulb. Observations: Forward Bias: The torch bulb lights up, indicating current flows through the diode when the anode is connected to the positive terminal and the cathode to the negative terminal. Reverse Bias: The torch bulb does not light up, indicating no current flows through the diode when the connections are reversed. Conclusion: A p-n junction diode allows current to pass in the forward bias configuration, where the applied voltage overcomes the potential barrier. In reverse bias, the potential barrier increases, preventing current flow, demonstrating the diode's rectifying property to allow current in only one direction.

Question: What is a Lewis dot diagram?

Answer: A Lewis dot diagram shows the covalent bonds of a molecule by representing the valence shell electrons of its atoms using dots.

Question: What are the primary functions of the respiratory system's main parts?

Answer: The nasal cavity filters and moistens air, the pharynx directs air to the lungs, the larynx produces sound, the trachea conducts air, bronchi and bronchioles distribute air, and alveoli facilitate gas exchange.

Question: What is the total surface area of a large marble cube with all six sides exposed?

Answer: The total surface area is  $24 \text{ cm}^2$  ( $4 \text{ cm}^2 \times 6$ ).

Question: How does the specific heat capacity of ethanol make it useful in laboratory thermometers?

Answer: Ethanol's specific heat capacity and high expansion rate with temperature changes make it useful in laboratory thermometers, providing accurate temperature measurements.

Question: What is vegetative propagation?

Answer: Vegetative propagation involves propagating plants using vegetative parts like stems, roots, and leaves rather than seeds.

Question: What happens to the induced current when the coil in a dynamo is parallel to the magnetic field?

Answer: When the coil is parallel to the magnetic field, the induced current becomes zero as there is no intersection of field lines.

Question: How does a logic analyzer help in digital circuit debugging?

Answer: A logic analyzer captures and displays multiple digital signals, allowing engineers to analyze and debug the behavior of digital circuits by observing timing and logic states.

Question: What is the effect of a convex lens on parallel light rays?

Answer: A convex lens converges parallel light rays to a focal point on the opposite side of the lens.

Question: How does a loudspeaker generate sound from electrical signals?

Answer: A loudspeaker converts electrical signals into sound by vibrating a coil and cone, producing sound waves that correspond to the signal.

Question: What is the average speed of a vehicle that travels 100 km in 2 hours?

Answer: The average speed is 50 km/h.

Question: What is the relationship between the speed of a bicycle and the output of the dynamo?

Answer: The output of the dynamo increases with the speed of the bicycle, as a faster rotation induces a higher electromotive force.

Question: What is uniform motion?

Answer: Uniform motion occurs when an object moves at a constant speed in a straight line.

Question: What is the role of a mediator in mediated electrochemical oxidation?

Answer: A mediator in mediated electrochemical oxidation is a redox-active species that facilitates the transfer of electrons between the electrode and the target compound, enhancing the efficiency and selectivity of the oxidation process.

Question: What is the role of the Golgi apparatus in protein trafficking?

Answer: The Golgi apparatus sorts and packages proteins into vesicles for transport to their final destinations, ensuring proper delivery and function within the cell or secretion outside the cell.

Question: How does thermal expansion affect the design of bridges?

Answer: Thermal expansion affects the design of bridges by requiring expansion joints to accommodate changes in length due to temperature variations, preventing structural damage and ensuring stability.

Question: What is the method to observe fungi on a slice of bread?

Answer: Add a few drops of water onto a slice of bread, leave it for 2 days, obtain a small amount of the mycelium, place it on a glass slide, cover it with a coverslip, and observe it through a microscope.

Question: What happens to the induced current when the coil in a dynamo moves parallel to the magnetic field?

Answer: When the coil moves parallel to the magnetic field, the induced current becomes zero as there is no intersection of field lines.

Question: Calculate the power required to do 400 J of work in 20 seconds.

Answer: The power required is 20 Watts (W).

Question: How do geneticists use bioinformatics to analyze genetic data?

Answer: Bioinformatics combines biology, computer science, and statistics to analyze and interpret large-scale genetic data, helping geneticists identify genes associated with diseases, understand genetic variation, and predict the effects of genetic mutations.

Question: How does the principle of pressure transmission apply to a hydraulic lift?

Answer: A hydraulic lift operates on Pascal's principle, using fluid pressure to lift heavy objects like cars in automotive services for maintenance and repairs.

Question: Describe the role of friction in the braking system of a car.

Answer: In a car's braking system, friction between the brake pads and the disc attached to the wheel slows down and stops the vehicle by converting kinetic energy into heat.

Question: What is the role of acetone in paper chromatography?

Answer: Acetone acts as the mobile phase, carrying the components of the mixture up the paper strip.

Question: How do light-independent reactions (Calvin cycle) contribute to photosynthesis?

Answer: Light-independent reactions (Calvin cycle) use ATP and NADPH produced in the light-dependent reactions to convert CO<sub>2</sub> into glucose.

Question: How do vibrating vocal cords produce sound?

Answer: Vibrating vocal cords cause the air around them to vibrate, generating sound waves that propagate through the air.

Question: What is the specific heat capacity of zinc?

Answer: The specific heat capacity of zinc is  $380 \text{ J kg}^{-1} \text{ K}^{-1}$ .

Question: What occurs during the proliferation phase of the uterine cycle?

Answer: During the proliferation phase, the uterine lining rebuilds under the influence of estrogen, forming a new cell layer and blood capillaries, typically lasting about ten days.

Question: What is the relative molecular mass of glucose (C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>)?

Answer: The relative molecular mass of glucose (C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>) is 180, calculated as  $6 \times 12$  for carbon,  $12 \times 1$  for hydrogen, and  $6 \times 16$  for oxygen.

Question: How does the pressure exerted by a gas change with temperature?

Answer: The pressure exerted by a gas increases with temperature, as higher temperatures cause gas molecules to move faster and collide with container walls more frequently.

Question: How did Mendel's experiments challenge the blending theory of inheritance?

Answer: Mendel's experiments showed that traits are inherited as discrete units (genes) rather than blending together, leading to the discovery of dominant and recessive alleles.

Question: How does the weight of an object in air compare to its weight when submerged in water?

Answer: The weight of an object in water is less than its weight in air due to the upthrust exerted by the water, which reduces the apparent weight of the object.

Question: How does the direction of induced current change with coil rotation?

Answer: The direction of induced current changes periodically with coil rotation, resulting in an alternating current output.

Question: What are the two main types of curved mirrors?

Answer: The two main types of curved mirrors are concave mirrors (reflecting surface curved inward) and convex mirrors (reflecting surface curved outward).

Question: What is the principle behind using ultrasound to examine internal organs?

Answer: Ultrasound waves are emitted and reflected back from internal structures, allowing for the visualization of organs and fetuses inside the body.

Question: How does the body manage sodium levels through kidney function?

Answer: The kidneys regulate sodium levels by filtering and reabsorbing sodium, influenced by hormones like aldosterone.

Question: What equipment is commonly used in laboratories to prepare standard solutions?

Answer: Volumetric flasks, wash bottles, watch glasses, and funnels.

Question: What is the relationship between specific heat capacity and thermal inertia?

Answer: Specific heat capacity and thermal inertia are related; substances with high specific heat capacities have high thermal inertia, meaning they resist temperature changes and require more heat to alter their temperature.

Question: What is the speed of light in glass?

Answer: 197,000 km/s.

Question: How do grooves on tires improve safety?

Answer: Grooves on tires improve safety by increasing friction with the road surface, preventing skidding, and enhancing traction, especially in wet conditions.

Question: What is the significance of the Tafel equation in electrochemistry?

Answer: The Tafel equation relates the overpotential to the current density in an electrochemical reaction, providing insights into reaction kinetics and mechanisms. It helps in determining the exchange current density and the Tafel slope, which are important parameters in electrode characterization.

Question: What are the uses of Copper sulphate?

Answer: Copper sulphate is used as a fungicide in agriculture, in making chemical reagents, electroplating, and in the paint industry.

Question: What are secondary sexual characteristics in females?

Answer: Secondary sexual characteristics in females, influenced by the hormones estrogen and progesterone, include pubertal hair growth on armpits and genital areas, widened pubic region, growth of mammary glands, increased body fat, accelerated growth of bones and muscles, and the start of the menstrual cycle.

Question: How do convex lenses form real images?

Answer: Convex lenses converge light rays to a focal point on the opposite side of the lens, forming real images.

Question: Explain the principle of a potentiostat and its use in electrochemical experiments.

Answer: A potentiostat controls the potential of the working electrode relative to a reference electrode while measuring the current flow. It is used in electrochemical experiments to study reaction mechanisms, kinetics, and electrode behavior.

Question: How is the chemical formula of phosphine represented?

Answer: The chemical formula of phosphine is  $\text{PH}_3$ , indicating one phosphorus atom and three hydrogen atoms.

Question: How does a battery differ from a single electrochemical cell?

Answer: A battery is a collection of several electrochemical cells, which allows it to provide a larger amount of electrical energy compared to a single cell.

Question: How does electronegativity vary across a period?

Answer: Electronegativity increases from left to right across a period.

Question: Explain the function of peroxisomes in lipid metabolism.

Answer: Peroxisomes contain enzymes that break down fatty acids through beta-oxidation, producing acetyl-CoA for energy production and detoxifying harmful byproducts.

Question: What is the significance of solubility in analytical chemistry?

Answer: Solubility is important in analytical chemistry for preparing solutions, conducting titrations, and analyzing the concentration and purity of substances.

Question: What are the elements present in common fuels like wax, petrol, and diesel?

Answer: Common fuels like wax, petrol, and diesel contain carbon and hydrogen.

Question: What is the significance of pH in agriculture?

Answer: Soil pH affects nutrient availability, microbial activity, and crop growth, making pH management essential for successful agriculture.

Question: What are the main parts of the female reproductive system?

Answer: The main parts of the female reproductive system include the ovaries, fallopian tubes, uterus, and vagina.

Question: What is the work done when a force of 1 N moves an object by 1 m?

Answer: The work done is 1 Joule (J).

Question: How do you calculate the distance traveled by an object with non-uniform speed?

Answer: The distance is calculated by finding the area under the speed-time graph or summing the distances traveled in each time interval.

Question: Describe the structure and functioning of a solar cell, and discuss its applications and advantages.

Answer: Solar cells, also known as photovoltaic cells, are devices that convert light energy into electrical energy using the principles of the photovoltaic effect. Structure: p-n Junction: Solar cells are constructed using silicon p-n junctions, similar to diodes. They are designed to allow light to fall on the junction. Light Absorption: When sunlight hits the silicon junction, it energizes electrons, causing them to move and generate an electromotive force (emf). Functioning: Generation of emf: Incident sunlight provides energy to electrons, enabling them to move across the p-n junction, creating a voltage difference. Electric Current: By connecting multiple cells in series and parallel, a larger voltage and current can be obtained, forming a solar panel. Applications: Power Generation: Solar panels are used to generate electricity for homes, reducing reliance on the main power supply. Initially developed for satellites, their use has expanded due to decreasing costs and improved efficiency. Portable Devices: Solar cells are used in calculators, clocks, and other small devices. Vehicles: Solar-powered vehicles use solar cells to convert sunlight into electrical energy to power the vehicle. Advantages: Renewable Energy: Solar cells harness solar radiation, an abundant and renewable energy source, without emitting harmful substances. Environmental Benefits: They produce clean energy, reducing the carbon footprint and environmental impact compared to fossil fuels. Longevity: Solar cells have a long operational life, with initial cells still in use today.

Question: How do you investigate the equilibrium of a meter ruler under the action of three coplanar parallel forces?

Answer: Suspend the meter ruler horizontally using two rubber bands and spring balances at either end. Measure the forces exerted by the balances and compare them to the weight of the ruler to ensure they balance and maintain equilibrium.

Question: What is dichogamy?

Answer: Dichogamy is an adaptation where stamens mature earlier than the pistil (proterandry) or the pistil matures earlier than the stamens



(protogyny), preventing self-pollination.

Question: What is the importance of the number of turns in a coil for electromagnetic devices?

Answer: More turns in a coil increase the induced electromotive force, enhancing the performance of electromagnetic devices like generators and transformers.

Question: How does the curvature of a concave mirror influence its ability to form images?

Answer: The curvature affects the focal length, with more curved mirrors having shorter focal lengths and a stronger ability to converge light rays.

Question: What happens when an object is placed at the focal point of a concave mirror?

Answer: The image is formed at infinity and is very large and inverted.

Question: What is the significance of the Convention on Biological Diversity (CBD)?

Answer: The Convention on Biological Diversity (CBD) is an international agreement aimed at conserving biodiversity, using biological resources sustainably, and sharing the benefits of genetic resources fairly.

Question: How is the chemical formula of hydrogen chloride represented?

Answer: The chemical formula of hydrogen chloride is HCl, indicating one hydrogen atom and one chlorine atom.

Question: How do ultrasound waves help in soldering metals?

Answer: Ultrasound waves cause metals to rub against each other, generating heat that melts and solders the metals at the contact point.

Question: What is the significance of the chitinous cuticle in Arthropods?

Answer: The chitinous cuticle acts as an exoskeleton providing protection and support to the body.

Question: Explain the operation of a thermocouple in temperature measurement.

Answer: A thermocouple generates a voltage proportional to the temperature difference between its two junctions, providing accurate temperature measurement for various applications.

Question: What is the first ionisation energy of neon?

Answer: The first ionisation energy of neon is 2081 kJ/mol.

Question: How is methane (CH<sub>4</sub>) released into the environment?

Answer: Methane is released due to bacterial activity on garbage and dead plant and animal matter in marshy lands, during the use of liquid petroleum (LP gas), petrol, diesel, and kerosene as fuel, and during the use of lubrication oil and grease.

Question: What is the significance of atomic lattices in elements like carbon?

Answer: Atomic lattices in elements like carbon result in structures like graphite and diamond, which have unique properties due to the way carbon atoms form covalent bonds with each other.

Question: What are the environmental impacts of deforestation on soil health?

Answer: Deforestation increases soil erosion, reduces nutrient availability, and degrades soil structure. It affects soil fertility and long-term agricultural productivity.

Question: How do you measure the force required to initiate the turning effect using a Newton balance and a stick?

Answer: Measure the force by attaching the Newton balance to the stick, applying a perpendicular force, and recording the minimum force required to slightly move the stick.

Question: How is the pH of a solution determined using a pH meter?

Answer: A pH meter measures the voltage difference between two electrodes in the solution, providing a precise pH value.

Question: What are the environmental benefits of using electrochemical methods for wastewater treatment?

Answer: The environmental benefits of using electrochemical methods for wastewater treatment include efficient removal of contaminants, reduced chemical usage, minimal sludge production, and the ability to treat a wide range of pollutants, resulting in cleaner water and reduced environmental impact.

Question: What is the role of bacteria in the nitrogen cycle?

Answer: Bacteria fix atmospheric nitrogen to increase soil nitrate levels, which is essential for plant growth.

Question: How do sex-linked genetic disorders differ between males and females?

Answer: Sex-linked genetic disorders are more common in males because they have only one X chromosome. Females have two X chromosomes, so a recessive gene on one X chromosome can be masked by a dominant gene on the other.

Question: What is the electronic configuration of a fluorine atom?

Answer: The electronic configuration of a fluorine atom is 2, 7.

Question: How is electric energy measured in kilowatt hours (kWh)?

Answer: Electric energy is measured in kilowatt hours (kWh), where one kWh is the amount of energy consumed by a 1 kW appliance operating for one hour.

Question: Describe the use of a function generator in electronic testing.

Answer: A function generator produces various waveform signals, such as sine, square, and triangle waves, used for testing, troubleshooting, and developing electronic circuits.

Question: What are the benefits of using electrolysis for industrial metal refining?

Answer: Electrolysis for metal refining produces high-purity metals, removes impurities, and allows for the recovery of valuable by-products, enhancing the overall efficiency and profitability of the process.

Question: How does the orientation of the coil affect the induced voltage in a dynamo?

Answer: The orientation of the coil affects the induced voltage, with maximum values generated when the coil is perpendicular to the magnetic field lines.

Question: How do convex mirrors produce diminished images?

Answer: Convex mirrors cause reflected rays to diverge, making the images appear smaller than the actual objects.

Question: What is the purpose of the neutral wire in an electric circuit?

Answer: The neutral wire completes the electrical circuit by carrying the current back to the power source, ensuring a continuous flow of electricity.

Question: How is the relative formula mass of ionic compounds calculated?

Answer: The relative formula mass of ionic compounds is calculated based on the simplest ratio of ions in the compound, using their relative atomic masses.

Question: What are the two types of layering in vegetative propagation?

Answer: The two types of layering are ground layering and aerial layering.

Question: How is the chemical formula of aluminium oxide represented?

Answer: The chemical formula of aluminium oxide is  $\text{Al}_2\text{O}_3$ , indicating two aluminium ions and three oxide ions.

Question: What is the difference between evaporation and boiling in terms of heat transfer?

Answer: Evaporation is the gradual conversion of a liquid to gas at temperatures below the boiling point, while boiling is the rapid conversion of a liquid to gas at its boiling point. Both processes involve heat transfer but occur under different conditions.

Question: How does thermal energy affect the conductivity of semiconductors?

Answer: Thermal energy increases the conductivity of semiconductors by providing enough energy to break covalent bonds, creating free electrons and holes that contribute to electrical conduction.

Question: How does gravitational potential energy depend on height?

Answer: Gravitational potential energy depends directly on height; increasing the height increases the potential energy proportionally.

Question: How does the coil's position affect the electromotive force in an alternating current dynamo?

Answer: The electromotive force varies with the coil's position, reaching maximum values when the coil intersects the magnetic field lines.

perpendicularly.

Question: How do lenses correct vision in eyeglasses?

Answer: Eyeglasses use convex or concave lenses to adjust the focal point of light entering the eye, aiding in clear vision for various refractive errors.

Question: What is the specific heat capacity of iron?

Answer: The specific heat capacity of iron is  $460 \text{ J kg}^{-1} \text{ K}^{-1}$ .

Question: How do plano-concave lenses differ from bi-concave lenses?

Answer: Plano-concave lenses have one flat and one inward-curved surface, while bi-concave lenses have two inward-curved surfaces.

Question: What is the nature of the image formed by a bi-concave lens?

Answer: A bi-concave lens forms a virtual, upright, and smaller image of the object.

Question: How can an electric current be generated using an electrochemical cell?

Answer: An electric current can be generated by setting up a reaction where electrons are transferred from one electrode (anode) to another (cathode) through an external circuit, allowing the flow of electrons.

Question: What is desertification, and what causes it?

Answer: Desertification is the process by which fertile land becomes unsuitable for plant growth due to deforestation, greenhouse effects, salination, and natural weather changes.

Question: How does the induced current direction change during coil rotation in a dynamo?

Answer: The induced current direction changes periodically, resulting in an alternating current as the coil rotates within the magnetic field.

Question: How does the high specific heat capacity of water influence its use in cooling systems?

Answer: The high specific heat capacity of water allows it to absorb and store large amounts of heat energy, making it effective for use in cooling systems.

Question: Describe the function of the Golgi apparatus in a cell.

Answer: The Golgi apparatus processes, modifies, sorts, and packages proteins and lipids for secretion or delivery to other organelles.

Question: Which of the following is the correct statement about the three main types of muscles in the human body, the skeletal muscles, smooth muscles and cardiac muscles? (1) Cardiac muscles and skeletal muscles are striated. (2) Cardiac muscles and smooth muscles are striated. (3) Skeletal muscles and smooth muscles are striated. (4) Only skeletal muscles are striated.

Answer: (1) Cardiac muscles and skeletal muscles are striated.

Question: Describe the chemical reaction when magnesium ribbon burns in air.

Answer: When magnesium ribbon burns in air, it reacts with oxygen to form magnesium oxide, releasing a bright white light and leaving behind a white powder. The reaction is:  $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$ .

Question: How does the surface area of reactants affect the rate of reaction in heterogeneous systems?

Answer: In heterogeneous systems, a larger surface area of reactants increases the interaction sites, thus accelerating the rate of reaction.

Question: What effect does manganese dioxide have on the decomposition of hydrogen peroxide?

Answer: Manganese dioxide increases the rate of decomposition of hydrogen peroxide into water and oxygen, acting as a catalyst.

Question: What are some examples of birds?

Answer: Examples of birds include Jungle fowl, Ostrich, and Penguin.

Question: Describe the structure of skeletal muscle fibers.

Answer: Skeletal muscle fibers are long, cylindrical, unbranched cells with multiple peripheral nuclei and striations due to the arrangement of actin and myosin filaments.

Question: What is the molar mass of sodium chloride (NaCl)?

Answer: The molar mass of sodium chloride is 58.5 grams per mole, calculated as 23 for sodium plus 35.5 for chlorine.

Question: What is the role of fruits and seeds in plant reproduction?

Answer: Fruits and seeds play a crucial role in plant reproduction by facilitating the dispersal and germination of new plants.

Question: What is the purpose of the center-zero galvanometer in a circuit?

Answer: The center-zero galvanometer measures the direction and magnitude of current flow, indicating whether the current is direct or alternating.

Question: How is the chemical formula of hydrochloric acid written?

Answer: The chemical formula of hydrochloric acid is HCl, indicating one hydrogen atom and one chlorine atom.

Question: What is the chemical formula for disaccharides?

Answer: The chemical formula for disaccharides is  $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ .

Question: Explain the importance of cell division.

Answer: Cell division is important for growth, development, tissue repair, and reproduction in multicellular organisms, ensuring genetic continuity and diversity.

Question: Describe the concept of energy conservation in physics.

Answer: Energy conservation in physics means that the total energy in a closed system remains constant, with energy transforming between different forms without being created or destroyed.

Question: What is the role of resistive forces in motion?

Answer: Resistive forces, like friction, oppose the motion of objects and can cause them to slow down or stop. They balance the applied force until a sufficiently large unbalanced force is applied.

Question: Explain the decomposition reaction of calcium carbonate.

Answer: Calcium carbonate decomposes upon heating to form calcium oxide and carbon dioxide:  $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$ .

Question: What is the main advantage of using steam distillation for extracting essential oils?

Answer: It prevents the decomposition of heat-sensitive compounds by keeping the temperature below their boiling points.

Question: What happens when two forces of equal magnitude act on an object in opposite directions?

Answer: The object remains in equilibrium and does not move.

Question: How do animals perform respiration?

Answer: Animals perform respiration by inhaling oxygen, which is transported to cells for cellular respiration, and exhaling carbon dioxide produced as a waste product.

Question: What is water pollution?

Answer: Water pollution is the contamination of water bodies with pollutants, making the water harmful for consumption and the environment.

Question: What happens to magnesium when it reacts with hydrochloric acid?

Answer: The temperature increases, indicating an exothermic reaction.

Question: How can renewable energy sources help combat climate change?

Answer: Renewable energy sources, such as solar, wind, and hydroelectric power, help combat climate change by reducing greenhouse gas emissions and dependence on fossil fuels.

Question: What is the impact of agrochemicals on environmental pollution?

Answer: Agrochemicals contribute to environmental pollution by contaminating soil and water, harming non-target species, and disrupting ecosystems. Their overuse leads to negative health effects on humans and wildlife.

Question: What is meant by the equilibrium of an object under the action of moments of force?

Answer: An object is in equilibrium under the action of moments of force when the sum of the clockwise moments equals the sum of the anti-clockwise moments, resulting in no net rotation.

Question: Does the surface area of contact affect the limiting frictional force?

Answer: No, the limiting frictional force does not depend on the surface area of the contact surfaces.

Question: How does the wavelength of a sound wave affect its pitch?

Answer: Shorter wavelengths correspond to higher frequencies and pitches, while longer wavelengths correspond to lower frequencies and pitches.

Question: What is the significance of the rate of reaction in chemical processes?

Answer: The rate of reaction determines how quickly products are formed, affecting the efficiency and feasibility of chemical processes.

Question: What are paints, and what are their main components?

Answer: Paints are materials applied on surfaces to protect and color them. Their main components are pigments, binders, and solvents.

Question: How does a bi-convex lens affect light rays traveling through it?

Answer: A bi-convex lens converges parallel light rays to a focal point on the opposite side of the lens.

Question: What is the significance of the boiling point difference in fractional distillation?

Answer: It allows for the separation of components with different volatilities by collecting vapors at different temperatures.

Question: What are the functions of lysosomes in animal cells?

Answer: Lysosomes digest cellular waste, debris, and foreign invaders using hydrolytic enzymes, playing a key role in cellular cleanup and recycling.

Question: How does fractional distillation separate components of crude oil?

Answer: By controlling the cooling conditions in a fractionating tower, allowing components with different boiling points to be separated at different levels.

Question: How does urbanization impact water resources?

Answer: Urbanization impacts water resources by increasing water demand, contributing to water pollution through runoff, reducing groundwater recharge, and altering natural water flow patterns.

Question: How does the conductivity of an electrolyte influence the performance of an electrochemical cell?

Answer: The conductivity of an electrolyte influences the performance of an electrochemical cell by affecting ion transport and reaction rates. High conductivity ensures efficient ion migration, reducing internal resistance and improving cell efficiency and power output.

Question: What is the relationship between the length of a vibrating string and the frequency of sound it produces?

Answer: The frequency of sound is inversely proportional to the length of the vibrating string; shorter strings produce higher frequencies.

Question: What is the significance of the meniscus in volumetric measurements?

Answer: The meniscus ensures accurate volume measurement by marking the correct level at the volume mark.

Question: How does a manometer measure gas pressure?

Answer: A manometer measures gas pressure by comparing the pressure of the gas to the atmospheric pressure, using a U-shaped tube partially filled with liquid. The difference in liquid levels indicates the pressure.

Question: What is the significance of crossing over during meiosis?

Answer: Crossing over during meiosis is significant because it increases genetic diversity by exchanging genetic material between homologous chromosomes, resulting in new combinations of alleles.

Question: Describe the significance of impedance matching in RF circuits.

Answer: Impedance matching ensures maximum power transfer and minimizes signal reflection in RF circuits by matching the impedance of the source and load, optimizing performance.

Question: What is the relationship between wavelength and the distance between crests in a transverse wave?

Answer: The wavelength is the distance between two consecutive crests (or troughs) in a transverse wave.

Question: What is the role of vegetative propagation in plant reproduction?

Answer: Vegetative propagation allows for the reproduction of plants using vegetative parts such as stems, roots, and leaves, rather than seeds.

Question: What is the significance of the Lewis dot and cross diagram?

Answer: The Lewis dot and cross diagram illustrates how electrons participate in the formation of covalent bonds by showing the arrangement of valence electrons as dots and crosses.

Question: What is the role of electrodes in an electrochemical cell?

Answer: Electrodes in an electrochemical cell serve as the sites for oxidation and reduction reactions. The anode is where oxidation occurs, and the cathode is where reduction occurs.

Question: What is the function of the heart in the blood circulatory system?

Answer: The heart functions as a pumping machine, facilitating double circulation consisting of systemic and pulmonary circulation.

Question: How can sexually transmitted diseases be prevented?

Answer: Sexually transmitted diseases can be prevented by avoiding risky sexual activities, using protection during intercourse, and avoiding blood transmission from infected individuals.

Question: How does the induced current direction change during coil rotation in a dynamo?

Answer: The induced current direction changes periodically, resulting in an alternating current as the coil rotates within the magnetic field.

Question: What is the relationship between force magnitude and the moment of force in practical applications?



Answer: The moment of force in practical applications is directly proportional to the magnitude of the applied force. An increase in force results in a larger moment, making it easier to rotate the object.

Question: What is the concept of gauge pressure and how is it different from absolute pressure?

Answer: Gauge pressure measures the pressure relative to atmospheric pressure, while absolute pressure includes atmospheric pressure in its measurement.

Question: How does the specific heat capacity of a substance determine its use in thermal storage systems?

Answer: Substances with high specific heat capacities are used in thermal storage systems because they can absorb and store large amounts of heat, making them effective for maintaining stable temperatures.

Question: What is the electronic configuration of potassium?

Answer: The electronic configuration of potassium is 2, 8, 8, 1.

Question: How does the induced voltage waveform in an alternating current dynamo look?

Answer: The induced voltage waveform in an alternating current dynamo is sinusoidal, alternating between positive and negative values.

Question: What are the goals of the United Nations Sustainable Development Goals (SDGs)?

Answer: The goals of the United Nations Sustainable Development Goals (SDGs) are to end poverty, protect the planet, and ensure prosperity for all by 2030.

Question: What environmental conditions are included in the environment?

Answer: Environmental conditions include temperature, rainfall, humidity, and sunlight.

Question: What is the formula to calculate the pressure exerted by a liquid column?

Answer: The formula to calculate the pressure exerted by a liquid column is  $P = h\rho g$ , where  $h$  is the height of the column,  $\rho$  is the density of the liquid, and  $g$  is gravitational acceleration.

Question: How does the electrolysis of water produce oxygen gas?

Answer: Oxygen gas is produced at the anode by the oxidation of  $\text{OH}^-$  ions:  $4\text{OH}^- (\text{aq}) \rightarrow \text{O}_2 (\text{g}) + 2\text{H}_2\text{O} (\text{l}) + 4\text{e}^-$ .

Question: What is the significance of the lines of action of forces in maintaining equilibrium in a system of three non-parallel forces?

Answer: The lines of action of the three non-parallel forces must intersect at a common point for equilibrium to be maintained. This ensures that the resultant of any two forces is equal in magnitude and opposite in direction to the third force.

Question: Explain the concept of overpotential in electrolysis.

Answer: Overpotential is the extra voltage required beyond the theoretical voltage to drive a non-spontaneous electrochemical reaction. It accounts for factors like electrode surface properties and reaction kinetics.

Question: What is the pressure exerted at a depth of 2 meters in a tank with water density of  $1000 \text{ kg/m}^3$  and  $g = 10 \text{ m/s}^2$ ?

Answer: The pressure is  $20,000 \text{ Pa}$ , calculated as  $2 \text{ m} \times 1000 \text{ kg/m}^3 \times 10 \text{ m/s}^2$ .

Question: Describe the process of electrorefining.

Answer: Electrorefining is a process used to purify metals by making the impure metal the anode and a pure metal sheet the cathode in an electrolytic cell. The metal from the anode dissolves into the electrolyte and is deposited onto the cathode, leaving impurities behind.

Question: What are underground stems?

Answer: Underground stems are stems of plants that grow under the soil and are involved in vegetative propagation, storage of food, and surviving adverse climatic conditions. Examples include rhizomes (ginger, turmeric), corms (taro, cocoyam), bulbs (onion, leek), and stem tubers (potato).

Question: How do corrective lenses work for nearsightedness?

Answer: Corrective lenses for nearsightedness use concave lenses to diverge light rays before they enter the eye, aiding in clear vision of distant objects.

Question: What is the unit for measuring electrical resistance?

Answer: The unit for measuring electrical resistance is the Ohm ( $\Omega$ ).

Question: How many electrons can the third energy level hold?

Answer: The third energy level can hold a maximum of 18 electrons.

Question: What is the activity series, and why is it important?

Answer: The activity series arranges metals in order of decreasing reactivity. It is important for predicting the outcomes of reactions, such as which metals can displace others in solutions and how they react with air, water, and acids.

Question: How many molecules are there in 0.2 moles of water ( $\text{H}_2\text{O}$ )?

Answer: There are  $1.204 \times 10^{23}$  molecules in 0.2 moles of water, calculated as  $0.2 \times 6.022 \times 10^{23}$ .

Question: How does the electronic configuration of sodium differ from that of neon and argon?

Answer: Sodium has an electronic configuration of 2, 8, 1, with one electron in its outermost shell, unlike neon and argon which have eight electrons in their valence shells.

Question: How is carbon dioxide gas collected by upward displacement of air?

Answer: Carbon dioxide, denser than air, is collected by allowing it to displace air upwards in an inverted gas jar, a method known as upward displacement of air.

Question: What is the difference between aerobic and anaerobic respiration?

Answer: Aerobic respiration requires oxygen and produces more energy by completely breaking down glucose, while anaerobic respiration occurs without oxygen and produces less energy.

Question: How is a tank bund constructed and maintained?

Answer: A tank bund is constructed of several layers of soil, including clay, gravel, and thoroughly beaten clay (Kirimeti) layers. It is essential to maintain the robustness of the tank bund to ensure stability and prevent erosion.

Question: How does a rechargeable battery differ from a primary battery?

Answer: A rechargeable battery can be recharged and used multiple times by reversing the electrochemical reactions through an external power source, while a primary battery is designed for single use and cannot be recharged.

Question: How do ultrasound waves help in the examination of pregnant women?

Answer: Ultrasound waves create images of the fetus, allowing healthcare providers to monitor the fetus's development and health.

Question: What is the formula to calculate the pressure exerted by a liquid column?

Answer: The formula to calculate the pressure exerted by a liquid column is  $P = h\rho g$ , where  $h$  is the height of the column,  $\rho$  is the density of the liquid, and  $g$  is gravitational acceleration.

Question: What are the advantages of using LED lights over traditional incandescent bulbs?

Answer: LED lights consume less power, have a longer lifespan, and produce less heat compared to traditional incandescent bulbs, making them more energy-efficient and cost-effective.

Question: How do brakes stop a moving vehicle?

Answer: Brakes stop a moving vehicle by applying frictional forces between the brake pads and the wheels, converting the kinetic energy into heat and slowing down the vehicle.

Question: What are the two types of chemical bonds?

Answer: The two types of chemical bonds are ionic bonds and covalent bonds.

Question: How does the direction of the magnetic field around a conductor depend on current flow?

Answer: The magnetic field direction around a conductor follows the right-hand rule, depending on the current flow direction.

Question: What is the significance of cyclic voltammetry in electrochemical analysis?

Answer: Cyclic voltammetry is a technique used in electrochemical analysis to study redox reactions, reaction kinetics, and electroactive species. It provides information on the oxidation and reduction potentials, current responses, and reaction mechanisms.

Question: What is the function of DNA?

Answer: DNA transfers genetic characteristics from generation to generation.

Question: What is Archimedes' principle and its significance?

Answer: Archimedes' principle states that when an object is partially or completely submerged in a fluid, the upthrust acting on it is equal to the weight of the fluid displaced by the object. It explains why objects float or sink.

Question: Explain the function of an analog-to-digital converter (ADC).

Answer: An analog-to-digital converter (ADC) converts analog signals into digital data, allowing analog inputs to be processed by digital systems.

Question: What is the purpose of a phase comparator in PLL circuits?

Answer: A phase comparator in PLL circuits compares the phase of an input signal with a reference signal, generating an error signal to adjust the frequency of the output signal for synchronization.

Question: What are the adverse effects of heavy metals on the environment?

Answer: The adverse effects of heavy metals on the environment include soil contamination, water pollution, bioaccumulation in organisms, and toxicity to plants and animals.

Question: What is the importance of genetic diversity in populations?

Answer: Genetic diversity is important for the adaptability and survival of populations, as it provides a range of traits that can help organisms cope with environmental changes and resist diseases.

Question: How do protected areas contribute to biodiversity conservation?

Answer: Protected areas contribute to biodiversity conservation by preserving habitats, preventing exploitation, and providing safe havens for endangered species.

Question: What happens when the force applied on the table is increased gradually?

Answer: When the force applied on the table is increased gradually, the table starts to move when the applied force exceeds the maximum frictional force that the surface can exert.

Question: How do lithium and oxygen atoms achieve a stable electronic configuration in lithium oxide?

Answer: Lithium atoms lose electrons to form  $\text{Li}^+$  ions, and oxygen atoms gain electrons to form  $\text{O}^{2-}$  ions. The electrostatic attraction between these ions forms lithium oxide ( $\text{Li}_2\text{O}$ ).

Question: How do you balance a rod with different weights suspended at various points?

Answer: Balance the rod by ensuring that the moments due to the weights on either side of the pivot are equal, which can be achieved by adjusting the positions or magnitudes of the weights.

Question: What factors affect the solubility of a substance?

Answer: Factors affecting solubility include temperature, the nature of the solute, and the nature of the solvent.

Question: What are the main functions of the urinary system?

Answer: The urinary system filters blood to remove waste products, regulates electrolyte and fluid balance, and maintains acid-base homeostasis.

Question: What is the significance of impedance matching in RF circuits?

Answer: Impedance matching ensures maximum power transfer and minimizes signal reflection in RF circuits by matching the impedance of the source and load, optimizing performance.

Question: What change occurs when sodium hydroxide pellets are added to dilute sulfuric acid?

Answer: When sodium hydroxide pellets are added to dilute sulfuric acid, the sodium hydroxide dissolves, and the solution becomes hot, indicating an exothermic reaction. The thermometer reading rises.

Question: Explain the role of friction in the braking system of a bicycle.

Answer: In a bicycle's braking system, friction between the rubber brake pads and the wheel rim slows down and eventually stops the bicycle.

Question: What are the uses of dry ice?

Answer: Dry ice is used as a super coolant for food preservation, creating artificial rain, and in various industrial applications due to its low temperature.

Question: How does the release of sulfur dioxide (SO<sub>2</sub>) contribute to acid rain formation?

Answer: Sulfur dioxide reacts with water vapor and other chemicals in the atmosphere to form sulfuric acid, which falls as acid rain. It damages ecosystems, buildings, and human health.

Question: What is energy management, and why is it important?

Answer: Energy management involves planning and monitoring energy production and consumption to conserve energy and minimize costs. It is crucial for sustainable utilization and fulfilling consumer needs while reducing environmental impact.

Question: What is the unit of force?

Answer: The unit of force is the Newton (N), which is defined as the force required to produce an acceleration of 1 m/s<sup>2</sup> in a body of 1 kg mass.

Question: What is the purpose of using a carbon rod as the anode in electroplating?

Answer: A carbon rod serves as an inert anode that does not participate in the electrochemical reactions, ensuring that only the desired metal ions are involved in the plating process and preventing contamination.

Question: What are the two forms of Cnidarians and how do they differ?

Answer: Cnidarians have two forms: Medusa (can move) and Polyp (attached to surfaces). Medusa is free-floating while Polyps are sessile.

Question: What is the role of glycogen in the human body?

Answer: Glycogen serves as a storage form of glucose in the liver and muscles, providing a readily available source of energy when needed.

Question: How is the direction of current flow due to the induced electromotive force determined?

Answer: Fleming's right-hand rule determines the direction: if the thumb, index finger, and middle finger of the right hand are oriented perpendicular to one another, with the index finger pointing in the direction of the magnetic field and the thumb pointing in the direction of motion, the middle finger points in the direction of current flow.

Question: What is the role of a galvanometer in demonstrating electromagnetic induction?

Answer: A galvanometer measures the induced current in a circuit, indicating the presence and magnitude of electromagnetic induction.

Question: What is the purpose of using a carbon rod as the anode in electroplating?

Answer: A carbon rod serves as an inert anode that does not participate in the electrochemical reactions, ensuring that only the desired metal ions are involved in the plating process.

Question: What is the greenhouse effect?

Answer: The greenhouse effect is the process by which greenhouse gases trap heat in the Earth's atmosphere, leading to an increase in global temperatures and contributing to climate change.

Question: What are the deficiency symptoms of sodium in the human body?

Answer: Deficiency symptoms of sodium include respiratory disorders, cramps, nausea, and diarrhea.

Question: How do elements in the same group compare in terms of chemical properties?

Answer: Elements in the same group have similar chemical properties because they have the same number of valence electrons.

Question: Why are some components in mixtures separated using mechanical methods?

Answer: Mechanical methods utilize differences in physical properties such as density, size, and magnetic properties to separate components.

Question: What occurs during the secretory phase of the uterine cycle?

Answer: During the secretory phase, the uterine lining thickens and blood supply increases, becoming secretory under the influence of progesterone, typically lasting about 14 days.

Question: How does the focal length of a spherical mirror relate to its radius of curvature?

Answer: The focal length is half of the radius of curvature.

Question: How does the number of coil turns affect the dynamo's performance?

Answer: More coil turns increase the induced electromotive force, enhancing the dynamo's efficiency and electricity generation.

Question: Who introduced the first scientific classification of organisms?

Answer: Aristotle introduced the first scientific classification of organisms in the 4th century B.C.

Question: How does reducing the mass of an object affect its momentum for a constant velocity?

Answer: Reducing the mass of an object decreases its momentum for a constant velocity, as momentum is the product of mass and velocity.

Question: What are some common sexually transmitted diseases?

Answer: Common sexually transmitted diseases include gonorrhea, syphilis, herpes, and AIDS.

Question: What is the potential difference across a bulb connected to two dry cells with a total voltage of 3 V and a resistance of  $6\ \Omega$ ?

Answer: The potential difference is 3 V, assuming the power supply voltage is the same as the voltage across the bulb.

Question: What happens when the forces acting on an object are not aligned along the same line?

Answer: When the forces acting on an object are not aligned along the same line, the object will experience a net moment, causing it to rotate or move, indicating that it is not in equilibrium.

Question: How does light behave when it enters a rare medium from a denser medium?

Answer: The light ray bends away from the normal when entering a rare medium from a denser medium.

Question: How does the density of a liquid affect the hydrostatic pressure it exerts?

Answer: The hydrostatic pressure exerted by a liquid increases with its density, as denser liquids exert more pressure at a given depth compared to less dense liquids.

Question: What is required for a transistor to operate properly in a circuit?

Answer: Appropriate voltages must be provided to the terminals for a transistor to operate properly, known as biasing the transistor.

Question: What is the role of acetic acid in the food industry?

Answer: Acetic acid is used in vinegar for food processing and preservation.

Question: How many valence electrons does potassium have?

Answer: Potassium has one valence electron.

Question: What safety precautions should be taken when using electric irons?

Answer: Safety precautions include using rubber slippers or mats, ensuring the iron is unplugged when not in use, and keeping the iron away from flammable materials.

Question: What is the electronic configuration of a sodium atom?

Answer: The electronic configuration of a sodium atom is 2, 8, 1.

Question: What is the role of interneurons?

Answer: Interneurons connect sensory neurons with motor neurons and are entirely located within the central nervous system.

Question: What is the specific heat capacity of water?

Answer: The specific heat capacity of water is  $4200 \text{ J kg}^{-1} \text{ K}^{-1}$ .

Question: How does the force on a current-carrying conductor vary with current strength?

Answer: The force increases with higher current strength, as it is directly proportional to the current flowing through the conductor.

Question: What are the environmental impacts of using heavy metals in industrial processes?

Answer: The environmental impacts of using heavy metals in industrial processes include soil and water contamination, bioaccumulation in organisms, and toxicity to plants and animals.

Question: What are some examples of mammals?

Answer: Examples of mammals include Humans, Mice, Loris, Monkey, Orangutan, Gorilla, Chimpanzee, Bat, Whale, Dolphin, Stag, Deer, and Buffalo.

Question: How does pressure influence the rate of reaction for gaseous reactants?

Answer: Increased pressure raises the concentration of gas molecules, leading to more collisions and a faster reaction rate.

Question: What is the right-hand grip rule?

Answer: The right-hand grip rule states that if the conductor is held with the right hand, with the thumb pointing in the direction of current flow, the direction of the other four fingers indicates the direction of the magnetic field.

Question: How is the purity of metals improved through electrolysis?

Answer: The purity of metals is improved through electrolysis by using an electrolytic refining process, where impure metal is used as the anode, pure metal is deposited at the cathode, and impurities are left behind or collected as sludge.



Question: What happens to the induced current when the coil in a dynamo is parallel to the magnetic field?

Answer: When the coil is parallel to the magnetic field, the induced current becomes zero as there is no intersection of field lines.

Question: What is the tolerance range of a resistor with a resistance value of  $270\ \Omega$  and a tolerance of  $\pm 5\%$ ?

Answer: The tolerance range is  $270\ \Omega \pm 5\% = 256.5\ \Omega$  to  $283.5\ \Omega$ .

Question: What is the principle behind the use of lenses in microscopes?

Answer: Microscopes use lenses to achieve high magnification of small objects by converging light rays through several focal points.

Question: What is the principle of thermal equilibrium?

Answer: Thermal equilibrium is the state when two objects in contact reach the same temperature, resulting in no net heat transfer between them.

Question: What happens when magnesium reacts with dilute acids?

Answer: Magnesium reacts rapidly with dilute acids to form the corresponding magnesium salt and hydrogen gas.

Question: What is the role of kidney function in drug metabolism and excretion?

Answer: The kidneys filter and excrete drugs and their metabolites from the blood, preventing their accumulation and potential toxicity.

Question: What are the physical and chemical properties of oxygen gas?

Answer: Oxygen has a density higher than normal air, is colorless and odorless, supports combustion, and is slightly soluble in water.

Question: How do plants perform gas exchange?

Answer: Plants perform gas exchange through stomata on their leaves, allowing carbon dioxide to enter for photosynthesis and oxygen to exit as a byproduct.

Question: What are the characteristics of non-flowering seedless plants?

Answer: Non-flowering seedless plants can be small to large, some lack tissue differentiation, and they reproduce asexually by spores and vegetative fragmentation.

Question: What is the significance of the 1:2:1 ratio in Mendel's monohybrid crosses?

Answer: The 1:2:1 ratio in Mendel's monohybrid crosses represents the distribution of genotypes (homozygous dominant, heterozygous, and homozygous recessive) in the F<sub>2</sub> generation, supporting the principles of inheritance.

Question: What is the function of a salt bridge in an electrochemical cell?

Answer: A salt bridge in an electrochemical cell allows the flow of ions between the two half-cells to maintain electrical neutrality and complete the electrical circuit without mixing the different solutions.

Question: Explain the operation of a relay in an electrical circuit.

Answer: A relay is an electrically operated switch that uses a small control current to open or close a larger load circuit, providing isolation and control in various applications.

Question: How do plants store energy?

Answer: Plants store energy in the form of starch, which is synthesized from glucose produced during photosynthesis and stored in various parts of the plant, such as roots and seeds.

Question: How does the pressure in a liquid change with depth?

Answer: The pressure in a liquid increases with the depth of the liquid column.

Question: How is the chemical formula of sulphur trioxide represented?

Answer: The chemical formula of sulphur trioxide is  $\text{SO}_3$ , indicating one sulphur atom and three oxygen atoms.

Question: What are the environmental benefits of reducing food waste?

Answer: Reducing food waste conserves resources, lowers greenhouse gas emissions, and decreases landfill waste. It supports sustainable food systems and environmental protection.

Question: What conclusion can be drawn from the observation that nails in tubes with lime juice and hydrochloric acid rust more?

Answer: Acidity accelerates the rusting process.

Question: What are the challenges associated with scaling up electrochemical processes for industrial applications?

Answer: Challenges associated with scaling up electrochemical processes include maintaining efficiency and selectivity, managing heat and mass transfer, ensuring material durability, optimizing reactor design, and reducing costs to achieve commercial viability.

Question: What is the function of the nucleolus within the nucleus?

Answer: The nucleolus is responsible for producing ribosomal RNA (rRNA) and assembling ribosomal subunits, which are essential for protein synthesis.

Question: What is potential difference?

Answer: Potential difference is the electric pressure difference between two points in a circuit, which causes electrons to flow.

Question: What is the SI unit used to measure electric current?

Answer: The SI unit used to measure electric current is the Ampere (A).

Question: What is the ozone layer, and why is it important?

Answer: The ozone layer is a thin layer of ozone molecules in the stratosphere that absorbs harmful ultraviolet (UV) radiation from the sun, protecting living organisms on Earth.

Question: How are essential oils separated from water after steam distillation?

Answer: By cooling the distillate, which separates into two layers due to the immiscibility of water and essential oils.

Question: What is an example of artificial classification?

Answer: An example of artificial classification is grouping animals with wings together, regardless of their evolutionary background.

Question: What are disinfectants, and how do they differ from antiseptics?

Answer: Disinfectants are chemicals used to destroy microorganisms on inanimate objects and surfaces. They are not safe for application on living tissues, unlike antiseptics.

Question: Describe the experiment to show that CO<sub>2</sub> is required for photosynthesis.

Answer: Place leaves in polythene bags with KOH (to absorb CO<sub>2</sub>) and water, expose to sunlight, and test for starch. The leaf with KOH shows no photosynthesis, while the leaf with water shows photosynthesis.

Question: What is the significance of the electrochemical series in predicting the outcome of electrolysis?

Answer: The electrochemical series ranks elements based on their tendency to lose or gain electrons, helping predict which ions will be reduced or oxidized.

Question: What is the role of the soft iron core in a transformer?

Answer: The soft iron core enhances the magnetic field, increasing the efficiency of energy transfer between the primary and secondary coils.

Question: How does the electrolysis of copper sulfate solution demonstrate the transfer of copper ions?

Answer: The electrolysis of copper sulfate solution demonstrates the transfer of Cu<sup>2+</sup> ions from the anode to the cathode, where they are reduced and deposited as copper metal, illustrating the movement of ions and the deposition process.

Question: What factors should be considered when preparing a solution of specific concentration?

Answer: Consider cleanliness, accurate weighing, proper mixing, and preventing contamination.

Question: What are the effects of acid rain on aquatic ecosystems?

Answer: The effects of acid rain on aquatic ecosystems include increased water acidity, harm to aquatic organisms, disruption of reproductive processes, and loss of biodiversity.

Question: What is the unit of momentum?

Answer: The unit of momentum is kg m/s.

Question: What is the specific heat capacity of lead?

Answer: The specific heat capacity of lead is  $130 \text{ J kg}^{-1} \text{ K}^{-1}$ .

Question: What is the result of the reaction between potassium hydroxide and hydrochloric acid?

Answer: Potassium hydroxide reacts with hydrochloric acid to form potassium chloride and water ( $\text{KOH} + \text{HCl} \rightarrow \text{KCl} + \text{H}_2\text{O}$ ).

Question: Explain the operation of a loudspeaker, detailing how it converts electrical signals into sound.

Answer: A loudspeaker converts electrical signals into sound waves through the interaction of magnetic fields and mechanical vibrations.

Components: Cone: A lightweight diaphragm, often made of paper or plastic, that moves to create sound waves. Voice Coil: A coil of wire

attached to the narrow end of the cone that moves within a magnetic field.

Magnet: A permanent ring magnet that generates a stable magnetic field.

Supporting Frame: Holds the cone and magnet in place, allowing the coil to move freely. Operation: An electrical audio signal flows through the voice

coil, generating a magnetic field around the coil. This magnetic field interacts with the magnetic field of the permanent magnet, producing a force on the coil. According to the variations in the audio signal, the direction and magnitude of the force change, causing the coil (and attached cone) to move back and forth. The cone's vibrations create pressure waves in the air, producing sound waves corresponding to the audio signal. The loudspeaker effectively translates electrical signals into mechanical motion, creating sound waves that correspond to the original audio input.

Question: How do you calculate the concentration of a solution in  $\text{mol/dm}^3$ ?

Answer: Concentration ( $\text{mol/dm}^3$ ) = Amount of moles of solute / Volume of solution in  $\text{dm}^3$ .

Question: What is the significance of the right-hand grip rule for solenoids?

Answer: The right-hand grip rule helps determine the magnetic field direction inside a solenoid, with the thumb indicating current flow and fingers showing the field direction.

Question: Explain the concept of thermal expansion in electric appliances.

Answer: Thermal expansion in electric appliances refers to the increase in size of components due to heat, which can affect their performance and safety if not properly managed.

Question: Describe the benefits of using energy-efficient cookers.

Answer: Energy-efficient cookers reduce energy consumption, cook food faster, and generate less heat waste, leading to cost savings and a reduced environmental impact.

Question: What is the reaction between aluminum and hydrochloric acid?

Answer: Aluminum reacts with hydrochloric acid to form aluminum chloride and hydrogen gas:  $2\text{Al} + 6\text{HCl} \rightarrow 2\text{AlCl}_3 + 3\text{H}_2$ .

Question: How does the electrolysis of sodium chloride solution produce chlorine gas?

Answer: Chlorine gas is produced at the anode by the oxidation of  $\text{Cl}^-$  ions:  $2\text{Cl}^- (\text{aq}) \rightarrow \text{Cl}_2 (\text{g}) + 2\text{e}^-$ .

Question: What is the density of water used in the calculation for the reaction between vinegar and lime water?

Answer:  $1000 \text{ kg m}^{-3}$ .

Question: How does the power output of an electric appliance relate to its energy consumption?

Answer: The power output of an electric appliance determines the rate at which it consumes energy. Higher power output results in higher energy consumption over time.

Question: Describe the function of a magnetic contactor in industrial control systems.

Answer: A magnetic contactor is an electrically operated switch that controls high-power circuits, providing reliable switching and protection for industrial control systems.

Question: How does a magnetic field vary in strength and direction?

Answer: The strength and direction of a magnetic field can vary from point to point, influencing the behavior of magnetic materials and compasses.

Question: What is growth in living organisms?

Answer: Growth is the irreversible increase in the dry mass of a cell. It involves cell division and differentiation to perform specific functions.

Question: How many bond pairs and lone pairs are present in the valence shell of an ammonia molecule?

Answer: In the ammonia molecule, there are three bond pairs and one lone pair in the valence shell.

Question: Differentiate between rough and smooth endoplasmic reticulum.

Answer: Rough endoplasmic reticulum has ribosomes attached to its membrane and transports proteins, while smooth endoplasmic reticulum lacks ribosomes and synthesizes and transports lipids and steroids.

Question: What are the advantages of using electrochemical methods for carbon capture and utilization?

Answer: Electrochemical methods for carbon capture and utilization offer advantages like high efficiency, selective conversion of  $\text{CO}_2$  to valuable products, integration with renewable energy sources, and reduced environmental impact compared to traditional methods.

Question: How does the reactivity of alkali metals change down Group I?

Answer: The reactivity of alkali metals increases down Group I.

Question: How is voltage measured in a circuit?

Answer: Voltage is measured using a voltmeter connected across the two points where the potential difference is to be measured.

Question: What are the features of connective tissue?

Answer: Connective tissue features a large extracellular matrix, various cell types, fibers, and typically possesses nerve and blood supply.

Question: Describe the different temperature scales used for measurements and their relationships, including examples of conversions between Celsius and Kelvin scales.

Answer: Three primary temperature scales are widely used for measuring temperatures: Celsius, Fahrenheit, and Kelvin scales. Celsius Scale: Defined by taking the melting point of ice ( $0^{\circ}\text{C}$ ) and the boiling point of water ( $100^{\circ}\text{C}$ ) under one atmosphere of pressure. These fixed points are divided into 100 equal divisions. Fahrenheit Scale: Also uses the melting point of ice and the boiling point of water as fixed points, but the melting point of ice is taken as  $32^{\circ}\text{F}$ , and the temperature range between the two points is divided into 180 equal divisions, making the boiling point of water  $212^{\circ}\text{F}$ . Kelvin Scale: The Kelvin scale starts at absolute zero, the theoretical temperature at which the kinetic energy of particles is zero ( $-273.15^{\circ}\text{C}$ ). The scale is defined such that a temperature difference of 1 K is equal to a difference of  $1^{\circ}\text{C}$ . The melting point of ice is 273.15 K, and the boiling point of water is 373.15 K. Conversions Between Celsius and Kelvin: To convert a temperature from Celsius to Kelvin, add 273 to the Celsius value. To convert a temperature from Kelvin to Celsius, subtract 273 from the Kelvin value. Examples: Convert  $50^{\circ}\text{C}$  to Kelvin:  $50^{\circ}\text{C} + 273 = 323\text{K}$  Convert 373 K to Celsius:  $373\text{K} - 273 = 100^{\circ}\text{C}$

Question: How does a liquid column in a capillary tube demonstrate surface tension?

Answer: A liquid column in a capillary tube demonstrates surface tension by rising or falling in the tube, depending on the adhesive and cohesive forces between the liquid and tube material.

Question: Explain the function of a phase detector in PLL circuits.

Answer: A phase detector compares the phase of an input signal with a reference signal in PLL circuits, generating an error signal to adjust the frequency and phase of the output signal for synchronization.

Question: What is the significance of a single bond in covalent compounds?

Answer: A single bond involves the sharing of one pair of electrons between atoms, resulting in a strong and stable bond that holds the atoms together in a molecule.

Question: What are inhibitors?

Answer: Inhibitors are substances that reduce the rate of chemical reactions.

Question: How do you express the composition of a solution in terms of mass/volume (m/v)?

Answer:  $m/v = \text{Mass of solute} / \text{Volume of solution}$ .

Question: How do you calculate the moment due to a force applied at a certain distance from the axis of rotation?

Answer: The moment due to a force is calculated as the product of the force and the perpendicular distance from the axis of rotation to the line of action of the force (Moment = Force  $\times$  Perpendicular distance).

Question: What is the function of the corolla?

Answer: The corolla, comprised of petals, protects the inner flower parts in the bud stage and attracts insects for pollination when the flower blooms.

Question: What is the chemical formula for calcium oxide?

Answer: The chemical formula for calcium oxide is  $\text{CaO}$ .

Question: What is the concentration of a solution containing 0.2 mol of  $\text{HCl}$  in  $1 \text{ dm}^3$  of water?

Answer: The concentration is  $0.2 \text{ mol/dm}^3$ .

Question: What is the significance of the perpendicular distance in the moment of a couple of forces?

Answer: The perpendicular distance in the moment of a couple of forces determines the magnitude of the moment. A greater distance results in a larger moment for the same force, enhancing the rotational effect.

Question: How does blood circulation support energy production in the body?

Answer: Blood transports glucose and oxygen to cells, which are essential for cellular respiration and energy production.

Question: Calculate the power required to do 150 J of work in 5 seconds.

Answer: The power required is 30 Watts (W).

Question: How does the induced voltage waveform look in an alternating current dynamo?

Answer: The induced voltage waveform in an alternating current dynamo is sinusoidal, alternating between positive and negative values.

Question: What is an endothermic reaction, and give an example from daily life?

Answer: An endothermic reaction absorbs heat from the surroundings. An example is photosynthesis in green plants.

Question: How does a plane mirror form a virtual image of a point object?

Answer: The mirror reflects rays from the point object such that they appear to come from a point behind the mirror, creating a virtual image.

Question: Explain the working principle of a light-emitting diode (LED).

Answer: A light-emitting diode (LED) emits light when a forward voltage is applied, causing electrons to recombine with holes in the semiconductor material, releasing energy as photons.

Question: What is the significance of natural classification in studying organisms?

Answer: Natural classification helps explain the evolutionary relationships among organisms and reveals the natural relationships among organisms of the same species.

Question: Describe the Daniell cell and its components.

Answer: The Daniell cell is an electrochemical cell consisting of a zinc electrode in zinc sulfate solution (anode) and a copper electrode in copper sulfate solution (cathode), connected by a salt bridge that allows ion flow to maintain electrical neutrality.

Question: What is the significance of the y-intercept on a displacement-time graph?

Answer: The y-intercept represents the initial displacement or the starting position of the object.

Question: Explain the concept of uniform velocity.

Answer: Uniform velocity means the object moves with a constant speed in a straight line.

Question: How does the accumulation of plastic waste in oceans affect marine life?

Answer: The accumulation of plastic waste in oceans affects marine life by causing ingestion and entanglement, leading to injury, starvation, and death, and by introducing toxic substances into the marine food web.

Question: What is the function of mitochondria in cellular respiration?

Answer: Mitochondria generate ATP through cellular respiration, converting glucose and oxygen into energy, carbon dioxide, and water, powering cellular activities.

Question: What are autotrophs?

Answer: Autotrophs are organisms that can transform simple inorganic compounds into organic compounds to fulfill their nutritional requirements, such as green plants, algae, and some bacteria.

Question: What is the significance of the cell cycle in living organisms?

Answer: The cell cycle is significant because it ensures the accurate replication and distribution of genetic material during cell division, supporting growth, development, and tissue repair.

Question: What is the impact of wavelength on the behavior of electromagnetic waves?

Answer: Wavelength affects the penetration, reflection, and refraction of electromagnetic waves, influencing their interaction with materials.

Question: How does a DC motor operate?

Answer: A DC motor operates by passing current through a coil placed in a magnetic field, causing the coil to rotate due to the force exerted on it by the magnetic field.

Question: What is upthrust and how is it experienced by objects in a liquid?

Answer: Upthrust is the upward force exerted by a liquid on an object immersed in it. It is experienced as a reduction in the apparent weight of the object due to the liquid's buoyant force.

Question: Describe the reaction of magnesium with steam.

Answer: Magnesium reacts with steam to form magnesium oxide and hydrogen gas:  $\text{Mg} + \text{H}_2\text{O} \rightarrow \text{MgO} + \text{H}_2$ .

Question: What are the main types of tissues in multicellular organisms?

Answer: The main types of tissues in multicellular organisms include epithelial tissue, connective tissue, muscle tissue, and nervous tissue, each with specific functions.



Question: What is the balanced equation for the reaction between sodium and chlorine?

Answer: The balanced equation for sodium reacting with chlorine is:  $2\text{Na} + \text{Cl}_2 \rightarrow 2\text{NaCl}$ , ensuring equal numbers of sodium and chlorine atoms on both sides.

Question: What is the role of limestone in the blast furnace?

Answer: Limestone decomposes to form calcium oxide, which reacts with impurities in iron ore to form slag, aiding in the extraction of pure iron.

Question: How is the chemical formula of methane represented?

Answer: The chemical formula of methane is  $\text{CH}_4$ , indicating one carbon atom and four hydrogen atoms.

Question: How do plant cells differ from animal cells in terms of vacuoles?

Answer: Plant cells typically have a large central vacuole that maintains turgor pressure, stores nutrients, and contributes to cell growth, while animal cells have smaller, less prominent vacuoles.

Question: What is the effect of a plano-concave lens on light rays?

Answer: Plano-concave lenses diverge light rays, creating virtual, upright, and smaller images.

Question: How much heat is required to increase the temperature of 2 kg of water by 10 K?

Answer: The amount of heat required to increase the temperature of 2 kg of water by 10 K is 84,000 J, calculated using the formula  $Q = mc\Delta T = 2 \times 4200 \times 10$ .

Question: How is the electrolysis of copper sulfate solution used in electroplating?

Answer: Electroplating with copper sulfate solution involves using a copper anode and an object to be plated as the cathode. Copper ions are reduced and deposited on the object.

Question: What is the role of the umbilical cord in fetal development?

Answer: The umbilical cord connects the fetus to the placenta, allowing the exchange of nutrients, oxygen, and waste products between the mother and fetus.

Question: What are the benefits of using electrochemical methods for hydrogen production?

Answer: Electrochemical methods for hydrogen production, such as water electrolysis, offer benefits like high purity hydrogen, scalability, and the potential for integration with renewable energy sources, providing a clean and sustainable energy carrier.

Question: What is a chemical formula?

Answer: A chemical formula is a representation of a compound using chemical symbols and numerical subscripts to indicate the number of atoms of each element present in a molecule of the compound.

Question: What is a depletion layer in a p-n junction?

Answer: The depletion layer in a p-n junction is the region around the junction where free electrons and holes have recombined, leaving behind immobile charged ions and creating an electric field that opposes further charge carrier movement.

Question: How does electronegativity change across a period?

Answer: Electronegativity increases across a period from left to right.

Question: How do you investigate the equilibrium of a meter ruler under the action of three coplanar parallel forces?

Answer: Suspend the meter ruler horizontally using two rubber bands and spring balances at either end. Measure the forces exerted by the balances and compare them to the weight of the ruler to ensure they balance and maintain equilibrium.

Question: How do geneticists study the inheritance of quantitative traits?

Answer: Geneticists study the inheritance of quantitative traits by analyzing the contributions of multiple genes and environmental factors, using statistical methods to identify genetic loci associated with the variation in these traits.

Question: What is the role of the large intestine in water absorption?

Answer: The large intestine absorbs water from the remaining indigestible food matter, forming semi-solid fecal matter for excretion.

Question: How do corrective lenses work for astigmatism?

Answer: Corrective lenses for astigmatism are specially shaped to compensate for irregular curvature in the cornea or lens of the eye.

Question: How is the chemical formula of calcium hydroxide written?

Answer: The chemical formula of calcium hydroxide is  $\text{Ca}(\text{OH})_2$ , indicating one calcium ion and two hydroxide ions.

Question: What happens during the electrolysis of water?

Answer: During the electrolysis of water, water molecules are split into hydrogen and oxygen gases. At the cathode, hydrogen ions ( $\text{H}^+$ ) are reduced to form hydrogen gas ( $\text{H}_2$ ), and at the anode, hydroxide ions ( $\text{OH}^-$ ) are oxidized to form oxygen gas ( $\text{O}_2$ ).

Question: How is the period of a wave related to its frequency?

Answer: The period ( $T$ ) of a wave is the reciprocal of its frequency ( $f$ ), expressed as  $T = 1/f$ .

Question: What is the concentration of a solution containing 2 mol of NaOH in  $1 \text{ dm}^3$  of water?

Answer: The concentration is  $2 \text{ mol/dm}^3$ .

Question: What is the function of the medulla oblongata?

Answer: It controls involuntary actions such as heart rate and respiration, and reflex actions like vomiting, coughing, and swallowing.

Question: What are the main components of the cell membrane?

Answer: The main components of the cell membrane are phospholipids, proteins, and carbohydrates, which together form a selective barrier that regulates the movement of substances in and out of the cell.

Question: How do electronegativity values change down a group?

Answer: Electronegativity values decrease down a group.

Question: How do you balance a uniform rod with different weights using the principle of moments?

Answer: Balance the rod by adjusting the positions and magnitudes of the weights such that the moments on either side of the pivot are equal, resulting in equilibrium.

Question: How do you compare the resistance of copper and iron wires of the same length and cross-sectional area?

Answer: Measure the current passing through each wire in the same circuit and compare the values to determine their resistances.

Question: How does the diaphragm in a moving coil microphone respond to sound?

Answer: The diaphragm vibrates in response to sound waves, moving the attached coil within a magnetic field and generating an alternating current.

Question: What is the role of manganese dioxide in the decomposition of hydrogen peroxide?

Answer: Manganese dioxide acts as a catalyst, increasing the rate of decomposition without being consumed in the reaction.

Question: What does an energy level diagram for an exothermic reaction show?

Answer: It shows that the energy contained in the products is less than the energy content of the reactants, indicating energy is released.

Question: What are the challenges of managing urban waste?

Answer: Challenges of managing urban waste include limited landfill space, high waste generation rates, inadequate recycling infrastructure, and environmental pollution.

Question: What happens when a light ray is incident on a plane mirror perpendicularly?

Answer: The light ray is reflected back along the same path, as shown with the incident ray AB and reflected ray BA in the document.

Question: How is alternating current generated?

Answer: Alternating current is generated by rotating a coil within a magnetic field, as in an alternating current dynamo.

Question: How is the reaction between hydrogen and chlorine represented?

Answer: The reaction between hydrogen and chlorine is represented as:  $\text{H}_2 + \text{Cl}_2 \rightarrow 2\text{HCl}$ , forming hydrogen chloride gas.

Question: How do epithelial tissues contribute to sensory perception?

Answer: Specialized epithelial cells in sensory organs detect stimuli such as taste, smell, and touch, transmitting sensory information to the nervous system.

Question: What is an example of a polar organic solute and solvent pair?

Answer: An example is ethanol (polar organic solute) dissolving in water (polar solvent).

Question: What are zoophilous flowers?

Answer: Zoophilous flowers are pollinated by animals. They have adaptations like fragrance, large size, and colorful appearance to attract animals.

Question: What is the difference between simple and fractional distillation?

Answer: Simple distillation separates a volatile component from non-volatile ones, while fractional distillation separates multiple volatile components with different boiling points.

Question: What is the first ionisation energy of fluorine?

Answer: The first ionisation energy of fluorine is 1681 kJ/mol.

Question: What does a vertical line on a velocity-time graph indicate?

Answer: A vertical line indicates an instantaneous change in velocity, which is theoretically impossible in practical scenarios.

Question: What is the reaction between acids and metals?

Answer: Acids react with metals above hydrogen in the reactivity series to form a salt and hydrogen gas.

Question: How does the diaphragm movement in a microphone relate to sound waves?

Answer: The diaphragm moves in response to sound waves, causing the attached coil to move within a magnetic field and generate an alternating current corresponding to the sound.

Question: How is a carbon dioxide (CO<sub>2</sub>) molecule formed through covalent bonding?

Answer: A carbon dioxide (CO<sub>2</sub>) molecule is formed when a carbon atom shares two pairs of electrons with each of two oxygen atoms, resulting in double bonds and a stable electronic configuration for each atom.

Question: How does the specific heat capacity of water influence its use in climate control systems?

Answer: Water's high specific heat capacity allows it to absorb and release large amounts of heat with minimal temperature change, making it effective for climate control systems in buildings and industrial processes.

Question: What happens to the valence electrons of sodium and chlorine atoms to achieve a stable electronic configuration?

Answer: Sodium loses one electron to achieve a stable configuration, while chlorine gains one electron to attain stability.

Question: What are the three isotopes of hydrogen?

Answer: The three isotopes of hydrogen are protium, deuterium, and tritium.

Question: How does a moving coil microphone generate electrical signals?

Answer: A moving coil microphone generates electrical signals by vibrating a coil within a magnetic field, inducing an electromotive force corresponding to sound waves.

Question: How do epithelial tissues assist in nutrient absorption?

Answer: Epithelial tissues in the digestive tract absorb nutrients from digested food, transferring them into the bloodstream for use by the body.

Question: What are the methods of releasing heavy metals into the environment?

Answer: Methods of releasing heavy metals into the environment include industrial waste, zinc mines, electroplating, the use of agrochemicals, and the combustion of fossil fuels.

Question: How does an electrochemical gradient drive active transport in biological systems?

Answer: An electrochemical gradient, created by the difference in ion concentration and electrical potential across a membrane, drives active transport in biological systems by providing the energy needed to move ions and molecules against their concentration gradient.

Question: How do Cnidarians reproduce?

Answer: Cnidarians reproduce both asexually (by budding) and sexually.

Question: Describe the image formed by a concave mirror when the object is placed between the mirror and its focal point.

Answer: The image is upright, larger than the object, and virtual.

Question: How do musical instruments create different pitches?

Answer: Musical instruments create different pitches by varying the frequency of vibrations produced by strings, air columns, or membranes.

Question: What are the applications of electrochemical cells in renewable energy storage?

Answer: Electrochemical cells are used in renewable energy storage systems like batteries and flow cells to store energy generated from renewable sources (e.g., solar, wind) for later use, ensuring a reliable and continuous power supply.

Question: What is the role of an electrolyte in a lithium-ion battery?

Answer: The electrolyte in a lithium-ion battery facilitates the movement of lithium ions between the anode and cathode during charging and discharging, enabling the electrochemical reactions that store and release energy.

Question: What is the role of genetic counseling in prenatal testing?

Answer: Genetic counseling provides information and support to expectant parents undergoing prenatal testing, helping them understand the risks, benefits, and implications of the tests, and guiding them in making

informed decisions about their pregnancy.

Question: How is the area under a velocity-time graph calculated for a body moving with uniform acceleration?

Answer: The area under the velocity-time graph is calculated as  $\frac{1}{2} \times (\text{Final velocity}) \times (\text{Time})$ .

Question: What happens to a compass needle near a magnet?

Answer: The compass needle deflects, showing the direction of the magnetic field created by the magnet.

Question: What is the role of the glomerulus in the nephron?

Answer: The glomerulus is a network of capillaries where blood is filtered, and small molecules pass into Bowman's capsule, forming the glomerular filtrate.

Question: What occurs in a p-n junction when it is reverse biased?

Answer: In reverse bias, the positive potential is applied to the n-type and the negative to the p-type, increasing the depletion region and preventing current flow across the junction.

Question: How do you calculate the number of atoms in a given mass of an element?

Answer: The number of atoms in a given mass of an element is calculated by dividing the mass by the molar mass to find the number of moles, then multiplying by Avogadro's constant.

Question: How is an ammonia (NH<sub>3</sub>) molecule formed through covalent bonding?

Answer: An ammonia (NH<sub>3</sub>) molecule is formed when a nitrogen atom shares three pairs of electrons with three hydrogen atoms, resulting in covalent bonds and a stable electronic configuration for each atom.

Question: What is the formula for the moment of a couple of forces in a given scenario?

Answer: The formula for the moment of a couple of forces is  $\text{Moment} = \text{Force} \times \text{Perpendicular distance between the lines of action of the two forces}$ .

Question: Write the balanced chemical equation for the complete combustion of propane.

Answer: The balanced chemical equation for the complete combustion of propane is  $\text{C}_3\text{H}_8 + 5\text{O}_2 \rightarrow 3\text{CO}_2 + 4\text{H}_2\text{O}$ .

Question: How is the concentration of a solution expressed in mol/dm<sup>3</sup>?

Answer: By dividing the number of moles of solute by the volume of the solution in cubic decimeters.

Question: How does the human body regulate temperature?

Answer: The human body regulates temperature through mechanisms such as sweating, shivering, and blood flow adjustments, maintaining homeostasis and optimal conditions for cellular functions.

Question: What happens to light rays parallel to the principal axis when they pass through a concave lens?

Answer: They are refracted away from the principal axis, appearing to diverge from a focal point.

Question: How does the composition of blood plasma contribute to its functions?

Answer: Blood plasma contains water, proteins, nutrients, nitrogenous waste, hormones, enzymes, gases, and ions, facilitating transport and maintaining homeostasis.

Question: What is the purpose of a barometer in weather forecasting?

Answer: A barometer measures atmospheric pressure, providing data for weather forecasting by indicating potential changes in weather patterns, such as incoming storms or clear skies.

Question: What happens to the induced current when the coil in a dynamo is vertical?

Answer: When the coil is vertical, the induced current becomes zero as the conductors do not intersect the magnetic field lines.

Question: What are the potential health risks associated with exposure to particulate matter?

Answer: Potential health risks associated with exposure to particulate matter include respiratory problems, cardiovascular diseases, lung cancer, and premature death.

Question: How does increasing the force applied to an object affect its motion?

Answer: Increasing the force applied to an object increases its acceleration, resulting in a greater change in velocity and motion.

Question: What are the features of vertebrates in the class Mammalia?

Answer: Vertebrates in the class Mammalia have skin covered by hair, mammary glands, sweat and sebaceous glands, ear lobes, a four-chambered heart, complete double circulation, biconcave red blood cells lacking a nucleus, and are warm-blooded with internal fertilization.

Question: What is the role of sulfuric acid in acidulated water for electrolysis?

Answer: Sulfuric acid increases the concentration of  $H^+$  ions, enhancing the conductivity of the solution and facilitating the electrolysis process.

Question: What is the pressure exerted at a depth of 2 meters in a tank with water density of  $1000 \text{ kg/m}^3$  and  $g = 10 \text{ m/s}^2$ ?

Answer: The pressure is  $20,000 \text{ Pa}$ , calculated as  $2 \text{ m} * 1000 \text{ kg/m}^3 * 10 \text{ m/s}^2$ .

Question: What is the chemical formula for calcium sulfate?

Answer: The chemical formula for calcium sulfate is  $\text{CaSO}_4$ .

Question: What is the significance of the electronic configuration in determining the reactivity of an element?

Answer: The electronic configuration determines the stability of an element's valence shell, influencing its tendency to gain, lose, or share electrons, and thus its chemical reactivity.

Question: Explain the process of electrochemical polymerization and its applications.

Answer: Electrochemical polymerization involves the formation of conductive polymers on an electrode surface through the electrochemical oxidation or reduction of monomers. Applications include sensors, batteries, supercapacitors, and corrosion-resistant coatings.

Question: How does a moving coil microphone generate electrical signals?

Answer: A moving coil microphone generates electrical signals by vibrating a coil within a magnetic field, inducing an electromotive force corresponding to sound waves.

Question: What is the function of guard cells in regulating stomatal movement?

Answer: Guard cells control the opening and closing of stomata, regulating gas exchange and water loss based on environmental conditions and internal signals.

Question: What are some uses of magnesium?

Answer: Magnesium is used to produce magnelium (an alloy with aluminium), medicines like milk of magnesia, and as a metal to prevent corrosion of iron. It is also used in the aircraft industry and making parts of automobiles.

Question: How is oxygen gas prepared from hydrogen peroxide?

Answer: Oxygen gas is prepared by the decomposition of hydrogen peroxide, producing water and oxygen:  $2\text{H}_2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{O}_2$ .

Question: How is the refractive index of a medium relative to air determined?

Answer: By measuring the ratio of the sine of the angle of incidence to the sine of the angle of refraction when light enters the medium from air.

Question: What are the main functions of the large intestine?

Answer: The large intestine absorbs water from indigestible food matter, forms feces, and eliminates waste from the body.

Question: How does cancer develop?

Answer: Cancer develops due to an uncontrolled division of abnormal cells in the body. Industrialization, exposure to harmful radiation, and intake of heavy metals increase the possibility of developing cancer.

Question: How does a supercapacitor differ from a traditional capacitor?

Answer: A supercapacitor differs from a traditional capacitor by offering much higher capacitance and energy storage capability, achieved through electrostatic charge separation at the electrode-electrolyte interface, allowing rapid charging and discharging.

Question: What are the features of vertebrates in the class Aves?



Answer: Vertebrates in the class Aves have a light bony endoskeleton, streamlined bodies, feathers covering their skin, beaks adapted for different modes of nutrition, eyes with eyelids, pentadactyle limbs (forelimbs converted into wings), a four-chambered heart, and are warm-blooded.

Question: How is oxygen production tested in aquatic plants during photosynthesis experiments?

Answer: Collect the gas released by aquatic plants under a boiling tube, and test with a glowing splinter. The splinter reignites, indicating oxygen production.

Question: What are the characteristics of noble gases?

Answer: Noble gases like helium, neon, and argon have stable electronic configurations with full valence shells, making them chemically inert and not forming compounds under normal conditions.

Question: How many molecules are there in 0.2 moles of water (H<sub>2</sub>O)?

Answer: There are  $1.204 \times 10^{23}$  molecules in 0.2 moles of water, calculated as  $0.2 \times 6.022 \times 10^{23}$ .

Question: What is the valency of nitrogen?

Answer: The valency of nitrogen is 3.

Question: Describe the function of bile in digestion.

Answer: Bile, produced by the liver and stored in the gall bladder, emulsifies lipids in food, breaking them down into small droplets to increase the surface area for enzyme action.

Question: What role do apical meristems play in plant growth?

Answer: Apical meristems are found in the shoot apex, root apex, and axillary buds and are responsible for the plant's increase in height.

Question: What is the role of acid-base titration in chemistry?

Answer: Acid-base titration is used to determine the concentration of an acid or base in a solution by neutralizing it with a known volume and concentration of a titrant.

Question: What neurons are involved in a reflex arc?

Answer: Motor neuron, sensory neuron, and inter neuron.

Question: How does a digital-to-analog converter (DAC) work?

Answer: A digital-to-analog converter (DAC) converts digital signals into corresponding analog voltages, enabling digital devices to interface with analog systems and control real-world analog processes.

Question: What is the purpose of using filter paper in filtration?

Answer: Filter paper acts as a barrier that allows smaller particles to pass through while retaining larger particles, effectively separating them from the mixture.

Question: How does the release of sulfur dioxide (SO<sub>2</sub>) affect air quality?

Answer: The release of sulfur dioxide (SO<sub>2</sub>) affects air quality by contributing to the formation of acid rain, which can harm human health, damage crops, and degrade buildings and infrastructure.

Question: How does an electrochemical gradient drive the production of ATP in cells?

Answer: An electrochemical gradient, created by the transport of protons across the mitochondrial membrane, drives the production of ATP in cells through chemiosmosis. The flow of protons back into the mitochondrial matrix through ATP synthase generates ATP from ADP and inorganic phosphate.

Question: What is the potential energy of a 5.5 kg object at a height of 4.5 m?

Answer: The potential energy is 247.5 Joules (J).

Question: What is the significance of intercellular spaces in parenchyma tissues?

Answer: Intercellular spaces in parenchyma tissues allow for the exchange of gases and the movement of water and nutrients within the plant.

Question: What happens when an object is placed at twice the focal length of a convex lens?

Answer: A real, inverted image of the same size as the object is formed at twice the focal length on the opposite side of the lens.

Question: What is sustainable development?

Answer: Sustainable development is the smart use of natural resources by safeguarding the balance of the environment in such a manner that future generations can also use them.

Question: How does the release of greenhouse gases contribute to global warming?

Answer: Greenhouse gases trap heat in the Earth's atmosphere, leading to increased global temperatures and climate change. They are released from human activities such as fossil fuel combustion, deforestation, and industrial processes.

Question: What are the features of invertebrates in the phylum Mollusca?

Answer: Invertebrates in the phylum Mollusca are triploblastic, soft-bodied animals with a body divided into head, visceral mass, and muscular foot, and some have internal and external shells made of CaCO<sub>3</sub>.

Question: How do Molluscs reproduce?

Answer: Molluscs show sexual reproduction and most of them are unisexual (produce one type of gamete).

Question: What is the specific heat capacity of rubber?

Answer: The specific heat capacity of rubber is  $1700 \text{ J kg}^{-1} \text{ K}^{-1}$ .

Question: What is meiosis, and why is it important?

Answer: Meiosis is a type of cell division that reduces the chromosome number by half, producing haploid gametes (sperm and eggs), ensuring

genetic diversity and proper chromosome number in offspring.

Question: What is fertilization in plants?

Answer: Fertilization in plants occurs when the male gamete in the pollen fuses with the ovum in the ovary, resulting in the formation of a zygote that develops into an embryo.

Question: How is the chyme formed in the stomach?

Answer: Chyme is formed by the mixing and breaking down of food with gastric juice, resulting in a semi-liquid mixture that moves to the small intestine.

Question: How is the chemical formula of water represented?

Answer: The chemical formula of water is  $H_2O$ , indicating two hydrogen atoms and one oxygen atom.

Question: What is the role of ultrasound waves in detecting dangerous air gaps in solid components?

Answer: High-frequency ultrasound waves detect air gaps and fractures in solid components by not penetrating through the gaps, indicating potential issues.

Question: How does the specific heat capacity of water compare to other substances?

Answer: Water has a high specific heat capacity ( $4200 \text{ J kg}^{-1} \text{ K}^{-1}$ ) compared to many other substances, meaning it requires more heat to increase its temperature by one degree.

Question: What is the difference between genotype and phenotype?

Answer: Genotype is the genetic makeup of an organism, while phenotype is the observable expression of traits determined by the genotype.

Question: What are the characteristics of images formed by bi-concave lenses?

Answer: Bi-concave lenses form virtual, upright, and smaller images by diverging light rays.

Question: How does a photodiode convert light into electrical current?

Answer: A photodiode generates electron-hole pairs when exposed to light, creating a current proportional to the light intensity, used in light detection and solar energy applications.

Question: Describe the function of fuses in protecting electric circuits.

Answer: Fuses protect electric circuits by breaking the circuit when the current exceeds a safe level, preventing overheating and potential fires.

Question: How does the reaction of zinc with hydrochloric acid demonstrate the reactivity series?

Answer: Zinc displaces hydrogen from hydrochloric acid, showing it is more reactive than hydrogen:  $Zn + 2HCl \rightarrow ZnCl_2 + H_2$ .

Question: How do scientists study the genetic basis of inherited traits?

Answer: Scientists study the genetic basis of inherited traits through experiments, genetic crosses, and analysis of DNA sequences to understand how traits are passed down from one generation to the next.

Question: How does pressure affect the solubility of gases in liquids?

Answer: Increasing pressure increases the solubility of gases in liquids.

Question: What are some examples of genetic disorders caused by mutations?

Answer: Examples include cystic fibrosis, sickle cell anemia, and Huntington's disease. These disorders result from mutations in specific genes that affect normal cellular functions.

Question: Calculate the molar mass of magnesium oxide (MgO).

Answer: The molar mass of magnesium oxide is 40 grams per mole, calculated as 24 for magnesium plus 16 for oxygen.

Question: Why do many essential components need to be separated from mixtures found in the Earth's crust?

Answer: Because substances like metals, mineral oils, salts, and other resources rarely exist in pure form in nature and need to be separated for use.

Question: What components are assembled together in a DC motor?

Answer: A DC motor consists of the armature, split rings, insulator, axle, brushes, and magnetic poles.

Question: Calculate the amount of oxygen in moles in 32 grams of oxygen (O<sub>2</sub>)?

Answer: The amount of oxygen in 32 grams is 1 mole, calculated as  $32/32 = 1$  mole.

Question: How is the quality of sound determined by its waveform?

Answer: The waveform of a sound determines its unique quality or timbre, allowing us to distinguish between different sound sources.

Question: What is the electronic configuration of magnesium?

Answer: The electronic configuration of magnesium is 2, 8, 2.

Question: What causes gonorrhea, and what are its symptoms?

Answer: Gonorrhea is caused by the bacterium *Neisseria gonorrhoeae* and is characterized by secretions from sex organs, pain, and blockage of the fallopian tube.

Question: Explain the process of DNA replication during the S phase.

Answer: During the S phase, the cell's DNA is replicated, resulting in two identical copies of each chromosome, ensuring that each daughter cell receives a complete set of genetic information.

Question: What is the purpose of using organic solvents in solvent extraction?

Answer: Organic solvents can dissolve certain solutes more effectively than water, allowing for efficient extraction of desired compounds.

Question: Conduct an experiment to demonstrate the electrolysis of acidulated water, including the setup, procedure, and observations.

Answer: The electrolysis of acidulated water involves decomposing water into its constituent gases, hydrogen and oxygen, using carbon electrodes and an electric current. Materials Required: Distilled water with a little dilute sulfuric acid, carbon rods, a 9V battery, connecting wires, a plastic cup, and two test tubes. Method: Pierce the bottom of a plastic cup and fix the carbon rods in place. Seal any gaps to prevent water leakage. Fill the cup with acidulated water. Invert two test tubes filled with water over the carbon rods. Connect the carbon rods to the battery terminals using connecting wires. Turn on the power and observe the gases collected in the test tubes. Observations: Gases collect in the test tubes. The volume of gas liberated at the cathode is greater than that at the anode. Reactions: At the Cathode (Negative Electrode): Reduction of hydrogen ions occurs. Reaction:  $2\text{H}^+(\text{aq}) + 2\text{e}^- \rightarrow \text{H}_2(\text{g})$  Hydrogen gas is liberated at the cathode. At the Anode (Positive Electrode): Oxidation of hydroxide ions occurs. Reaction:  $4\text{OH}^-(\text{aq}) \rightarrow \text{O}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l}) + 4\text{e}^-$  Oxygen gas is liberated at the anode. Overall Reaction:  $2\text{H}_2\text{O}(\text{l}) \rightarrow 2\text{H}_2(\text{g}) + \text{O}_2(\text{g})$  Outcome: Hydrogen gas is produced at the cathode and oxygen gas at the anode. The volume of hydrogen gas is twice that of oxygen gas, consistent with the stoichiometric ratio of water decomposition.

Question: How does reforestation help mitigate environmental degradation?

Answer: Reforestation helps mitigate environmental degradation by restoring ecosystems, enhancing biodiversity, sequestering carbon, and improving soil and water quality.

Question: What is the role of the radicle in seed germination?

Answer: The radicle is the first part of the seedling to emerge from the seed during germination, developing into the primary root.

Question: What happens to the byproduct oxygen produced in photosynthesis?

Answer: The byproduct oxygen ( $\text{O}_2$ ) is diffused into the atmosphere through the stomata.

Question: How does urban sprawl impact natural habitats?

Answer: Urban sprawl leads to habitat fragmentation, loss of biodiversity, and increased pollution. It reduces the availability of natural habitats and disrupts ecosystem functions.

Question: What is the velocity of an object with a displacement of 25 meters in 5 seconds?

Answer: Velocity =  $25 \text{ m} / 5 \text{ s} = 5 \text{ m/s}$ .

Question: What is the significance of enzymes in metabolic processes?

Answer: Enzymes act as catalysts that speed up biochemical reactions in metabolic processes, allowing them to occur at a rate necessary for life.

Question: How is the chemical formula of potassium hydroxide written?

Answer: The chemical formula of potassium hydroxide is KOH, indicating one potassium ion and one hydroxide ion.

Question: How does the principle of pressure transmission apply to a hydraulic jack?

Answer: A hydraulic jack operates on the principle of pressure transmission, where a small force applied to a small piston generates pressure in the oil, which is transmitted to a larger piston, lifting the vehicle.

Question: Describe the reactivity of calcium with water.

Answer: Calcium reacts with cold water to form calcium hydroxide and hydrogen gas, though not as vigorously as sodium:  $\text{Ca} + 2\text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2 + \text{H}_2$ .

Question: What is the role of a potentiostat in conducting electrochemical experiments?

Answer: A potentiostat controls the potential of the working electrode relative to a reference electrode while measuring the current flow, allowing precise control and analysis of electrochemical reactions, kinetics, and mechanisms.

Question: How do nitrogen-fixing bacteria contribute to the nitrogen cycle?

Answer: Nitrogen-fixing bacteria convert atmospheric nitrogen into ammonia, which can be used by plants.

Question: How do you express the composition of a solution as a percentage?

Answer: Percentage composition = (Fraction of component)  $\times$  100.

Question: What is the general trend in metallic character across a period?

Answer: The metallic character decreases across a period from left to right.

Question: How does the strength of the magnetic field affect the performance of a dynamo?

Answer: A stronger magnetic field increases the induced electromotive force, improving the dynamo's performance and electricity generation.

Question: What is the significance of chlorophyll in plants?

Answer: Chlorophyll is significant because it captures light energy required for photosynthesis, enabling plants to produce glucose and oxygen from carbon dioxide and water.

Question: Why do black surfaces absorb more thermal radiation than white or shiny surfaces?

Answer: Black surfaces absorb more thermal radiation due to their higher emissivity and lower reflectivity, whereas white or shiny surfaces reflect more radiation and absorb less heat.

Question: What is the trend in atomic size across a period from left to right?

Answer: The atomic size decreases across a period from left to right.

Question: What is upthrust and how is it experienced by objects in a liquid?

Answer: Upthrust is the upward force exerted by a liquid on an object immersed in it. It is experienced as a reduction in the apparent weight of the object due to the liquid's buoyant force.

Question: What role do intercalary meristems play in grass family plants?

Answer: Intercalary meristems in grass family plants facilitate the rapid growth and elongation of internodes, contributing to the overall height of the plant.

Question: What is the pH scale used for?

Answer: The pH scale indicates how acidic or basic a solution is, ranging from 0 to 14, with acids below 7, bases above 7, and neutral substances at 7.

Question: How does a digital-to-analog converter (DAC) work?

Answer: A digital-to-analog converter (DAC) converts digital signals into corresponding analog voltages, enabling digital devices to interface with analog systems.

Question: What is the role of the electrolyte in an electroplating setup?

Answer: The electrolyte provides a source of metal ions for the plating process, facilitating the transfer of ions between the anode and cathode and ensuring a consistent and even deposition of the metal layer.

Question: How do mechanical waves differ from electromagnetic waves?

Answer: Mechanical waves need a material medium to travel through, while electromagnetic waves can propagate through a vacuum.

Question: How does electromagnetic induction enable the operation of a moving coil microphone?

Answer: Electromagnetic induction enables the microphone to convert sound waves into electrical signals by inducing a current in the vibrating coil.

Question: What assumptions are made in Activity 8.4 regarding the heat change calculation?

Answer: It is assumed that the entire quantity of heat of the reaction is used to raise the temperature of  $100\text{ cm}^3$  of the solution, the specific heat capacity of the solution is equal to that of water, and the density of the solution is equal to that of water.

Question: How is the chemical formula of calcium chloride written?

Answer: The chemical formula of calcium chloride is  $\text{CaCl}_2$ , indicating one calcium ion and two chloride ions.

Question: How is the chemical formula of potassium hydroxide written?

Answer: The chemical formula of potassium hydroxide is  $\text{KOH}$ , indicating one potassium ion and one hydroxide ion.

Question: What is the function of the Golgi apparatus in cells?

Answer: The Golgi apparatus modifies, sorts, and packages proteins and lipids for transport to their destinations within or outside the cell.

Question: What are polyatomic ions?

Answer: Polyatomic ions are ions composed of two or more atoms covalently bonded together that carry a net charge, such as  $\text{NH}_4^+$  and  $\text{SO}_4^{2-}$ .

Question: How does the force on a conductor vary with current strength?

Answer: The force increases with higher current strength, as it is directly proportional to the current in the conductor.

Question: Why do birds not get shocked when perching on high-voltage power lines?

Answer: Birds do not get shocked because they only touch one point on the wire, and there is no potential difference across their bodies to cause current flow.

Question: Explain the significance of Ohm's Law in electrical circuits.

Answer: Ohm's Law states that the current through a conductor is directly proportional to the voltage across it and inversely proportional to its resistance, forming the basis for analyzing electrical circuits.

Question: What are some examples of organisms in the Domain Archaea?

Answer: Examples include Methanogens and Halophiles.

Question: What components are essential for the operation of a bicycle dynamo?

Answer: Essential components of a bicycle dynamo include the rotating coil, magnetic field, mechanical connection to the tire, and electrical circuit.

Question: What is the SI unit used to measure electric current?

Answer: The SI unit used to measure electric current is the Ampere (A).

Question: How is resistance calculated using Ohm's Law?

Answer: Resistance ( $R$ ) is calculated using the formula  $R = V/I$ , where  $V$  is the potential difference and  $I$  is the current.

Question: What is slag, and how is it formed in the blast furnace?

Answer: Slag is a mixture of calcium silicate and calcium aluminate formed when impurities in the iron ore react with calcium oxide produced by the decomposition of limestone. It floats on molten iron and is removed separately.

Question: How does convection contribute to heat transfer in fluids?

Answer: Convection contributes to heat transfer in fluids by creating circulation patterns where heated fluid rises and cooler fluid sinks, continuously transferring heat throughout the fluid.

Question: How are volatile compounds extracted from cinnamon leaves using steam distillation?

Answer: Steam passes through cinnamon leaves, carrying the volatile compounds as vapor, which is then condensed and separated from water.

Question: What is the relationship between sound wave amplitude and loudness?



Answer: Higher amplitude sound waves are perceived as louder, while lower amplitude waves are perceived as softer.

Question: What is the role of an electrolyte in a lithium-ion battery?

Answer: The electrolyte in a lithium-ion battery facilitates the movement of lithium ions between the anode and cathode during charging and discharging, enabling the electrochemical reactions that store and release energy.

Question: How is the exothermic reaction between magnesium and hydrochloric acid represented?

Answer:  $\text{Mg (s)} + 2\text{HCl (aq)} \rightarrow \text{MgCl}_2 \text{ (aq)} + \text{H}_2 \text{ (g)} + \text{Heat}.$

Question: How does the high specific heat capacity of water influence its use in heating and cooling systems?

Answer: Water's high specific heat capacity allows it to absorb and store large amounts of heat energy with minimal temperature change, making it effective for regulating temperature in heating and cooling systems.

Question: What is the function of vitamin D?

Answer: Vitamin D controls the absorption of calcium and phosphorous.

Question: How does Newton's first law apply to a passenger standing in a moving bus?

Answer: When a moving bus suddenly stops, the passenger tends to fall forward due to inertia. The lower part of the body stops with the bus, but the upper part continues moving forward, demonstrating Newton's first law.

Question: What is the role of a circuit breaker in an electrical system?

Answer: A circuit breaker is a protective device that automatically interrupts the flow of current in a circuit when it detects an overload or short circuit, protecting the circuit and connected devices.

Question: How do viruses differ from bacteria in terms of structure and reproduction?

Answer: Viruses differ from bacteria in that they lack cellular structures, such as organelles, and can only replicate inside a host cell, while bacteria are unicellular organisms capable of independent growth and reproduction.

Question: What is the role of a galvanic cell in generating electrical energy?

Answer: A galvanic cell generates electrical energy from spontaneous redox reactions occurring between the electrodes, with chemical energy being converted into electrical energy that can be used to power devices.

Question: What is the significance of a single bond in a methane ( $\text{CH}_4$ ) molecule?

Answer: A single bond in a methane ( $\text{CH}_4$ ) molecule involves the sharing of one pair of electrons between a carbon atom and each hydrogen atom, resulting in a stable and tetrahedral structure.

Question: Describe the process Mendel followed for his experiments.

Answer: Mendel cultivated pure breeding tall and short plants, cross-pollinated them, and observed the resulting generations, noting the dominant and recessive traits.

Question: What is the test for identifying hydrogen gas?

Answer: Hydrogen gas is identified by its reaction with a lighted splint, producing a characteristic squeaky 'pop' sound.

Question: What is atherosclerosis, and how does it affect blood circulation?

Answer: Atherosclerosis is the buildup of cholesterol and lipid deposits (atheroma) in arteries, reducing lumen size and restricting blood flow, leading to conditions like heart failure.

Question: What adaptations do plants have to maximize light capture in shaded environments?

Answer: Plants in shaded environments have larger, thinner leaves with higher chlorophyll content, optimizing light capture and photosynthetic efficiency.

Question: What is the significance of the proximal convoluted tubule in the nephron?

Answer: The proximal convoluted tubule reabsorbs essential nutrients, water, and ions from the glomerular filtrate back into the blood.

Question: What is tissue culture?

Answer: Tissue culture is the production of new offspring identical to the parental plant by cultivating any vegetative tissue in a culture medium under controlled conditions.

Question: How does the pressure inside a sealed container change with temperature?

Answer: The pressure inside a sealed container increases with temperature, as the gas molecules move faster and collide with the container walls more frequently.

Question: What is the significance of the lines of action of forces in maintaining equilibrium in a system of three non-parallel forces?

Answer: The lines of action of the three non-parallel forces must intersect at a common point for equilibrium to be maintained. This ensures that the resultant of any two forces is equal in magnitude and opposite in direction to the third force.

Question: Explain the purpose of using a double pole switch in household circuits.

Answer: A double pole switch is used to simultaneously disconnect both the live and neutral wires, providing a higher level of safety when working on household circuits.

Question: Materials required :- Two small beakers, common salt, sugar

Method :- Take 50 ml of water at the same temperature into each of two small beakers. Accurately weigh 50 g each of salt and sugar. Adding a little at a time, dissolve salt in one beaker and sugar in the other. When it comes to the point beyond which no more solid dissolves, stop adding the

substance and weigh the remaining solid. See whether the amounts left are equal. What materials are needed for this Activity to investigate solubility?  
Answer: Materials needed include two small beakers, common salt, sugar, and water.

Question: What is the function of the lens in a human eye?  
Answer: The lens in the human eye refracts light to focus images on the retina, enabling clear vision.

Question: How does lime application affect soil pH?  
Answer: Lime (calcium carbonate) increases soil pH, reducing acidity and improving conditions for plant growth.

Question: How does the orientation of a coil affect the output of an alternating current dynamo?  
Answer: The coil's orientation affects the output, with maximum voltage generated when the coil is perpendicular to the magnetic field lines.

Question: How is a calcium ion ( $\text{Ca}^{2+}$ ) formed from a calcium atom?  
Answer: A calcium ion ( $\text{Ca}^{2+}$ ) is formed when a calcium atom loses two electrons, resulting in a positively charged ion with an electronic configuration of 2, 8, 8.

Question: What is the displacement of a body moving at a constant velocity of 6 m/s for 5 seconds?  
Answer: The displacement is 30 m.

Question: Explain the function of the central vacuole in plant cells.  
Answer: The central vacuole stores nutrients, waste products, and pigments, maintains turgor pressure for structural support, and contributes to cell growth by expanding.

Question: What is a hand lens or simple microscope, and how does it work?  
Answer: A hand lens or simple microscope is a convex lens that magnifies objects placed within its focal length, making them appear larger.

Question: How is power calculated when lifting an object?  
Answer: Power is calculated by dividing the work done (lifting the object) by the time taken to do the work.

Question: What are the potential health risks associated with exposure to particulate matter?  
Answer: Potential health risks associated with exposure to particulate matter include respiratory problems, cardiovascular diseases, lung cancer, and premature death.

Question: What are the key components of an electroplating setup?  
Answer: The key components include the object to be plated as the cathode, a solution of a metal salt as the electrolyte, and a metal plate or rod as the anode.

Question: What is the reaction between sodium and oxygen, and what are the products?

Answer: Sodium reacts with oxygen to form sodium oxide:  $4\text{Na} + \text{O}_2 \rightarrow 2\text{Na}_2\text{O}$ , a white solid.

Question: What are two disadvantages of friction?

Answer: Two disadvantages of friction are causing wear and tear on mechanical parts and leading to energy loss in the form of heat.

Question: What are the characteristics of ionic compounds?

Answer: Ionic compounds are composed of oppositely charged ions, have high melting and boiling points, conduct electricity in aqueous solutions and the fused state, and are mostly soluble in water.

Question: What are the factors that affect the rate of chemical reactions?

Answer: Factors include surface area of reactants, concentration of reactants, pressure of gaseous reactants, temperature, and the presence of catalysts or inhibitors.

Question: What is the image formed by a concave mirror for an object placed very far from the mirror?

Answer: The image is real, inverted, smaller than the object, and formed at the focal point.

Question: Explain the energy transformation in a bouncing ball.

Answer: In a bouncing ball, potential energy at the peak converts to kinetic energy as it falls, and kinetic energy converts back to potential energy as it rises after hitting the ground.

Question: What is the relationship between the speed of light and the medium it travels through?

Answer: Light travels at different speeds in different media, with a higher speed in less dense (rare) media and a lower speed in denser media.

Question: What are the signs of renal anemia, and how is it treated?

Answer: Signs of renal anemia include fatigue, weakness, and pallor. It is treated with erythropoiesis-stimulating agents, iron supplements, and blood transfusions if necessary.

Question: What is the chemical formula for sodium chloride?

Answer: The chemical formula for sodium chloride is  $\text{NaCl}$ .

Question: How do calcium and chlorine atoms achieve a stable electronic configuration in calcium chloride?

Answer: Calcium atoms lose electrons to form  $\text{Ca}^{2+}$  ions, and chlorine atoms gain electrons to form  $\text{Cl}^-$  ions. The electrostatic attraction between these ions forms calcium chloride ( $\text{CaCl}_2$ ).

Question: How do you investigate the equilibrium of a meter ruler under the action of three coplanar parallel forces?

Answer: Suspend the meter ruler horizontally using two rubber bands and spring balances at either end. Measure the forces exerted by the balances and compare them to the weight of the ruler to ensure they balance and maintain equilibrium.

Question: How do you determine the force exerted by a pile of soil distributed over an area of  $8 \text{ m}^2$  with a pressure of  $150 \text{ Pa}$ ?

Answer: The force exerted is  $1200 \text{ N}$ , calculated as  $150 \text{ Pa} * 8 \text{ m}^2$ .

Question: What is the reaction between magnesium and nitrogen?

Answer: Magnesium reacts with nitrogen to form magnesium nitride:  $3\text{Mg} + \text{N}_2 \rightarrow \text{Mg}_3\text{N}_2$ .

Question: How is the concept of resultant force demonstrated in pulling a trolley?

Answer: The concept is demonstrated by using Newton balances to apply forces in different directions and observing the resultant force.

Question: What is the purpose of smoothing in rectification circuits?

Answer: Smoothing in rectification circuits uses capacitors to reduce the variations in the rectified voltage, producing a more constant DC output suitable for electronic devices.

Question: What are the effects of the sympathetic nervous system?

Answer: It activates the fight or flight response, increasing heart rate, dilating pupils, and decreasing digestion, among other effects.

Question: How is atmospheric pressure measured using a mercury barometer?

Answer: Atmospheric pressure is measured using a mercury barometer by the height of the mercury column in a glass tube. The height of the column represents the atmospheric pressure exerted on the mercury in the container.

Question: How does the thermal decomposition of limestone illustrate an endothermic reaction?

Answer: The reaction absorbs heat to produce quicklime and carbon dioxide:  $\text{CaCO}_3 (\text{s}) \rightarrow \text{CaO} (\text{s}) + \text{CO}_2 (\text{g})$ .

Question: What is parturition?

Answer: Parturition, or childbirth, is the process of delivering the fetus from the uterus through the vagina, facilitated by the contraction of uterine muscles.

Question: How does the body regulate pH in the blood?

Answer: The body regulates blood pH through buffer systems, respiration, and kidney function, maintaining a stable internal environment.

Question: What is the purpose of a pressure relief valve in industrial systems?

Answer: A pressure relief valve prevents excessive pressure buildup in industrial systems by releasing pressure when it exceeds a set limit, ensuring safety.

Question: Describe the decomposition reaction of silver oxide.

Answer: Silver oxide decomposes upon heating to form silver and oxygen gas:  $2\text{Ag}_2\text{O} \rightarrow 4\text{Ag} + \text{O}_2$ .

Question: What is the specific latent heat of fusion of ice?

Answer: The specific latent heat of fusion of ice is  $3.36 \times 10^5 \text{ J/kg}$ .

Question: What happens when the coil in an alternating current dynamo is parallel to the magnetic field?

Answer: When the coil is parallel to the magnetic field, the induced electromotive force becomes zero as the conductors do not intersect the field lines.

Question: What is the role of the nervous system in coordination?

Answer: The nervous system transmits impulses through nerves to specific effectors, maintaining coordination between receptors and effectors.

Question: How do sound waves propagate through different media?

Answer: Sound waves propagate through compressions and rarefactions in the medium, whether it is air, water, or solid material.

Question: What does the area under the velocity-time graph represent for a body moving with uniform acceleration?

Answer: The area under the velocity-time graph represents the displacement of the body.

Question: How does tightening a screw affect the moment of force required to rotate a stick?

Answer: Tightening the screw increases the moment of force required to rotate the stick, confirming that the moment depends on the magnitude of the force.

Question: Explain the role of a rectifier in an electric circuit.

Answer: A rectifier converts alternating current (AC) to direct current (DC), allowing the use of DC-powered devices and systems from an AC power supply.

Question: How does the displacement of particles vary in a transverse wave?

Answer: In a transverse wave, particles move up and down perpendicular to the direction of wave propagation, creating crests and troughs.

Question: What occurs when potassium bromide reacts with chlorine gas?

Answer: Potassium bromide reacts with chlorine gas to form potassium chloride and bromine:  $2\text{KBr} + \text{Cl}_2 \rightarrow 2\text{KCl} + \text{Br}_2$ .

Question: How does the production of slaked lime from quicklime illustrate an exothermic reaction?

Answer: Adding water to quicklime releases a lot of heat:  $\text{CaO (s)} + \text{H}_2\text{O (l)} \rightarrow \text{Ca(OH)}_2 \text{ (s)}$ .

Question: What are some harmful effects of fungi?

Answer: Harmful effects of fungi include causing diseases in plants and animals and spoiling food.

Question: Materials required :- A beaker, water, common salt, a piece of cloth  
Method :- Take about 250 ml of water into a beaker. Add about 10 g

of pure salt into it, stir till the salt dissolves and filter the solution with a piece of cloth. Allow to stand still for about one hour and see whether the clearness of the solution is equal from top to bottom. Repeat what you did in activity 3.1.2 for this solution as well. What is demonstrated by dissolving salt in water in this Activity ?

Answer: Dissolving salt in water shows that the transparency and distribution of the salt particles are uniform throughout the solution, indicating a homogeneous mixture.

Question: What is the atomic number and mass number of deuterium?

Answer: The atomic number is 1 and the mass number is 2 for deuterium.

Question: What conclusion can be drawn from the experiment using KOH and water in polythene bags on leaves?

Answer: The experiment concludes that CO<sub>2</sub> is necessary for photosynthesis, as photosynthesis only occurred in the leaf with access to CO<sub>2</sub>.

Question: What is the molar mass of carbon dioxide (CO<sub>2</sub>)?

Answer: The molar mass of carbon dioxide is 44 grams per mole, calculated as 12 for carbon plus 2 x 16 for oxygen.

Question: What are the key features of amphibians (Amphibia)?

Answer: Amphibians have eyes without eyelids, require water to complete their life cycle, undergo metamorphosis, have thin mucous skin with glands, pentadactyle limbs, a three-chambered heart, and respire through lungs, moist skin, and buccal cavity.

Question: What is the effect of connecting two dry cells in series on the potential difference and current in a circuit?

Answer: Connecting two dry cells in series increases the potential difference, which can increase the current in the circuit if the resistance remains constant.

Question: What is the atomic number of hydrogen?

Answer: The atomic number of hydrogen is 1.

Question: What is static friction?

Answer: Static friction is the frictional force that acts on a body when there is no relative motion between the contact surfaces, preventing the body from moving.

Question: What is the significance of the water-energy-food nexus?

Answer: The water-energy-food nexus is significant because it highlights the interdependence of these resources and the need for integrated management to ensure sustainability and security.

Question: How does electromagnetic induction enable the operation of a moving coil microphone?

Answer: Electromagnetic induction enables the microphone to convert sound waves into electrical signals by inducing a current in the vibrating coil.

Question: How does a microcontroller differ from a microprocessor?

Answer: A microcontroller integrates a microprocessor with memory, input/output peripherals, and other components on a single chip, making it suitable for embedded applications. In contrast, a microprocessor is mainly a central processing unit (CPU) used in general-purpose computing.

Question: How does a battery differ from a single electrochemical cell?

Answer: A battery is a collection of several electrochemical cells, which allows it to provide a larger amount of electrical energy compared to a single cell.

Question: What is the specific heat capacity of rubber?

Answer: The specific heat capacity of rubber is  $1700 \text{ J kg}^{-1} \text{ K}^{-1}$ .

Question: What is the effect of reversing current direction on the magnetic field around a conductor?

Answer: Reversing the current direction reverses the field direction, changing the magnetic field's orientation around the conductor.

Question: What are the effects of smoking on kidney health?

Answer: Smoking can damage blood vessels, reduce blood flow to the kidneys, increase blood pressure, and elevate the risk of kidney disease.

Question: How does the surface area of electrodes influence the performance of an electrochemical cell?

Answer: The surface area of electrodes influences the performance of an electrochemical cell by affecting the reaction rate and current density. Larger surface areas provide more active sites for reactions, improving cell efficiency and capacity.

Question: What are the differences between aerobic and anaerobic respiration?

Answer: Aerobic respiration requires oxygen and produces more energy, while anaerobic respiration occurs without oxygen and produces less energy, often resulting in lactic acid or alcohol.

Question: What is Faraday's law of electrolysis?

Answer: Faraday's law of electrolysis states that the amount of substance deposited or liberated at an electrode during electrolysis is directly proportional to the quantity of electric charge passed through the electrolyte.

Question: What is Fleming's left-hand rule?

Answer: Fleming's left-hand rule states that if the thumb, index finger, and middle finger of the left hand are held perpendicular to each other, with the middle finger pointing in the direction of current flow and the index finger along the magnetic field, the thumb points in the direction of the force acting on the conductor.

Question: What are homologous chromosomes?

Answer: Homologous chromosomes are pairs of chromosomes that have the same sequence of characters. They are similar in length, width, and the location of the centromere, with one chromosome inherited from each



parent.

Question: What functions do parenchyma tissues perform?

Answer: Parenchyma tissues perform functions such as photosynthesis, food storage, water storage, and providing mechanical support.

Question: What is the significance of intermolecular bonds in water?

Answer: Intermolecular bonds in water are responsible for its high boiling point, high specific heat capacity, and the fact that it is a liquid at room temperature.

Question: What is photosynthesis, and why is it considered an endothermic process?

Answer: Photosynthesis is the process by which green plants produce simple sugars by absorbing solar energy:  $6\text{CO}_2 (\text{g}) + 6\text{H}_2\text{O} (\text{l}) + \text{solar energy} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 (\text{s}) + 6\text{O}_2 (\text{g})$ .

Question: What is the boiling point of ethanol?

Answer: The boiling point of ethanol is  $78^\circ\text{C}$ .

Question: What is the function of ribosomes in cells?

Answer: Ribosomes are responsible for protein synthesis, translating genetic information from mRNA to build proteins necessary for cellular functions and growth.

Question: What types of waves are included in the electromagnetic spectrum?

Answer: The electromagnetic spectrum includes gamma rays, X-rays, ultraviolet rays, visible light, infrared rays, microwaves, and radio waves.

Question: What are some common inherited traits observed in plants?

Answer: Common inherited traits in plants include flower color, seed shape, pod shape, and plant height, which can vary among different varieties of the same species.

Question: What is the function of the commutator in maintaining motor efficiency?

Answer: The commutator alternates the current direction, preventing reverse motion and ensuring continuous, efficient rotation.

Question: What happens to the induced current when the coil in a dynamo moves parallel to the magnetic field?

Answer: When the coil moves parallel to the magnetic field, the induced current becomes zero as there is no intersection of field lines.

Question: What elements are always present in proteins?

Answer: Carbon, Hydrogen, Oxygen, and Nitrogen are always present in proteins.

Question: Materials required ; - Two small beakers about 100 cm<sup>3</sup> , A thermometer, a glass rod, solid sodium hydroxide (NaOH), solid ammonium chloride (NH<sub>4</sub>Cl) Method; - Add about half full of water to a beaker, measure its temperature and note it down. Add a little amount of solid

sodium hydroxide to the same beaker, stir with the glass rod and again measure and record the temperature. State your observations. Fill half of a beaker with water and record its temperature. Add a little amount of solid ammonium chloride to this beaker. Stir with the glass rod and record the temperature again. State your observations. What materials are required for the activity?

Answer: Two small beakers about 100 cm<sup>3</sup>, a thermometer, a glass rod, solid sodium hydroxide (NaOH), and solid ammonium chloride (NH<sub>4</sub>Cl).

Question: What is the main elemental composition of carbohydrates?

Answer: The main elemental composition of carbohydrates is Carbon (C), Hydrogen (H), and Oxygen (O).

Question: What is the role of magnesium in the human body?

Answer: Magnesium is a constituent of bones and teeth, controls nerve activity in skeletal muscles, and helps in metabolic activities.

Question: How do you achieve equilibrium in a system of forces acting on an object suspended by multiple strings?

Answer: Achieve equilibrium by ensuring that the forces exerted by the strings balance the weight of the object. The tensions in the strings must be equal and opposite to the weight, and their lines of action must intersect at a common point.

Question: How does the specific heat capacity of ethanol make it useful in laboratory thermometers?

Answer: Ethanol's specific heat capacity and high expansion rate with temperature changes make it useful in laboratory thermometers, providing accurate temperature measurements.

Question: What happens to the charges on an object when electrons are removed?

Answer: When electrons are removed from an object, it becomes positively charged.

Question: What is the principle of operation of a Bourdon tube in measuring pressure?

Answer: A Bourdon tube measures pressure by deforming under pressure, with the deformation moving an indicator to show the pressure level on a scale.

Question: What is the effect of thermal expansion on the design of railway tracks?

Answer: Thermal expansion affects the design of railway tracks by requiring expansion gaps to accommodate the tracks' length changes due to temperature variations, preventing deformation and ensuring safe operation.

Question: What are the main features of the Kingdom Fungi?

Answer: The Kingdom Fungi includes organisms with chitinous cell walls, eukaryotic cellular organization, and the ability to decompose organic matter.

Question: How do geneticists predict the outcomes of genetic crosses?

Answer: Geneticists use Punnett squares and probability calculations to predict the outcomes of genetic crosses, estimating the likelihood of different genotypes and phenotypes in offspring.

Question: What are unisexual flowers?

Answer: Unisexual flowers have either male or female reproductive parts and are classified into staminate (male) and pistillate (female) flowers.

Question: Why does the temperature increase when solid sodium hydroxide dissolves in water?

Answer: The temperature increases because of the loss of heat, indicating an exothermic reaction.

Question: How does a compressed gas exert pressure?

Answer: A compressed gas exerts pressure due to the force of the gas molecules colliding with the walls of the container. The more the gas is compressed, the higher the pressure.

Question: What is the work done in lifting a 2 kg object to a height of 3 m?

Answer: The work done is 60 Joules (J).

Question: What happens to the induced current when the coil in a dynamo moves parallel to the magnetic field?

Answer: When the coil moves parallel to the magnetic field, the induced current becomes zero as there is no intersection of field lines.

Question: How do neurons transmit impulses?

Answer: Neurons transmit impulses through electrical and chemical signals, allowing communication between the brain, spinal cord, and other parts of the body.

Question: What type of image is formed by light rays that reach the screen after passing through a convex lens?

Answer: A real image, because it is formed by light rays that actually converge on the screen.

Question: What are some examples of autotrophic organisms?

Answer: Examples of autotrophic organisms include most plants, algae, and some bacteria, which produce their own food through photosynthesis or chemosynthesis.

Question: How does the principle of pressure transmission apply to a hydraulic jack?

Answer: A hydraulic jack operates on the principle of pressure transmission, where a small force applied to a small piston generates pressure in the oil, which is transmitted to a larger piston, lifting the vehicle.

Question: How does gas exchange occur in the alveoli?

Answer: Oxygen diffuses from the alveoli into the blood capillaries, while carbon dioxide and water vapor diffuse from the blood into the alveoli to be exhaled.

Question: How does the electrochemical reduction of CO<sub>2</sub> to hydrocarbons contribute to sustainable energy solutions?

Answer: The electrochemical reduction of CO<sub>2</sub> to hydrocarbons converts CO<sub>2</sub>, a greenhouse gas, into valuable fuels and chemicals using renewable electricity, contributing to sustainable energy solutions and reducing carbon emissions.

Question: What are the physical properties of carbon dioxide gas?

Answer: Carbon dioxide is denser than normal air, colorless, odorless, does not burn or support combustion, and is slightly soluble in water.

Question: What is the principle of operation of a diaphragm pump?

Answer: A diaphragm pump operates by flexing a diaphragm to create a variable volume, drawing in and expelling fluid through check valves, useful for moving liquids and gases.

Question: What are the methods of managing electronic waste?

Answer: Methods of managing electronic waste include recycling, proper disposal, and the recovery of valuable materials to prevent environmental contamination.

Question: How do you calculate the mass of a solute required to prepare a solution of specific concentration?

Answer:  $\text{Mass required} = \text{Molar mass of solute} \times \text{Desired concentration} \times \text{Volume of solution}$ .

Question: What are the key features of mammals (Mammalia)?

Answer: Mammals have skin covered by hair, mammary glands, sweat and sebaceous glands, ear lobes, a four-chambered heart, complete double circulation, biconcave red blood cells lacking a nucleus, and are warm-blooded with internal fertilization.

Question: What factors affect the buoyant force on an object submerged in a fluid?

Answer: The buoyant force on an object is affected by the fluid's density, the volume of the displaced fluid, and the gravitational acceleration.

Question: What is the function of a voltage regulator in electronic devices?

Answer: A voltage regulator maintains a constant output voltage despite variations in input voltage or load conditions, ensuring stable and reliable power supply for electronic devices.

Question: How is the loudness of sound related to its amplitude?

Answer: Loudness increases with the amplitude of the sound wave; larger amplitudes result in louder sounds.

Question: What is the chemical formula for ammonium chloride?

Answer: The chemical formula for ammonium chloride is NH<sub>4</sub>Cl.

Question: How does the image distance compare to the object distance in plane mirrors?

Answer: The image distance is equal to the object distance in plane mirrors.

Question: What is the relative molecular mass of sulfuric acid ( $\text{H}_2\text{SO}_4$ )?

Answer: The relative molecular mass of sulfuric acid is 98, calculated as  $2 \times 1$  for hydrogen, 32 for sulfur, and  $4 \times 16$  for oxygen.

Question: Experimental determination of the heat change of the reaction between sodium hydroxide ( $\text{NaOH}$ ) and hydrochloric acid ( $\text{HCl}$ )  
Materials required : - 50 cm<sup>3</sup> of 2 mol dm<sup>-3</sup> sodium hydroxide solution, 50 cm<sup>3</sup> of 2 mol dm<sup>-3</sup> hydrochloric acid solution, two 100 cm<sup>3</sup> beakers, a thermometer of range 0-100 °C, a polystyrene cup, a glass rod  
Method : - To two beakers, measure 50 cm<sup>3</sup> of the sodium hydroxide solution and 50 cm<sup>3</sup> of the hydrochloric acid solution separately using the measuring cylinder.

With the thermometer, measure the initial temperatures of the two solutions. (After measuring the temperature of the solution of the base, wash the thermometer before measuring the temperature of the acid solution . Mix these two solutions in a polystyrene cup, stir with the glass rod and record the maximum temperature. What materials are required for the Activity ?

Answer: 50 cm<sup>3</sup> of 2 mol dm<sup>-3</sup> sodium hydroxide solution, 50 cm<sup>3</sup> of 2 mol dm<sup>-3</sup> hydrochloric acid solution, two 100 cm<sup>3</sup> beakers, a thermometer (0-100°C range), a polystyrene cup, and a glass rod.

Question: What is the historical significance of the compass?

Answer: The compass, invented by the Chinese in the eleventh century AD, has been used for navigation by showing the direction of the earth's magnetic field.

Question: How do microtubules function in a cell?

Answer: Microtubules are part of the cytoskeleton, providing structural support, aiding in cell division by forming the mitotic spindle, and serving as tracks for intracellular transport.

Question: What are the advantages of using fuel cells over traditional combustion engines?

Answer: Fuel cells offer higher efficiency, lower emissions, and quieter operation compared to traditional combustion engines. They produce only water as a byproduct, making them environmentally friendly.

Question: How do antennas function in the transmission and reception of radio waves?

Answer: Antennas transmit and receive radio waves by converting electrical signals into radio waves and vice versa.

Question: What is the moment of a couple of forces acting on a plank of timber pivoted at the center?

Answer: The moment of a couple of forces acting on a plank of timber pivoted at the center is calculated as the product of one of the forces and the perpendicular distance between the lines of action of the two forces.

Question: What is bioaccumulation?

Answer: Bioaccumulation is the buildup of substances, such as pesticides, in the tissues of organisms over time.

Question: Describe the function of a voltage reference in precision measurement systems.

Answer: A voltage reference provides a stable and accurate voltage output, used as a reference point for precision measurement systems and ensuring accurate and reliable measurements.

Question: What test can be conducted to identify glucose?

Answer: A glucose solution is mixed with Benedict's solution and heated in a water bath to observe color changes from blue to green, yellow, orange, and finally a brick red precipitate.

Question: What happens to the motion of an object on a horizontal table when pulled in opposite directions with two unequal forces?

Answer: When an object on a horizontal table is pulled in opposite directions with two unequal forces, it will move in the direction of the larger force with a resultant force equal to the difference between the two forces.

Question: What is electromagnetic induction?

Answer: Electromagnetic induction is the generation of an electromotive force in a conductor placed in a changing magnetic field or moving through a constant magnetic field.

Question: What is the role of a catalyst in a chemical reaction?

Answer: A catalyst increases the rate of a chemical reaction without being consumed in the process. It provides an alternative pathway with a lower activation energy, speeding up the reaction.

Question: What is the function of phloem fibers in phloem tissue?

Answer: Phloem fibers are dead cells that provide structural support to the phloem tissue.

Question: How does the principle of pressure transmission apply to a hydraulic jack?

Answer: A hydraulic jack operates on the principle of pressure transmission, where a small force applied to a small piston generates pressure in the oil, which is transmitted to a larger piston, lifting the vehicle.

Question: What are the effects of noise pollution on wildlife?

Answer: Noise pollution disrupts communication, navigation, and reproductive behavior in wildlife. It causes stress, affects health, and can lead to population declines.

Question: What is the current flowing through a nichrome wire coil with a resistance of  $6\ \Omega$  connected to a  $3\ \text{V}$  power supply?

Answer: Using Ohm's Law,  $I = V/R$ , the current is  $I = 3\ \text{V} / 6\ \Omega = 0.5\ \text{A}$ .

Question: What is the role of a potentiostat in conducting electrochemical experiments?

Answer: A potentiostat controls the potential of the working electrode relative to a reference electrode while measuring the current flow, allowing precise control and analysis of electrochemical reactions, kinetics, and mechanisms.

Question: How does a mercury barometer work?

Answer: A mercury barometer consists of a glass tube filled with mercury and inverted in a mercury container. The height of the mercury column in the tube is balanced by atmospheric pressure, typically 76 cm Hg at sea level.

Question: State Newton's third law of motion.

Answer: Newton's third law of motion states that for every action, there is an equal and opposite reaction.

Question: Who first introduced the Periodic Table for classifying elements?

Answer: Dmitri Mendeleev first introduced the Periodic Table for classifying elements.

Question: How does the length of a vibrating string affect the sound produced by string instruments?

Answer: The length of the vibrating string determines the frequency of the sound, with shorter strings producing higher frequencies and longer strings producing lower frequencies.

Question: How do flowering plants reproduce?

Answer: Flowering plants reproduce sexually through flowers and have seeds covered by a fruit.

Question: How does Newton's first law apply to a passenger standing in a moving bus when it starts moving?

Answer: When a bus at rest suddenly starts moving, the passenger tends to fall backward due to inertia. The lower part of the body starts moving with the bus, but the upper part remains at rest, demonstrating Newton's first law.

Question: How does an aneroid barometer measure atmospheric pressure?

Answer: An aneroid barometer measures atmospheric pressure using a sealed, air-evacuated cavity with flexible walls. Changes in pressure cause the walls to flex, moving an indicator to show the pressure on a scale.

Question: What is the nature of the image formed by a concave lens?

Answer: A concave lens forms a virtual, upright, and smaller image of the object.

Question: What is the function of epithelial tissue in the respiratory tract?

Answer: Epithelial tissue in the respiratory tract secretes mucus, trapping dust and microbes, and protecting the lungs from infection and damage.

Question: How do you connect two dry cells to ensure a potential difference across a bulb?

Answer: Connect the positive terminal of one cell and the negative terminal of the other cell to the terminals of the bulb to create a potential difference

and allow current to flow.

Question: What are the causes of deforestation?

Answer: Causes of deforestation include logging, agricultural expansion, urbanization, and infrastructure development.

Question: What is a wave?

Answer: A wave is a disturbance that propagates through a medium or space, carrying energy from one point to another without transmitting the substance of the medium.

Question: What is the significance of Mendel's choice of the garden pea plant for his experiments?

Answer: The garden pea plant's ease of cultivation, short generation time, and clear contrasting traits made it an ideal choice for Mendel's genetic experiments, allowing for accurate observations of inheritance patterns.

Question: What are sclereids, and where are they found?

Answer: Sclereids are a type of sclerenchyma cell found in the endocarp of fruits like coconut, the pericarp of guava, and the seed coat of coffee and dates.

Question: What is the role of the Golgi apparatus in protein trafficking?

Answer: The Golgi apparatus sorts and packages proteins into vesicles for transport to their final destinations, ensuring proper delivery and function within the cell or secretion outside the cell.

Question: How do geneticists predict the outcomes of genetic crosses?

Answer: Geneticists use Punnett squares and probability calculations to predict the outcomes of genetic crosses, estimating the likelihood of different genotypes and phenotypes in offspring.

Question: How do magnetic materials differ from non-magnetic materials?

Answer: Magnetic materials, like iron and steel, are attracted by magnets, while non-magnetic materials, like plastic and wood, are not.

Question: Describe the function of an isolation amplifier in medical instrumentation.

Answer: An isolation amplifier provides electrical isolation between its input and output, ensuring patient safety by preventing electrical interference and ground loops in medical instrumentation.

Question: How does water scarcity impact agriculture?

Answer: Water scarcity reduces crop yields, affects livestock health, and limits agricultural productivity. It poses challenges to food security and sustainable agricultural practices.

Question: What is the role of oscillations in the generation of waves?

Answer: Oscillations of particles or fields generate waves by creating periodic disturbances that propagate through a medium or space.

Question: How does genetic engineering contribute to sustainable agriculture?



Answer: Genetic engineering contributes to sustainable agriculture by creating crops that require fewer chemical inputs, such as pesticides and herbicides, and by developing plants that can withstand environmental stresses like drought and salinity.

Question: What are the benefits of using bio-based products?

Answer: Bio-based products are renewable, biodegradable, and environmentally friendly. They reduce dependency on fossil fuels, lower greenhouse gas emissions, and support sustainable development.

Question: How is the chemical formula of hydrochloric acid written?

Answer: The chemical formula of hydrochloric acid is HCl, indicating one hydrogen atom and one chlorine atom.

Question: How can you detect a magnetic field?

Answer: A magnetic field can be detected using a compass, which will align itself along the direction of the magnetic field.

Question: How does the speed of sound in steel compare to that in air?

Answer: The speed of sound in steel is much higher, about 5000 m/s, compared to 330 m/s in air.

Question: Conduct an experiment to demonstrate electromagnetic induction, including the setup, procedure, and observations.

Answer: To demonstrate electromagnetic induction, an experiment can be set up using a bar magnet, a coil of wire, and a galvanometer. Setup: Form a coil by winding a meter-length of copper wire around a thread reel. Connect the ends of the coil to a center-zero galvanometer. Procedure: Move the bar magnet towards the coil and observe the galvanometer. Move the bar magnet away from the coil and observe the galvanometer. Keep the bar magnet stationary near the coil and observe the galvanometer. Move the coil towards and away from the stationary magnet and observe the galvanometer. Vary the speed of the magnet's movement and observe the galvanometer's deflection. Observations: The galvanometer deflects when the magnet is moved towards or away from the coil, indicating a current is induced in the coil. No deflection occurs when the magnet and coil are stationary relative to each other. Faster movements of the magnet result in larger deflections on the galvanometer, indicating a greater induced emf. Conclusion: The experiment demonstrates that an emf is induced in a conductor when there is a relative motion between the conductor and the magnetic field. The magnitude of the induced emf is proportional to the rate of change of the magnetic flux.

Question: What is important to control hypertension?

Answer: Reduction of consumption of saturated fatty acids, avoiding smoking, alcohol, mental stress, and obesity are important to control hypertension.

Question: How do you express the composition of a solution in terms of moles/volume (n/v)?

Answer:  $n/v = \text{Amount of moles of solute} / \text{Volume of solution}$ .

Question: What is the atomic number of neon?

Answer: The atomic number of neon is 10.

Question: What is the potential energy of a 1 kg object at a height of 15 m?

Answer: The potential energy is 150 Joules (J).

Question: What are gymnosperms?

Answer: Gymnosperms are non-flowering seed plants with seeds that are not covered by a fruit.

Question: What is the role of carbon brushes in an alternating current dynamo?

Answer: Carbon brushes maintain contact with the rotating brushing rings, allowing current to flow to the external circuit without wearing out quickly.

Question: Describe the equilibrium of a rod resting on two supports.

Answer: The rod is in equilibrium because the weight of the rod is balanced by the perpendicular reaction forces exerted by the supports. The forces are coplanar and parallel, and their magnitudes add up to equal the weight of the rod.

Question: Define the biosphere.

Answer: The biosphere is the part of the Earth and its atmosphere that is inhabited by living things.

Question: What is the maximum number of electrons in the N shell?

Answer: The maximum number of electrons in the N shell is 32.

Question: How can the effect of a catalyst on a reaction be demonstrated experimentally?

Answer: By comparing the rate of gas evolution in reactions with and without the catalyst, the effect of the catalyst can be observed.

Question: What happens to the induced current when the coil in a dynamo is vertical?

Answer: When the coil is vertical, the induced current becomes zero as the conductors do not intersect the magnetic field lines.

Question: What are the effects of chronic dehydration on the kidneys?

Answer: Chronic dehydration can lead to kidney stones, urinary tract infections, and reduced kidney function over time.

Question: Explain the significance of cyclic voltammetry in studying redox reactions.

Answer: Cyclic voltammetry is significant in studying redox reactions as it provides information on the electrochemical behavior, reaction kinetics, and mechanisms of electroactive species by measuring current response to varying potential.

Question: What is seed dormancy?

Answer: Seed dormancy is a condition where seeds do not germinate even when the essential factors for germination are fulfilled. It is an adaptation for adverse environmental conditions.

Question: How does the body eliminate excess nitrogen through kidney function?

Answer: The kidneys filter and excrete nitrogenous waste products, primarily in the form of urea and uric acid, maintaining nitrogen balance.

Question: What are conductors?

Answer: Conductors are materials that allow a current of electrons to pass easily through them.

Question: What is the resultant force when two forces of 8 N and 16 N act on a trolley?

Answer: The resultant force is 24 N.

Question: What are the components of the cytoskeleton, and what are their functions?

Answer: The cytoskeleton consists of microtubules, intermediate filaments, and microfilaments, providing structural support, facilitating cell movement, and aiding in intracellular transport.

Question: What is the function of the nucleus in eukaryotic cells?

Answer: The nucleus houses the cell's genetic material (DNA) and controls cellular activities by regulating gene expression and facilitating DNA replication and transcription.

Question: What is the role of a Bourdon tube in pressure measurement?

Answer: A Bourdon tube measures pressure by deforming under pressure, with the deformation moving an indicator to show the pressure level.

Question: What is the function of the palisade cells in plant leaves?

Answer: Palisade cells in plant leaves contain chloroplasts and are primarily responsible for photosynthesis, converting light energy into chemical energy.

Question: What are the characteristics of parenchyma cells in the context of photosynthesis?

Answer: Parenchyma cells involved in photosynthesis contain chloroplasts with chlorophyll, allowing them to capture light energy and convert it into chemical energy.

Question: How does the electrolyte temperature affect the rate of electrochemical reactions?

Answer: The electrolyte temperature affects the rate of electrochemical reactions by influencing ion mobility and reaction kinetics. Higher temperatures generally increase reaction rates but may also accelerate side reactions and reduce electrolyte stability.

Question: What is the role of an operational amplifier (op-amp) in electronic circuits?

Answer: An operational amplifier (op-amp) amplifies the difference between two input voltages, providing high gain and stability for various analog signal processing applications.

Question: What are the two isotopes of chlorine?

Answer: The two isotopes of chlorine are Cl-35 and Cl-37.

Question: How is the Celsius scale defined?

Answer: The Celsius scale is defined by taking the temperature at which pure ice melts into liquid water under one atmosphere as 0°C and the temperature at which water vaporizes into steam as 100°C.

Question: How do fungi obtain nutrients?

Answer: Fungi obtain nutrients by decomposing organic matter, absorbing dissolved nutrients through their hyphae, and sometimes forming symbiotic relationships with other organisms.

Question: What is the valency of aluminium?

Answer: The valency of aluminium is 3.

Question: What is the composition of gastric juice, and what are its functions?

Answer: Gastric juice contains hydrochloric acid (HCl) and the enzyme pepsin, which together help digest proteins and activate digestive enzymes.

Question: What happens to a light ray entering a rare medium from a dense medium?

Answer: The light ray bends away from the normal.

Question: What are some examples of non-flowering seedless plants?

Answer: Examples of non-flowering seedless plants include Marchantia, Pogonatum, Selaginella, Nephrolepis, Salvinia, Acrosticum, and Drynaria.

Question: What are the three categories of frictional forces?

Answer: The three categories of frictional forces are static friction, limiting friction, and dynamic friction.

Question: What is the mitochondrion, and why is it called the power house of the cell?

Answer: The mitochondrion is a membrane-bound organelle where aerobic respiratory reactions release energy, making it the power house of the cell.

Question: What are the key characteristics of non-flowering seedless plants?

Answer: Non-flowering seedless plants can have a thalloid body or small fern type, are autotrophic and photosynthetic, and reproduce asexually by spores and vegetative fragmentation.

Question: How is energy produced during respiration?

Answer: Energy is produced through anaerobic and aerobic respiration, with part of it lost as heat and the rest stored in ATP as chemical energy.

Question: How do polar covalent bonds influence the solubility of molecules in water?

Answer: Polar covalent bonds influence the solubility of molecules in water by creating partial charges that interact with water molecules, allowing the substance to dissolve more readily.

Question: How does the concentration of hydrogen ions relate to pH?

Answer: The concentration of hydrogen ions inversely relates to pH, with higher H<sup>+</sup> concentrations resulting in lower pH values (more acidic).

Question: What is the significance of the color bands on a resistor?

Answer: The color bands on a resistor indicate its resistance value and tolerance using a standardized color code.

Question: What is an amalgam?

Answer: An amalgam is a special solution formed when metals are dissolved in mercury.

Question: What is the significance of Avogadro's constant in determining the number of particles in a mole?

Answer: Avogadro's constant provides the exact number of particles (atoms, molecules, or ions) in one mole of a substance, which is  $6.022 \times 10^{23}$ , allowing for precise calculations in chemical reactions.

Question: How do you calculate average speed for an object that traveled 18 meters in 6 seconds?

Answer: Average speed =  $18 \text{ m} / 6 \text{ s} = 3 \text{ m/s}$ .

Question: What is the balanced equation for the reaction between magnesium and oxygen?

Answer: The balanced equation for magnesium reacting with oxygen is:  $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$ , ensuring equal numbers of magnesium and oxygen atoms on both sides.

Question: Why is it important to measure the rate of reaction under different conditions?

Answer: Measuring the rate of reaction under different conditions helps understand the factors influencing reaction kinetics and optimize industrial processes.

Question: How is atmospheric pressure measured using a mercury barometer?

Answer: Atmospheric pressure is measured using a mercury barometer by the height of the mercury column in a glass tube. The height of the column represents the atmospheric pressure exerted on the mercury in the container.

Question: What are the effects of deforestation on the water cycle?

Answer: Deforestation reduces transpiration, alters rainfall patterns, and increases runoff and soil erosion. It disrupts the water cycle and affects water availability and quality.

Question: How did Mendel's experiments demonstrate the concept of dominant and recessive traits?

Answer: Mendel's experiments demonstrated that dominant traits mask recessive traits in the F1 generation, but recessive traits reappear in the F2 generation, showing the principles of dominance and recessiveness.

Question: What are the effects of habitat fragmentation on wildlife migration?

Answer: Habitat fragmentation restricts wildlife movement, reduces access to resources, and increases vulnerability to environmental changes. It disrupts migration patterns and affects species survival.

Question: How does the type of electrode material affect the performance of an electrochemical cell?

Answer: The type of electrode material affects the performance of an electrochemical cell by influencing reaction kinetics, conductivity, stability, and compatibility with the electrolyte. Optimal electrode materials ensure efficient and durable cell operation.

Question: What is the significance of heat changes in chemical reactions?

Answer: Heat changes provide insight into the energy dynamics of reactions, indicating whether energy is released or absorbed.

Question: What are monoecious plants?

Answer: Monoecious plants bear both staminate (male) and pistillate (female) flowers on the same plant, allowing for cross-pollination within the same plant.

Question: How does thermal expansion affect the design and construction of buildings and infrastructure?

Answer: Thermal expansion affects the design and construction of buildings and infrastructure by requiring allowances for expansion and contraction due to temperature changes, preventing structural damage and ensuring stability.

Question: What is the relative molecular mass of glucose (C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>)?

Answer: The relative molecular mass of glucose is 180, calculated as 6 x 12 for carbon, 12 x 1 for hydrogen, and 6 x 16 for oxygen.

Question: How are the kingdoms in the Domain Eukarya divided?

Answer: The kingdoms in the Domain Eukarya are divided into Protista, Fungi, Plantae, and Animalia.

Question: What occurs when potassium permanganate decomposes upon heating?

Answer: When potassium permanganate is heated, it decomposes into potassium manganate, manganese dioxide, and oxygen gas:  $2\text{KMnO}_4 \rightarrow \text{K}_2\text{MnO}_4 + \text{MnO}_2 + \text{O}_2$ .

Question: Describe the efficiency of different types of bulbs and their energy consumption, including a comparison of their lifetimes and advantages.

Answer: Efficiency and lifetime are critical factors in choosing electric bulbs for energy conservation and cost-effectiveness. The efficiency of a bulb is the ratio of the useful light output to the total electrical energy consumed, often expressed as a percentage. Types of Bulbs: Filament Bulbs: Power: 60 W Lifetime: 1200 hours Filament bulbs convert electrical energy into heat and light, but they are inefficient due to high heat production. Fluorescent Tubes: Power: 22 W Lifetime: 3000 hours These tubes are more

efficient than filament bulbs and have a longer lifespan, converting electrical energy primarily into light with less heat. CFL Bulbs (Compact Fluorescent Lights): Power: 11-13 W Lifetime: 8000 hours CFL bulbs are more efficient and have a significantly longer lifespan compared to traditional filament bulbs, providing better energy savings. LED Lights: Power: 6-8 W Lifetime: 50,000 hours LEDs are the most efficient and durable, converting almost all electrical energy into light with minimal heat loss. Despite the higher initial cost, their long lifespan and efficiency make them cost-effective in the long run. Comparison: LED bulbs are the most advantageous due to their high efficiency and long lifespan, though their initial cost is higher. Over time, the energy savings and reduced replacement frequency offset the initial expense.

Question: What is the potential energy of a 10 kg object at a height of 5 m?  
Answer: The potential energy is 500 Joules (J).

Question: How does photosynthesis contribute to the carbon cycle?  
Answer: Photosynthesis converts CO<sub>2</sub> into organic compounds, which are used by living organisms and eventually returned to the atmosphere through respiration and decomposition.

Question: What is the difference between direct current and alternating current?  
Answer: Direct current flows in a constant direction, while alternating current changes direction periodically.

Question: How is the chlorophyll extract applied to the paper strip in chromatography?  
Answer: Using a capillary tube, a small amount of chlorophyll extract is placed on the paper strip, which is then suspended in a solvent.

Question: What is the relationship between wavelength and frequency in the electromagnetic spectrum?  
Answer: Wavelength and frequency are inversely related; as frequency increases, wavelength decreases, and vice versa.

Question: How is the chemical formula of sodium chloride written?  
Answer: The chemical formula of sodium chloride is NaCl, indicating one sodium ion and one chloride ion.

Question: How does a thermistor measure temperature?  
Answer: A thermistor measures temperature by changing its resistance in response to temperature variations, allowing it to be used in temperature sensing and control applications.

Question: How does the stomach's peristaltic activity aid in digestion?  
Answer: Peristaltic activity in the stomach mixes and breaks down the food bolus, combining it with gastric juice to form chyme.

Question: What is the significance of genetic drift in small populations?  
Answer: Genetic drift is a random process that can lead to significant changes in allele frequencies in small populations, potentially reducing genetic diversity and increasing the risk of inbreeding and genetic

disorders.

Question: What are the characteristics of ionic compounds that make them suitable for use in electrical applications?

Answer: Ionic compounds are suitable for electrical applications because they conduct electricity in aqueous solutions and the fused state, and they have high melting and boiling points, making them stable under varying conditions.

Question: What experiment demonstrates the need for a medium for sound propagation?

Answer: The bell jar experiment, where the sound of an electric bell fades as air is removed, shows that sound cannot travel through a vacuum.

Question: What is the significance of the potential barrier in a p-n junction?

Answer: The potential barrier in a p-n junction prevents charge carriers from recombining and creates an electric field that opposes further charge carrier movement.

Question: What is the purpose of the galvanometer in demonstrating electromagnetic induction?

Answer: The galvanometer measures the induced current, indicating the presence and magnitude of electromagnetic induction in a circuit.

Question: Explain the concept of forward voltage in diodes.

Answer: Forward voltage is the minimum voltage required to overcome the potential barrier in a diode's p-n junction and allow current to flow in the forward direction.

Question: Describe the working principle of a phase-locked loop (PLL) in communication systems.

Answer: A PLL synchronizes an output signal's phase and frequency with a reference signal, providing stable frequency synthesis and signal demodulation in communication systems.

Question: What occurs when zinc reacts with copper sulfate solution?

Answer: Zinc displaces copper from copper sulfate, forming zinc sulfate and copper:  $\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$ .

Question: How do you measure the voltage drop across a resistor in a series circuit?

Answer: Use a voltmeter connected in parallel with the resistor to measure the voltage drop across it.

Question: What are organic compounds?

Answer: Organic compounds are compounds containing carbon and other elements like hydrogen, oxygen, nitrogen, halogen, phosphorus, and sulfur, excluding carbon oxides, carbonates, and bicarbonates.

Question: What are the conditions for equilibrium in an object under the action of three non-parallel coplanar forces?

Answer: The three forces must be coplanar, their lines of action must intersect at a common point, and the resultant of any two forces must be



equal in magnitude and opposite in direction to the third force.

Question: What is a light beam, and what are its types?

Answer: A light beam is a bundle of light rays, which can be parallel (parallel beam), convergent (rays meeting at a point), or divergent (rays spreading from a point).

Question: Describe the concept of energy conservation in a closed system.

Answer: In a closed system, energy conservation means that the total energy remains constant, with energy transforming between different forms but not being created or destroyed.

Question: What is acid rain?

Answer: Acid rain is precipitation that contains high levels of sulfuric and nitric acids, resulting from the emission of sulfur dioxide and nitrogen oxides into the atmosphere.

Question: What is the role of lenses in cameras?

Answer: Camera lenses adjust their curvature and position to focus light on the film or sensor, capturing clear images.

Question: What is the significance of the specific latent heat of fusion in everyday life?

Answer: The specific latent heat of fusion is significant in everyday life for processes like melting ice, where it explains the energy required to convert solid ice into liquid water without changing temperature.

Question: Where is cellulose found?

Answer: Cellulose is found in the cell wall of plant cells.

Question: Define speed.

Answer: Speed is the rate at which a given distance is traversed.

Question: How does mass influence the kinetic energy of a moving object?

Answer: Mass influences the kinetic energy of a moving object linearly; increasing the mass increases the kinetic energy proportionally.

Question: What is the effect of bioaccumulation on food webs?

Answer: Bioaccumulation can magnify the concentration of harmful substances at higher trophic levels, affecting predators and the overall health of the ecosystem.

Question: How does the reaction of zinc with copper sulfate demonstrate a single displacement reaction?

Answer: Zinc displaces copper from copper sulfate, forming zinc sulfate and copper:  $\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$ .

Question: How does paper chromatography work?

Answer: Paper chromatography separates components based on their different rates of movement through a paper strip due to varying attractions to the stationary phase (paper).

Question: Consider a situation where a child is walking 60 m from A to B along the straight line. Thereafter, if the child walks another 40 m along the same direction and reaches point C. What happens to the displacement if a child walks back 40 m after reaching point B?

Answer: The displacement becomes 20 m.

Question: What is the principle behind detecting fractures in airplane components using ultrasound waves?

Answer: High-frequency ultrasound waves do not penetrate air gaps, indicating potential fractures or structural issues in solid components.

Question: What are the applications of electrochemical sensors in environmental monitoring?

Answer: Electrochemical sensors in environmental monitoring detect pollutants like heavy metals, gases, and organic compounds, providing real-time data on air, water, and soil quality, essential for regulatory compliance and environmental protection.

Question: What is the biological component of the environment composed of?

Answer: The biological component of the environment is composed of all organisms, including plants, animals, and microorganisms.

Question: How do plants obtain carbon dioxide for photosynthesis?

Answer: Plants obtain carbon dioxide from the atmosphere, which diffuses into the leaf through the stomata and reaches the mesophyll cells via intercellular spaces.

Question: What is the significance of the lines of action of forces in maintaining equilibrium in a system of three parallel forces?

Answer: The lines of action of the three parallel forces must be aligned for equilibrium to be maintained. Forces that are not aligned will result in a net moment, causing the object to rotate or move.

Question: Why is it important to use a hot solvent in the initial step of recrystallization?

Answer: A hot solvent ensures complete dissolution of the solute, allowing for effective separation of impurities during filtration.

Question: What are the main components of the human digestive system ?

Answer: The main components include the buccal cavity, esophagus, diaphragm, salivary glands, epiglottis, stomach, liver, gall bladder, pancreas, small intestine, large intestine, appendix, caecum, rectum, and anus.

Question: What is the significance of the principal axis in ray diagrams for spherical mirrors?

Answer: The principal axis is the reference line for determining the paths of incident and reflected rays in ray diagrams.

Question: What are the deficiency symptoms of vitamin K?

Answer: Deficiency symptoms of vitamin K include delayed blood clotting.

Question: How is the chemical formula of phosphorus pentoxide represented?

Answer: The chemical formula of phosphorus pentoxide is  $P_2O_5$ , indicating two phosphorus atoms and five oxygen atoms.

Question: What is the international unit for measuring heat?

Answer: The international unit for measuring heat is the Joule (J).

Question: How does climate change impact the frequency and intensity of heatwaves?

Answer: Climate change increases the frequency and intensity of heatwaves, leading to higher temperatures, increased health risks, and greater demand for cooling. It affects human well-being and environmental stability.

Question: What is the role of the supporting metal frame in a loudspeaker?

Answer: The supporting metal frame holds the components in place, ensuring proper alignment and functionality of the loudspeaker.

Question: What are the main parts of the digestive system?

Answer: The mouth, esophagus, stomach, small intestine, large intestine, rectum, and anus.

Question: How is the production of quicklime from limestone an endothermic reaction?

Answer: The thermal decomposition of limestone absorbs heat:  $CaCO_3 (s) \rightarrow CaO (s) + CO_2 (g)$ .

Question: What are the main features of the Kingdom Plantae?

Answer: The Kingdom Plantae includes multicellular organisms known as plants, which have cell walls with cellulose, appear green due to chlorophyll, and reproduce sexually and asexually.

Question: What is the nucleus, and what are its functions?

Answer: The nucleus is the main organelle in a cell, surrounded by a nuclear envelope, containing nucleolus and chromatin. It stores genetic material and controls the life activities of the cell.

Question: How does the use of organic farming methods benefit soil health?

Answer: Organic farming methods enhance soil fertility, improve soil structure, and increase biodiversity. They reduce chemical inputs and support sustainable agricultural practices.

Question: What is the role of ultrasound waves in detecting fractures in airplane components?

Answer: High-frequency ultrasound waves can detect dangerous air gaps and fractures in solid components of airplanes by not penetrating air gaps, indicating potential structural issues.

Question: How does the rate of change of the magnetic field affect the induced voltage?

Answer: A faster rate of change of the magnetic field induces a higher voltage, as the induced electromotive force is directly proportional to the

rate of change.

Question: What is electromagnetic induction?

Answer: Electromagnetic induction is the generation of an electromotive force in a closed circuit due to a variable magnetic field.

Question: What are the differences between monocots and dicots in terms of flower structure?

Answer: Monocot flowers are trimerous (parts in threes), while dicot flowers are tetra- or pentamerous (parts in fours or fives).

Question: What is the role of a U-magnet in the study of electromagnetic induction?

Answer: A U-magnet provides a strong, uniform magnetic field used to demonstrate the force acting on a current-carrying conductor placed in a magnetic field.

Question: What method is used to examine the effect of acids on rusting?

Answer: Put an iron nail in each of three boiling tubes, add cold water to the first, water mixed with lime juice to the second, and water mixed with dilute hydrochloric acid to the third. Observe after one day.

Question: What is the difference between alkalis and other bases?

Answer: Alkalis are bases that readily dissolve in water.

Question: How is equilibrium maintained in an object under the action of two equal and opposite forces?

Answer: Equilibrium is maintained when the magnitudes of the two forces are equal and they act in opposite directions along the same line of action, resulting in no net force.

Question: How do you plot a graph of voltage (V) against current (I) for a nichrome wire coil?

Answer: Measure multiple sets of voltage and current values, plot voltage on the y-axis and current on the x-axis, and draw a straight line through the points. The slope of the line represents the resistance.

Question: Who invented the world's first thermometer and when?

Answer: Galileo Galilei invented the world's first thermometer around 1600 A.D.

Question: How do dolphins use ultrasound waves for communication?

Answer: Dolphins emit and receive ultrasound waves to communicate with each other, find prey, and avoid predators like sharks.

Question: How do you calculate the current flowing through a nichrome wire coil with a resistance of  $12\ \Omega$  and a potential difference of 6 V?

Answer: Using Ohm's Law,  $I = V/R$ , the current is  $I = 6\ \text{V} / 12\ \Omega = 0.5\ \text{A}$ .

Question: How can the strength of an acid or base be determined using pH papers?

Answer: By dipping pH paper in a solution and comparing the color change to a reference chart, the strength of the acid or base can be estimated.

Question: What is the boiling point of kerosene obtained from fractional distillation of crude oil?

Answer: Kerosene boils at 150-240°C.

Question: What is the menstrual cycle?

Answer: The menstrual cycle is a cyclic process associated with the reproductive systems of sexually matured females. It involves the development and release of ova and changes in the uterus, typically occurring over approximately 28 days.

Question: What are the industrial applications of electrolysis for producing chemicals?

Answer: Industrial applications include the production of chemicals like sodium hydroxide, chlorine, hydrogen, and oxygen through the electrolysis of various solutions, providing essential raw materials for numerous industries.

Question: How does the orientation of the coil affect the output of an alternating current dynamo?

Answer: The coil's orientation affects the output, with maximum voltage generated when the coil is perpendicular to the magnetic field lines.

Question: What is the significance of a constant ratio of voltage to current in a conductor?

Answer: A constant ratio of voltage to current indicates that the conductor follows Ohm's Law, with a fixed resistance at constant temperature.

Question: What is the relative molecular mass of glucose (C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>)?

Answer: The relative molecular mass of glucose is 180, calculated as 6 x 12 for carbon, 12 x 1 for hydrogen, and 6 x 16 for oxygen.

Question: What is the role of the plasma membrane in cells?

Answer: The plasma membrane regulates the movement of substances in and out of the cell, maintaining homeostasis and enabling communication with the external environment.

Question: What is an atomic lattice?

Answer: An atomic lattice is a structure where atoms are organized in a regular, repeating pattern and are covalently bonded.

Question: How does chemical digestion differ from mechanical digestion?

Answer: Chemical digestion involves breaking down complex molecules into simpler ones through enzymatic action, making them absorbable by the body.

Question: What does the periodic law imply about the properties of elements?

Answer: The periodic law implies that the properties of elements are periodic functions of their atomic number, meaning similar properties recur at regular intervals.

Question: What is the chemical formula for ammonium chloride?

Answer: The chemical formula for ammonium chloride is  $\text{NH}_4\text{Cl}$ .

Question: How does electrochemical impedance spectroscopy help in battery research?

Answer: Electrochemical impedance spectroscopy (EIS) helps in battery research by analyzing the impedance response of a battery over a range of frequencies, providing insights into charge transfer resistance, diffusion processes, and overall battery performance and degradation.

Question: What is the function of a slinky in demonstrating longitudinal waves?

Answer: A slinky can demonstrate longitudinal waves by creating compressions and rarefactions as it is pushed and pulled along its length.

Question: How do intermolecular forces affect the physical properties of covalent compounds?

Answer: Intermolecular forces affect the physical properties of covalent compounds by determining melting and boiling points, solubility, and states of matter at room temperature.

Question: What is the significance of Michael Faraday's experiments on electromagnetic induction?

Answer: Faraday's experiments established the principles of electromagnetic induction, leading to the development of electrical generators and transformers.

Question: What is latent heat?

Answer: Latent heat is the heat absorbed or released by a substance during a change of state without changing its temperature.

Question: What is the function of brushing rings in an alternating current dynamo?

Answer: Brushing rings connect the rotating coil to the external circuit, allowing current to flow continuously despite the coil's rotation.

Question: What occurs at the anode and cathode of an electrochemical cell?

Answer: At the anode, oxidation occurs where electrons are lost by a species. At the cathode, reduction occurs where electrons are gained by a species.

Question: Calculate the amount of oxygen in moles in 32 grams of oxygen ( $\text{O}_2$ )?

Answer: The amount of oxygen in 32 grams is 1 mole, calculated as  $32/32 = 1$  mole.

Question: What factors contribute to the high incidence of CKD among people who spray agrochemicals?

Answer: Factors contributing to the high incidence of CKD among people who spray agrochemicals include the absorption of toxic elements emitted by blue-green algae, heavy metals such as cadmium, lead, and arsenic, dehydration, and drinking water with fluoride.

Question: How does particle size affect the rate of reaction?

Answer: Smaller particle size increases the surface area, leading to more collision sites and a faster rate of reaction.

Question: What is the maximum number of electrons in the M shell?

Answer: The maximum number of electrons in the M shell is 18.

Question: How does the body regulate sleep-wake cycles?

Answer: The body regulates sleep-wake cycles through the circadian rhythm, influenced by light exposure, and regulated by the hypothalamus and melatonin secretion.

Question: What are the advantages of using lithium-ion batteries in portable electronics?

Answer: Lithium-ion batteries offer high energy density, long cycle life, low self-discharge, and lightweight properties, making them ideal for portable electronics like smartphones, laptops, and electric vehicles.

Question: How do different animals perceive sound frequencies differently?

Answer: Animals like elephants hear low frequencies (infra-sound), while bats and dolphins hear high frequencies (ultrasound), each adapted to their specific environmental needs.

Question: How do you plot a graph of voltage (V) against current (I) for a nichrome wire coil?

Answer: Measure multiple sets of voltage and current values, plot voltage on the y-axis and current on the x-axis, and draw a straight line through the points. The slope of the line represents the resistance.

Question: Explain the significance of cyclic voltammetry in studying redox reactions.

Answer: Cyclic voltammetry is significant in studying redox reactions as it provides information on the electrochemical behavior, reaction kinetics, and mechanisms of electroactive species by measuring current response to varying potential.

Question: What are the applications of electrochemical sensors in food quality testing?

Answer: Electrochemical sensors in food quality testing are used to detect contaminants, pesticides, pathogens, and nutrient levels, ensuring food safety and quality by providing rapid and accurate analysis.

Question: What is fertilization in humans?

Answer: Fertilization occurs when a sperm cell fuses with an ovum in the fallopian tube, resulting in the formation of a zygote that eventually develops into an embryo.

Question: Explain the electrolysis of fused sodium chloride using carbon electrodes, including the reactions at each electrode and the overall process.

Answer: The electrolysis of fused (molten) sodium chloride using carbon electrodes involves decomposing sodium chloride into its constituent elements by passing an electric current through the molten compound.

Setup: Materials Required: Fused sodium chloride, carbon electrodes, power supply. Method: Connect the carbon electrodes to the power supply. Immerse the electrodes in the molten sodium chloride. Procedure: Turn on the Power: Start the electrolysis by providing a direct current. Observe the Electrodes: Note the reactions occurring at each electrode. Reactions: At the Cathode (Negative Electrode): Reduction:  $\text{Na}^+(\text{l}) + \text{e}^- \rightarrow \text{Na}(\text{l})$  Sodium ions gain electrons and form liquid sodium metal. This is the cathodic reaction, as it involves the gain of electrons (reduction). At the Anode (Positive Electrode): Oxidation:  $2\text{Cl}^-(\text{l}) \rightarrow \text{Cl}_2(\text{g}) + 2\text{e}^-$  Chloride ions lose electrons and form chlorine gas. This is the anodic reaction, as it involves the loss of electrons (oxidation). Overall Reaction:  $2\text{NaCl}(\text{l}) \rightarrow 2\text{Na}(\text{l}) + \text{Cl}_2(\text{g})$  Process: Sodium chloride is melted to produce the fused (molten) state, allowing ions to move freely. Sodium ions migrate to the cathode, where they are reduced to sodium metal. Chloride ions migrate to the anode, where they are oxidized to chlorine gas. The process results in the formation of sodium metal at the cathode and chlorine gas at the anode. Applications: This process is used industrially in the Downs cell to extract sodium metal and chlorine gas. The principles of electrolysis enable the extraction and purification of various elements from their compounds.

Question: What is the significance of the overall electrolytic reaction for acidulated water?

Answer: The overall electrolytic reaction for acidulated water,  $2\text{H}_2\text{O}(\text{l}) \rightarrow 2\text{H}_2(\text{g}) + \text{O}_2(\text{g})$ , demonstrates the decomposition of water into hydrogen and oxygen gases.

Question: What are the environmental impacts of using fossil fuels for energy?

Answer: Fossil fuels contribute to greenhouse gas emissions, air and water pollution, habitat destruction, and climate change. Their extraction and use have significant negative effects on the environment.

Question: Describe the process of electrochemical machining.

Answer: Electrochemical machining (ECM) removes material from a workpiece using controlled anodic dissolution, where the workpiece is the anode and a tool is the cathode in an electrolyte solution. It is used for precise machining of hard-to-machine materials.

Question: How do you prepare a  $1 \text{ mol/dm}^3$  solution of urea?

Answer: Weigh the required mass of urea, dissolve it in water, and adjust the final volume in a volumetric flask.

Question: What is the role of a diaphragm or membrane in some electrolytic cells?

Answer: A diaphragm or membrane in electrolytic cells separates the anode and cathode compartments, preventing the mixing of products and allowing selective ion transport to improve cell efficiency and prevent unwanted side reactions.

Question: What is the resultant force when two forces of 8 N and 6 N act in opposite directions?

Answer: The resultant force is 2 N in the direction of the larger force (8 N).



Question: Explain the process of electrochemical polymerization and its applications.

Answer: Electrochemical polymerization involves the formation of conductive polymers on an electrode surface through the electrochemical oxidation or reduction of monomers. Applications include sensors, batteries, supercapacitors, and corrosion-resistant coatings.

Question: What is the role of oscillations in wave motion?

Answer: Oscillations of particles in a medium or field generate and propagate waves, transferring energy without transporting matter.

Question: What is the balanced ionic equation for the reaction between zinc and hydrogen ions?

Answer: The balanced ionic equation is  $\text{Zn(s)} + 2\text{H}^+(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{H}_2(\text{g})$ .

Question: How does the kidney's ability to filter blood change with age?

Answer: Kidney function naturally declines with age, reducing the glomerular filtration rate (GFR) and increasing the risk of kidney disease.

Question: How does the kidney's ability to concentrate urine protect against dehydration?

Answer: The kidneys concentrate urine by reabsorbing water, reducing urine volume, and conserving water in the body during dehydration.

Question: How do you investigate the effect of perpendicular distance on the moment of force using a stick and Newton balance?

Answer: Investigate the effect by attaching a loop and Newton balance to different points on the stick, applying a constant force, and measuring the distance required to initiate rotation.

Question: What are heavy metals, and how are they introduced into the environment?

Answer: Heavy metals are metals with high density and higher relative molecular mass. They are introduced into the environment through industrial wastes, zinc mines, electroplating, and the excessive use of agrochemicals.

Question: Describe the equilibrium of a rod resting on two supports.

Answer: The rod is in equilibrium because the weight of the rod is balanced by the perpendicular reaction forces exerted by the supports. The forces are coplanar and parallel, and their magnitudes add up to equal the weight of the rod.

Question: How do geneticists study the genetic basis of diseases?

Answer: Geneticists study the genetic basis of diseases by identifying genetic variants associated with disease risk, analyzing family pedigrees, conducting functional studies on disease-related genes, and using model organisms to understand disease mechanisms.

Question: How is the chemical formula of sodium hydroxide written?

Answer: The chemical formula of sodium hydroxide is NaOH, indicating one sodium ion and one hydroxide ion.

Question: What is the relationship between dominant and recessive alleles?  
Answer: Dominant alleles determine the trait expressed when present, while recessive alleles are expressed only when both alleles are recessive.

Question: Explain the principle of operation of an electric fuse.  
Answer: An electric fuse operates by melting its internal wire when the current exceeds a safe level, breaking the circuit and preventing damage to electrical components.

Question: How is the resultant force of two parallel forces acting in the same direction found?  
Answer: The resultant force is found by adding the magnitudes of the two forces.

Question: Why might a table not move when a very small force is applied?  
Answer: A table might not move when a very small force is applied because the floor exerts an equal and opposite frictional force, cancelling out the applied force.

Question: How is the chemical formula of nitrogen dioxide written?  
Answer: The chemical formula of nitrogen dioxide is  $\text{NO}_2$ , indicating one nitrogen atom and two oxygen atoms.

Question: What is the potential energy of a 5 kg object at a height of 6 m?  
Answer: The potential energy is 300 Joules (J).

Question: What is the role of the culture medium in tissue culture?  
Answer: The culture medium provides essential nutrients, including sucrose, mineral salts, vitamins, and growth substances, and is solidified with agar.

Question: How does the velocity of an object affect its kinetic energy?  
Answer: The velocity of an object affects its kinetic energy quadratically; doubling the velocity quadruples the kinetic energy.

Question: What is the definition of work in physics?  
Answer: Work in physics is defined as the energy transferred when an object is moved over a distance by an external force applied in the direction of the movement.

Question: How do platelets contribute to blood clotting?  
Answer: Platelets release chemicals that activate clotting factors, forming a fibrin mesh that seals wounds and prevents excessive bleeding.

Question: What is the role of white and green areas in mosaic leaves during the chlorophyll experiment?  
Answer: Green areas contain chlorophyll and show starch production, while white areas lack chlorophyll and show no starch production.

Question: What is the significance of the lines of action of forces in maintaining equilibrium in a system of three parallel forces?  
Answer: The lines of action of the three parallel forces must be aligned for equilibrium to be maintained. Forces that are not aligned will result in a net

moment, causing the object to rotate or move.

Question: What is the role of carbon brushes in an alternating current dynamo?

Answer: Carbon brushes maintain contact with the rotating brushing rings, allowing current to flow to the external circuit without wearing out quickly.

Question: How is the chyme formed in the stomach?

Answer: Chyme is formed by the mixing and breaking down of food with gastric juice, resulting in a semi-liquid mixture that moves to the small intestine.

Question: How does the strength of the magnetic field affect the performance of a dynamo?

Answer: A stronger magnetic field increases the induced electromotive force, improving the dynamo's performance and electricity generation.

Question: How do epithelial tissues participate in filtration?

Answer: Epithelial tissues in structures like the kidneys filter blood, removing waste products and excess substances to form urine.

Question: What is the trend in electronegativity across Period 3?

Answer: The trend in electronegativity across Period 3 is an increase from left to right.

Question: What is the potential difference across a bulb connected to a 3 V power supply with a resistance of  $6\ \Omega$ ?

Answer: The potential difference is 3 V, assuming the power supply voltage is the same as the voltage across the bulb.

Question: What is a lethal dose (LD<sub>50</sub>)?

Answer: A lethal dose (LD<sub>50</sub>) is the dose of a pesticide required to kill 50% of a population of a particular pest species.

Question: What is parthenocarpy?

Answer: Parthenocarpy is the development of fruits without fertilization, resulting in seedless fruits. Artificial growth substances can induce parthenocarpy.

Question: How does Newton's second law apply to lifting a heavy object?

Answer: When lifting a heavy object, the force applied by the muscles determines the acceleration of the object. The mass of the object and the applied force determine the object's motion according to Newton's second law.

Question: Materials required : - A small beaker, a solution of citric acid, a solution of sodium bicarbonate  
Method : - Add about 10 cm<sup>3</sup> of the citric acid solution to a small beaker and record its temperature. Record the temperature of the sodium bicarbonate solution also. Add about 10 cm<sup>3</sup> of the sodium bicarbonate solution to the beaker containing citric acid, stir and note the temperature. State your observations. What materials are required for the Activity?

Answer: A small beaker, a solution of citric acid, and a solution of sodium bicarbonate.

Question: What are the essential factors for seed germination?

Answer: The essential factors for seed germination are seed viability, air (oxygen), water or moisture, and optimum temperature.

Question: Explain the concept of limiting friction.

Answer: Limiting friction is the maximum frictional force that can be exerted by a surface just before an object starts moving, determining the threshold for initiating motion.

Question: What is the primary energy source for all ecosystems in the biosphere?

Answer: The primary energy source for all ecosystems in the biosphere is the sun.

Question: What is the role of environmental policies in mitigating climate change?

Answer: Environmental policies play a role in mitigating climate change by regulating greenhouse gas emissions, promoting renewable energy, encouraging energy efficiency, and supporting conservation efforts.

Question: What is the acceleration of a car that goes from 0 to 60 km/h in 5 seconds?

Answer: The acceleration is 12 km/h/s.

Question: What is the role of genetic counseling in prenatal testing?

Answer: Genetic counseling provides information and support to expectant parents undergoing prenatal testing, helping them understand the risks, benefits, and implications of the tests, and guiding them in making informed decisions about their pregnancy.

Question: What is the significance of valence electrons in determining the chemical properties of elements?

Answer: Valence electrons determine the chemical properties of elements as they participate in chemical reactions.

Question: What is the balanced chemical equation for the reaction between magnesium and oxygen?

Answer: The balanced chemical equation for magnesium reacting with oxygen is:  $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$ .

Question: How is the chemical formula of hydrochloric acid written?

Answer: The chemical formula of hydrochloric acid is HCl, indicating one hydrogen atom and one chlorine atom.

Question: How is the chemical formula of phosphorus pentoxide written?

Answer: The chemical formula of phosphorus pentoxide is  $\text{P}_2\text{O}_5$ , indicating two phosphorus atoms and five oxygen atoms.

Question: How do you calculate the potential difference across a bulb with a current of 1.5 A and a resistance of 6  $\Omega$ ?

Answer: Using Ohm's Law,  $V = IR$ , the potential difference is  $V = 1.5 \text{ A} \times 6 \Omega = 9 \text{ V}$ .

Question: What is eutrophication, and what causes it?

Answer: Eutrophication is the excessive growth of algae in water bodies due to increased concentrations of phosphates and nitrates from industrial waste, agrochemicals, faecal matter, and detergents.

Question: What is the Paris Agreement, and what is its goal?

Answer: The Paris Agreement is an international treaty aimed at limiting global warming to well below  $2^{\circ}\text{C}$  above pre-industrial levels and pursuing efforts to limit it to  $1.5^{\circ}\text{C}$ .

Question: What is the effect of insulation removal on a simple DC motor?

Answer: Removing insulation on one side of the coil prevents current flow during half of the cycle, ensuring unidirectional rotation and consistent performance.

Question: What is frequency in wave motion?

Answer: Frequency is the number of oscillations per unit time, measured in Hertz (Hz).

Question: Describe the working principle of an electric bell.

Answer: An electric bell operates by using an electromagnet to attract a metal armature, striking a bell and breaking the circuit, which resets the armature, repeating the process to produce sound.

Question: How do dentists use concave mirrors?

Answer: Dentists use concave mirrors to view enlarged images of teeth, making it easier to see details inside the mouth.

Question: How do sound waves propagate through liquids?

Answer: Sound waves propagate through liquids by causing particles in the liquid to vibrate and transfer energy through the medium.

Question: How does the direction of current affect the direction of the magnetic field?

Answer: The direction of the magnetic field around a current-carrying conductor is determined by the direction of the current flow, as illustrated by the right-hand grip rule.

Question: What is the structure and function of the nephron?

Answer: The nephron is the structural and functional unit of the kidney, responsible for filtering blood and forming urine. It includes parts like Bowman's capsule, glomerulus, proximal and distal convoluted tubules, and the loop of Henle.

Question: What are the features of sclerenchyma fibers?

Answer: Sclerenchyma fibers are long, narrow, and dead cells with lignified walls, providing mechanical strength to the plant.

Question: Why is it important to follow safety measures when using electric appliances?

Answer: Following safety measures prevents electric shocks, fires, and other accidents, ensuring the safe and efficient operation of electric appliances.

Question: Why is it important to measure the rate of reaction in different conditions?

Answer: Measuring the rate of reaction under different conditions helps understand the factors influencing reaction kinetics and optimize industrial processes.

Question: What is the molar mass of calcium carbonate ( $\text{CaCO}_3$ )?

Answer: The molar mass of calcium carbonate is 100 grams per mole, calculated as 40 for calcium, 12 for carbon, and  $3 \times 16$  for oxygen.

Question: What is the magnitude and direction of the resultant force if two collinear forces of 10 N and 6 N act in opposite directions?

Answer: The magnitude of the resultant force is 4 N in the direction of the 10 N force.

Question: What is the unit of speed?

Answer: The unit of speed is meters per second (m/s).

Question: How does Newton's third law apply to rowing a boat?

Answer: When rowing a boat, the oars push water backward (action), and the water pushes the boat forward (reaction), causing the boat to move forward.

Question: How does the electrolysis of water demonstrate the decomposition of water molecules?

Answer: The electrolysis of water decomposes water molecules into hydrogen and oxygen gases, illustrating the breakdown of water into its constituent elements through an electrochemical process.

Question: What causes appendicitis, and what are its symptoms?

Answer: Appendicitis is caused by infection and swelling of the appendix, leading to symptoms such as abdominal pain, fever, and digestive disturbances.

Question: What are the effects of acid rain on aquatic ecosystems?

Answer: The effects of acid rain on aquatic ecosystems include increased water acidity, harm to aquatic organisms, disruption of reproductive processes, and loss of biodiversity.

Question: How do geneticists use twin studies to understand the heritability of traits?

Answer: Geneticists use twin studies to compare the similarities and differences between monozygotic (identical) and dizygotic (fraternal) twins, helping to estimate the genetic and environmental contributions to the heritability of traits.

Question: What are the potential health risks of chronic kidney disease (CKD)?

Answer: CKD can lead to cardiovascular disease, anemia, bone disease, electrolyte imbalances, and increased risk of infections.

Question: What is the significance of Michael Faraday's experiments on electromagnetic induction?

Answer: Faraday's experiments established the principles of electromagnetic induction, leading to the development of electrical generators and transformers.

Question: What are the benefits of using electrochemical methods for wastewater treatment?

Answer: Electrochemical methods for wastewater treatment offer benefits like high efficiency, ability to treat a wide range of contaminants, low chemical usage, and the potential for on-site treatment, reducing the environmental impact and operational costs.

Question: What are the advantages of using fuel cells over traditional combustion engines?

Answer: Fuel cells offer higher efficiency, lower emissions, and quieter operation compared to traditional combustion engines. They produce only water as a byproduct, making them environmentally friendly.

Question: What is the significance of the lattice structure in ionic compounds?

Answer: The lattice structure in ionic compounds provides stability, high melting and boiling points, and electrical conductivity in the molten and aqueous states due to the strong electrostatic forces between ions.

Question: What are the main features of the Kingdom Protista?

Answer: The Kingdom Protista includes eukaryotic organisms that can be unicellular or multicellular without specialized tissues and live in water-associated environments.

Question: What are natural polymers, and give examples?

Answer: Natural polymers are polymers found in nature, such as proteins, starch, cellulose, and DNA.

Question: Describe the experiment to show that O<sub>2</sub> is produced during photosynthesis.

Answer: Place an aquatic plant in a funnel in water, invert a boiling tube over the funnel, expose to sunlight, collect the gas released, and test with a glowing splinter. The splinter reignites, confirming oxygen production.

Question: Describe the operation of a thermocouple in temperature measurement.

Answer: A thermocouple generates a voltage proportional to the temperature difference between its two junctions, providing accurate temperature measurement for various applications.

Question: How do you prepare a solution with a concentration of 1 mol/dm<sup>3</sup>?

Answer: Weigh the required mass of solute, dissolve it in water, and adjust the final volume to the desired level.

Question: Why is it important to stir the mixture in heat change experiments?

Answer: To ensure uniform temperature distribution throughout the mixture.

Question: What is concentration in terms of mole-volume ratio?

Answer: Concentration ( $n/V$ ) is the amount of moles of solute per cubic decimeter of solution, expressed in  $\text{mol/dm}^3$ .

Question: What are the main features of the Domain Archaea?

Answer: The Domain Archaea includes prokaryotes that can live in extreme environments and are not sensitive to most antibiotics.

Question: Why do ionic compounds conduct electricity in aqueous solutions but not in solid state?

Answer: Ionic compounds conduct electricity in aqueous solutions because the ions are free to move and carry an electric charge, whereas in the solid state, the ions are fixed in place within the lattice structure and cannot move.

Question: How do ultrasound waves help in detecting dangerous air gaps in solid components?

Answer: High-frequency ultrasound waves detect air gaps and fractures in solid components by not penetrating through the gaps, indicating potential issues.

Question: What is the focal length of a spherical mirror?

Answer: The focal length is the distance between the pole and the focal point, while the radius of curvature is twice the focal length.

Question: What is the speed of electromagnetic waves in a vacuum?

Answer: The speed of electromagnetic waves in a vacuum is approximately  $3 \times 10^8 \text{ m/s}$ .

Question: How does friction cause a loss of energy in machines?

Answer: Friction causes a loss of energy in machines by converting some of the mechanical work into heat, which raises the temperature of the object.

Question: How does a nichrome wire coil behave when connected to a power supply?

Answer: A nichrome wire coil exhibits resistance and allows current to flow through it when connected to a power supply, producing heat.

Question: How does changing the battery terminals affect the direction of current in a conductor?

Answer: Changing the battery terminals reverses the current direction, altering the magnetic field and force direction on the conductor.

Question: How does habitat fragmentation affect biodiversity?

Answer: Habitat fragmentation isolates populations, reduces genetic diversity, limits species' ability to move and find resources, and increases vulnerability to environmental changes and human activities.



Question: How does double blood circulation work in humans?

Answer: Double circulation involves two circuits: pulmonary circulation, where blood flows through the lungs, and systemic circulation, where blood flows through other organs. Blood passes through the heart twice in one complete cycle.

Question: What are the standards of binomial nomenclature?

Answer: The standards include using Latin or Greek for names, capitalizing the first letter of the generic name, underlining handwritten names, and italicizing printed names.

Question: How do plants respond to light?

Answer: Plants respond to light through growth movements such as phototropism, where the shoot tip grows towards the light source.

Question: What are the main functions of epithelial tissues in the body?

Answer: Epithelial tissues protect surfaces, absorb nutrients, detect sensory stimuli, secrete substances, and filter fluids.

Question: How are components with lower boiling points separated in a fractionating tower?

Answer: They are separated at the upper levels of the tower, where the temperature is lower.

Question: How does the use of sustainable agricultural practices benefit the environment?

Answer: Sustainable agricultural practices enhance soil health, reduce chemical inputs, promote biodiversity, and support long-term productivity. They contribute to environmental sustainability and food security.

Question: Where can cartilage tissue be found in the body?

Answer: Cartilage tissue is found in joints, the rib cage, ear, nose, bronchial tubes, and intervertebral discs.

Question: How do noble gases achieve a stable electronic configuration?

Answer: Noble gases achieve a stable electronic configuration by having a full valence shell, typically with eight electrons, making them chemically inert.

Question: What is the significance of water in living organisms?

Answer: Water is essential for maintaining living matter, providing a medium for biochemical reactions, transportation of nutrients, removal of waste, and regulating body temperature.

Question: What is the effect of temperature on the speed of sound?

Answer: As temperature increases, the speed of sound also increases due to faster movement of particles in the medium.

Question: Explain the significance of the nuclear envelope in protecting genetic material.

Answer: The nuclear envelope protects genetic material by separating the nucleus from the cytoplasm, regulating the exchange of materials, and

maintaining the integrity of DNA.

Question: How is rooting of stem cuttings done?

Answer: Rooting of stem cuttings involves planting twigs from a healthy plant that do not bear tender leaves, flowers, or fruits. This method is used for plants like rose, shoe flowers, ixora, bougainvillea, and croton.

Question: What is the trend in reactivity of Group VII elements?

Answer: The reactivity of Group VII elements decreases down the group.

Question: Explain the significance of cyclic voltammetry in studying redox reactions.

Answer: Cyclic voltammetry is significant in studying redox reactions as it provides information on the electrochemical behavior, reaction kinetics, and mechanisms of electroactive species by measuring current response to varying potential.

Question: How does thermal expansion affect the design of bridges and buildings?

Answer: Thermal expansion affects the design of bridges and buildings by requiring expansion joints to accommodate changes in length due to temperature variations, preventing structural damage and ensuring stability.

Question: What is the resultant force if two forces of 10 N and 6 N act in the same direction?

Answer: The resultant force is 16 N in the same direction.

Question: Describe the construction and working of a zinc-carbon dry cell.

Answer: A zinc-carbon dry cell consists of a zinc anode, a carbon rod cathode surrounded by a manganese dioxide and carbon powder mixture, and an electrolyte paste of ammonium chloride. The zinc anode undergoes oxidation, and manganese dioxide is reduced, generating electrical energy.

Question: What is classification in the context of organisms?

Answer: Classification is the grouping of organisms into different levels based on their common characteristics.

Question: What is the principle behind the operation of a hydraulic press?

Answer: The principle behind a hydraulic press is that pressure applied to a confined fluid is transmitted undiminished in all directions, allowing a small force applied to a small piston to generate a larger force on a larger piston.

Question: How does the release of nitrogen oxides (NO<sub>x</sub>) contribute to the formation of ground-level ozone?

Answer: The release of nitrogen oxides (NO<sub>x</sub>) contributes to the formation of ground-level ozone by reacting with volatile organic compounds (VOCs) in the presence of sunlight, forming ozone and other pollutants.

Question: Discuss the causes and consequences of acid rain.

Answer: Acid rain is precipitation that has been made acidic by pollutants in the atmosphere, particularly sulfur dioxide (SO<sub>2</sub>) and nitrogen oxides (NO<sub>x</sub>). These pollutants react with water vapor in the atmosphere to form

sulfuric and nitric acids, which then fall to the ground as rain, snow, or fog. Causes of Acid Rain: Combustion of Fossil Fuels: Burning coal and oil in power plants, factories, and vehicles releases large amounts of SO<sub>2</sub> and NO<sub>x</sub> into the atmosphere. Industrial Processes: Certain industrial processes, such as smelting of metal ores and refining of oil, also release significant amounts of SO<sub>2</sub> and NO<sub>x</sub>. Natural Sources: Volcanic eruptions and wildfires can release sulfur dioxide and nitrogen oxides, though human activities are the primary contributors. Consequences of Acid Rain: Damage to Forests: Acid rain leaches essential nutrients from the soil, harming trees and plants. It can also damage the leaves and bark, making them more susceptible to disease and harsh weather. Aquatic Ecosystems: Acid rain lowers the pH of water bodies, making them more acidic. This can harm or kill aquatic life, including fish, insects, and amphibians, and disrupt the entire aquatic food web. Soil Degradation: Acid rain can alter soil chemistry by depleting important minerals and increasing toxic metals like aluminum, which can be harmful to plants. Built Environment: Acid rain corrodes buildings, monuments, and infrastructure, particularly those made of limestone and marble. This can lead to significant economic costs for repair and maintenance. Human Health: Although acid rain itself does not pose a direct health risk, the pollutants that cause it (SO<sub>2</sub> and NO<sub>x</sub>) can lead to respiratory problems, such as asthma and bronchitis, especially in vulnerable populations.

Question: What are some uses of sulphur?

Answer: Sulphur is used to produce sulphuric acid, vulcanize rubber, make calcium and magnesium sulphites for bleaching wood pulp, produce paints containing sulphides, solvents like carbon disulphide, sulphur dioxide gas, matches, crackers, gunpowder, and as a fungicide. It is also used in wine and beer production and in medicines.

Question: What is the role of chlorophyll in capturing light energy?

Answer: Chlorophyll absorbs light energy, particularly red and blue wavelengths, and converts it into chemical energy used in photosynthesis.

Question: What does electronic configuration represent?

Answer: Electronic configuration represents how electrons are filled in the respective energy levels from the one nearest to the nucleus of an atom and outwards.

Question: What is the speed of light compared to the speed of sound?

Answer: The speed of light is approximately 300,000 km/s ( $3 \times 10^8$  m/s), much faster than the speed of sound at 330 m/s.

Question: What is conservation biology?

Answer: Conservation biology is the scientific study of the preservation, protection, and restoration of biodiversity and natural habitats.

Question: What are the features of invertebrates in the phylum Annelida?

Answer: Invertebrates in the phylum Annelida are triploblastic, have segmented bodies, bilateral symmetry, a coelom, and reproduce both asexually and sexually.

Question: What is the function of brushing rings in an alternating current dynamo?

Answer: Brushing rings connect the rotating coil to the external circuit, allowing current to flow continuously despite the coil's rotation.

Question: How is the relative activity of metals used to predict the outcome of electrolysis?

Answer: The activity series helps determine which ions will be reduced or oxidized based on their reactivity.

Question: What are luminous objects, and can you provide an example?

Answer: Luminous objects emit light, such as a candle flame or a light bulb, making them visible to our eyes.

Question: What are the products of a neutralization reaction between an acid and a base?

Answer: The products are a salt and water.

Question: How do geneticists study the genetic basis of behavior?

Answer: Geneticists study the genetic basis of behavior by analyzing genetic differences between individuals, using animal models, and conducting twin and family studies to understand the heritability of behaviors.

Question: What are the potential risks of gene editing in humans?

Answer: Potential risks of gene editing in humans include off-target effects, unintended genetic changes, ethical concerns about germline editing, and the possibility of creating genetic inequalities.

Question: How can lifestyle changes help prevent atherosclerosis?

Answer: Controlling food intake with low saturated fats, regular exercise, and maintaining a healthy diet can help reduce the risk of atherosclerosis.

Question: How does an alkaline battery work, and what are its advantages?

Answer: An alkaline battery uses zinc as the anode, manganese dioxide as the cathode, and an alkaline electrolyte (potassium hydroxide). It offers higher energy density, longer shelf life, and better performance at low temperatures compared to zinc-carbon batteries.

Question: How is gravel removed from sand?

Answer: By sieving, which utilizes the difference in the size of component particles.

Question: What is the equation used to find the concentration of a solution when  $n$  moles of solute are dissolved in a volume  $V$ ?

Answer: The equation is  $C = n/V$ , where  $C$  is concentration in  $\text{mol/dm}^3$ ,  $n$  is the number of moles, and  $V$  is the volume in cubic decimeters.

Question: What is the significance of the Pauling scale in measuring electronegativity?

Answer: The Pauling scale provides a numerical representation of an element's ability to attract electrons, allowing comparison between different elements.

Question: What is the effect of connecting resistors in series on the total resistance of the circuit?

Answer: Connecting resistors in series increases the total resistance, as the total resistance is the sum of the individual resistances.

Question: How do human activities contribute to the release of CO<sub>2</sub> into the environment?

Answer: Human activities contribute to the release of CO<sub>2</sub> through the excessive combustion of fossil fuels.

Question: How is a water molecule (H<sub>2</sub>O) formed through covalent bonding?

Answer: A water molecule (H<sub>2</sub>O) is formed when an oxygen atom shares two pairs of electrons with two hydrogen atoms, resulting in covalent bonds and a stable electronic configuration for each atom.

Question: How does the latent heat of vaporization affect the cooling effect of sweating?

Answer: The latent heat of vaporization allows sweat to absorb a large amount of heat from the body as it evaporates, providing a cooling effect and helping to regulate body temperature.

Question: How do ultrasound waves assist in medical diagnostics for heart conditions?

Answer: Ultrasound waves are used to visualize the heart's internal structures, measure blood flow, and assess the heart's size and function.

Question: Why is movement important for living organisms?

Answer: Movement is essential for living organisms to fulfill their requirements such as food, protection, and reproduction. It also helps them respond to stimuli.

Question: How does the specific latent heat of fusion relate to the phase change of a substance?

Answer: The specific latent heat of fusion relates to the phase change of a substance by quantifying the amount of heat required to convert a solid into a liquid at its melting point without changing its temperature.

Question: What are the features of invertebrates in the phylum Cnidaria?

Answer: Invertebrates in the phylum Cnidaria are aquatic, mostly marine, diploblastic with a coelenteron, have radial symmetry, and are predators with nematocysts.

Question: How does a capacitor store electrical energy?

Answer: A capacitor stores electrical energy by accumulating charge on its plates when a voltage is applied, creating an electric field between the plates.

Question: What is the principle of thermal equilibrium?

Answer: Thermal equilibrium is the state when two objects in contact reach the same temperature, resulting in no net heat transfer between them.

Question: What is thermal expansion?

Answer: Thermal expansion is the increase in the dimensions (length, area, or volume) of a substance when its temperature increases. Conversely, contraction is the decrease in dimensions when the temperature decreases.

Question: What are the two ways of grafting?

Answer: The two ways of grafting are bud grafting and twig grafting.

Question: How does the process of biomagnification affect ecosystems, and what are its consequences?

Answer: Biomagnification is the process by which the concentration of toxic substances increases at each successive trophic level in a food chain. These substances, often persistent organic pollutants (POPs) like DDT, PCBs, and heavy metals, are absorbed by organisms at the base of the food chain and become more concentrated as they move up the chain. Process of Biomagnification: Absorption by Primary Producers: Toxic substances enter the ecosystem through soil, water, or air and are absorbed by plants and microorganisms. Consumption by Herbivores: Herbivores eat the contaminated plants, accumulating higher concentrations of the toxins in their bodies. Predation by Carnivores: Carnivores eat herbivores, and the toxins become even more concentrated in the bodies of these predators. Top predators, like birds of prey or large fish, can have toxin levels millions of times higher than those in the environment. Consequences of Biomagnification: Health Effects on Wildlife: High toxin levels can cause reproductive failures, developmental abnormalities, and increased mortality rates in wildlife. For example, DDT led to eggshell thinning in birds of prey, resulting in significant population declines. Ecosystem Disruption: Predatory species often serve as keystone species, playing a crucial role in maintaining the structure of their ecosystems. Biomagnification-induced declines can lead to imbalances and loss of biodiversity. Human Health Risks: Humans are also affected by biomagnification, particularly those who consume a lot of fish or other animals at the top of the food chain. This can lead to health issues such as cancer, neurological disorders, and reproductive problems. Efforts to mitigate biomagnification involve reducing the use of persistent toxic substances, implementing stringent regulations on pollutant emissions, and promoting sustainable agricultural and industrial practices.

Question: What are essential amino acids?

Answer: Essential amino acids are those that cannot be synthesized within the body and must be obtained from food.

Question: What is the efficiency of an electric appliance?

Answer: The efficiency of an electric appliance is the ratio of the useful energy output to the total energy input, expressed as a percentage.

Question: Describe the physical properties of boron.

Answer: Pure boron is a black crystalline solid with a melting point of  $2200^{\circ}\text{C}$  and a density of  $3300\text{ kg/m}^3$ . It has low reactivity, not reacting even at high temperatures in air.

Question: How does the expansion of liquids demonstrate thermal expansion principles?

Answer: The expansion of liquids demonstrates thermal expansion principles by showing how liquid volume increases with temperature, as seen in experiments with colored water and test tubes.

Question: How are transparent objects characterized?

Answer: Transparent objects allow light to pass through them completely, making objects on the other side clearly visible. Examples include glass and polythene.

Question: Describe the process of electrochemical water splitting and its significance.

Answer: Electrochemical water splitting involves the use of electricity to split water into hydrogen and oxygen gases. It is significant for producing clean hydrogen fuel and oxygen, providing a sustainable energy solution and reducing dependence on fossil fuels.

Question: Describe the reaction between aluminum and hydrochloric acid.

Answer: Aluminum reacts with hydrochloric acid to form aluminum chloride and hydrogen gas:  $2\text{Al} + 6\text{HCl} \rightarrow 2\text{AlCl}_3 + 3\text{H}_2$ .

Question: What are some harmful effects of fungi?

Answer: Harmful effects of fungi include causing diseases in plants and animals and spoiling food.

Question: How do you calculate the mass fraction of a solute in a mixture?

Answer: Mass fraction = Mass of solute / Total mass of the mixture.

Question: How does temperature affect atmospheric pressure?

Answer: Temperature affects atmospheric pressure by changing the density of air. Warm air is less dense and exerts less pressure, while cold air is denser and exerts more pressure.

Question: What is the function of interneurons?

Answer: Interneurons connect sensory neurons to motor neurons within the central nervous system, facilitating communication and reflexes.

Question: How does the resistance of a conductor depend on its length?

Answer: The resistance of a conductor is directly proportional to its length; a longer conductor has higher resistance.

Question: What is the relationship between dominant and recessive alleles?

Answer: Dominant alleles determine the trait expressed when present, while recessive alleles are expressed only when both alleles are recessive.

Question: What is the role of a galvanometer in demonstrating electromagnetic induction?

Answer: A galvanometer measures the induced current in a circuit, indicating the presence and magnitude of electromagnetic induction.

Question: Calculate the power required to lift a 6 kg object to a height of 2 m in 10 seconds.

Answer: The power required is 12 Watts (W).

Question: What are some common examples of inherited traits in humans?

Answer: Common examples include eye color, hair type, skin color, earlobe attachment, and the ability to roll the tongue.

Question: What are the two types of nucleic acids?

Answer: The two types of nucleic acids are DNA and RNA.

Question: What is the current passing through a  $10\ \Omega$  resistor connected in series with a 24 V power supply?

Answer: The current is  $I = V/R = 24\text{ V}/10\ \Omega = 2.4\text{ A}$ .

Question: How does the efficiency of electric appliances impact energy consumption?

Answer: Efficient electric appliances convert more of the supplied energy into useful work, reducing overall energy consumption and lowering electricity bills.

Question: How do electrons and holes contribute to electrical conductivity in semiconductors?

Answer: In semiconductors, both electrons (negative charge carriers) and holes (positive charge carriers) contribute to electrical conductivity. When an electric potential difference is applied, electrons move towards the positive potential, and holes move towards the negative potential.

Question: What are the features of vertebrates in the class Amphibia?

Answer: Vertebrates in the class Amphibia have eyes without eyelids, require water to complete their life cycle, undergo metamorphosis, have thin mucous skin with glands, pentadactyle limbs, a three-chambered heart, and respire through lungs, moist skin, and buccal cavity.

Question: What is the significance of the Sri Lankan irrigation system?

Answer: The Sri Lankan irrigation system is a unique water management system with a historical significance. It includes large tanks with complex scientific knowledge for water collection and management, essential for agricultural activities in the dry zone.

Question: What is the purpose of a light-dependent resistor (LDR)?

Answer: A light-dependent resistor (LDR) changes its resistance based on the intensity of light it is exposed to, making it useful in light-sensing applications such as automatic lighting and alarm systems.

Question: What is the function of the skin in protecting the body?

Answer: The skin acts as a barrier against pathogens, regulates body temperature, prevents dehydration, and produces vitamin D.

Question: How is the Lewis structure of methane ( $\text{CH}_4$ ) represented?

Answer: The Lewis structure of methane ( $\text{CH}_4$ ) shows a carbon atom in the center with four hydrogen atoms bonded to it, represented by lines.

Question: What is the importance of genetic diversity in populations?



Answer: Genetic diversity is important for the adaptability and survival of populations, as it provides a range of traits that can help organisms cope with environmental changes and resist diseases.

Question: What are the principle changes in fetal development during the fifth month?

Answer: During the fifth month, the fetus is completely covered with hair, the mother can feel fetal movements, and the fetal heartbeat can be observed.

Question: What is the result of connecting the positive terminals of two dry cells to a bulb?

Answer: Connecting the positive terminals of two dry cells to a bulb results in no potential difference across the bulb, and therefore, no current flow.

Question: What is cell division, and why is it important?

Answer: Cell division is the process by which new cells are formed by dividing cellular materials. It is important for growth, asexual reproduction, wound healing, and cell replacement.

Question: What is the significance of indigenous medical science?

Answer: Indigenous medical science, including Ayurveda, Siddha, Unani, and native medicinal fields, has a history of thousands of years. It offers treatments based on balancing the body's three factors (Va, Pith, and Kapha) and uses natural remedies with minimal side effects.

Question: What happens to the velocity of an object if it experiences uniform acceleration?

Answer: The velocity of the object increases or decreases by equal amounts in equal time intervals.

Question: What is the pitch of a sound wave with a frequency of 512 Hz?

Answer: The pitch of a sound wave with a frequency of 512 Hz corresponds to the note higher C on the musical scale.

Question: What is the trend in electronegativity across the second period?

Answer: The trend in electronegativity across the second period is an increase from left to right.

Question: What is the average speed of an object that traveled 200 meters in 40 seconds?

Answer: Average speed =  $200 \text{ m} / 40 \text{ s} = 5 \text{ m/s}$ .

Question: What is the significance of the center of curvature in spherical mirrors?

Answer: The center of curvature is the center of the hypothetical sphere of which the mirror is a part, and it is the point from which all lines drawn to the mirror are perpendicular to the surface.

Question: How does a silicon-controlled rectifier (SCR) work?

Answer: A silicon-controlled rectifier (SCR) is a semiconductor device that conducts current when triggered by a gate signal, used for controlling high power in applications like motor drives and light dimmers.

Question: What is upthrust and how is it experienced by objects in a liquid?

Answer: Upthrust is the upward force exerted by a liquid on an object immersed in it. It is experienced as a reduction in the apparent weight of the object due to the liquid's buoyant force.

Question: What is the difference between a neutral atom and an ion?

Answer: A neutral atom has an equal number of protons and electrons, resulting in no net charge, while an ion has an unequal number of protons and electrons, resulting in a positive or negative charge.

Question: How does a bridge rectifier convert AC to DC?

Answer: A bridge rectifier uses four diodes arranged in a bridge configuration to convert AC to DC, allowing both halves of the AC waveform to contribute to the DC output.

Question: What is the resultant force when two forces of 4 N and 6 N act in opposite directions?

Answer: The resultant force is 2 N in the direction of the 6 N force.

Question: What are the three methods of heat transfer, and how do they differ?

Answer: The three methods of heat transfer are conduction, convection, and radiation. Conduction involves heat transfer through direct contact of particles, convection involves heat transfer through fluid motion, and radiation involves heat transfer through electromagnetic waves without a medium.

Question: Describe the benefits of using energy-efficient cookers.

Answer: Energy-efficient cookers reduce energy consumption, cook food faster, and generate less heat waste, leading to cost savings and a reduced environmental impact.

Question: What is the chemical formula for calcium chloride?

Answer: The chemical formula for calcium chloride is  $\text{CaCl}_2$ .

Question: Explain the working principle of a light-emitting diode (LED).

Answer: A light-emitting diode (LED) emits light when a forward voltage is applied, causing electrons to recombine with holes in the semiconductor material, releasing energy as photons.

Question: How does the power consumption of LED televisions compare to that of older CRT televisions?

Answer: LED televisions consume significantly less power than older CRT televisions, making them more energy-efficient and cost-effective.

Question: What are the necessary factors for maintaining equilibrium in a system of three non-parallel coplanar forces?

Answer: To maintain equilibrium in a system of three non-parallel coplanar forces, the forces must be coplanar, their lines of action must intersect at a common point, and the resultant of any two forces must equal the third force in magnitude and be opposite in direction.

Question: What is the importance of calibrating pressure measuring instruments?

Answer: Calibrating pressure measuring instruments ensures accuracy and reliability in pressure readings, which is crucial for safety and efficiency in various applications.

Question: How does reducing friction affect the distance traveled by a moving object?

Answer: Reducing friction increases the distance traveled by a moving object, as less resistive force opposes its motion, allowing it to move further before coming to rest.

Question: How does the speed of a rotating coil affect the generated voltage?

Answer: Faster rotation of the coil increases the rate of change of the magnetic field, generating higher voltage.

Question: How does a silicon-controlled rectifier (SCR) control high power?

Answer: A silicon-controlled rectifier (SCR) conducts current when triggered by a gate signal, used for controlling high power in applications like motor drives and light dimmers.

Question: How does the polarity of a solvent influence solubility?

Answer: Polar solvents dissolve polar solutes well due to similar intermolecular interactions, while non-polar solvents dissolve non-polar solutes.

Question: What are the features of vertebrates in the class Amphibia?

Answer: Vertebrates in the class Amphibia have eyes without eyelids, require water to complete their life cycle, undergo metamorphosis, have thin mucous skin with glands, pentadactyle limbs, a three-chambered heart, and respire through lungs, moist skin, and buccal cavity.

Question: How can the heat of reaction for solid sodium hydroxide be different from its aqueous solution?

Answer: The physical state affects the heat change, resulting in different values for solid and aqueous sodium hydroxide.

Question: What is the role of magnetic field strength in electromagnetic induction?

Answer: A stronger magnetic field increases the induced electromotive force, enhancing the effectiveness of the induction process.

Question: What are groups in the Periodic Table?

Answer: Groups are vertical columns in the Periodic Table.

Question: How does the period of a wave relate to its frequency?

Answer: The period is the reciprocal of the frequency, indicating the time for one complete cycle of the wave.

Question: Describe the process of cell division in meristematic tissues.

Answer: Meristematic tissues undergo mitosis, a type of cell division that produces new cells, allowing for plant growth and the formation of new

tissues.

Question: What are the four kingdoms in the Domain Eukarya?

Answer: The four kingdoms in the Domain Eukarya are Protista, Fungi, Plantae, and Animalia.

Question: What is the concentration of a solution containing 0.1 mol of glucose in 250 cm<sup>3</sup> of water?

Answer: The concentration is 0.4 mol/dm<sup>3</sup>.

Question: What are the functions of the different cell types in xylem tissue?

Answer: Xylem vessel elements and tracheids transport water, xylem fibers provide support, and xylem parenchyma cells store food and nutrients.

Question: What is the significance of blood clotting in blood tissue?

Answer: Blood clotting involves the formation of fibers that help stop bleeding, prevent infection, and facilitate wound healing.

Question: How does the epiglottis function during swallowing?

Answer: The epiglottis closes the trachea during swallowing, preventing food from entering the respiratory tract and directing it into the esophagus.

Question: How does the weight of an object in water compare to its weight in air?

Answer: The weight of an object in water is less than its weight in air because the upthrust exerted by the water reduces the apparent weight of the object.

Question: What are common symptoms of urinary tract infections (UTIs)?

Answer: Symptoms of UTIs include frequent urination, burning sensation during urination, cloudy or strong-smelling urine, and pelvic pain.

Question: How does a glass-alcohol thermometer differ from a glass-mercury thermometer?

Answer: A glass-alcohol thermometer uses ethyl alcohol (ethanol) instead of mercury, making it suitable for measuring low temperatures much below 0°C due to ethanol's melting point of -115°C.

Question: What are the characteristics of organisms in the Domain Archaea?

Answer: Organisms in the Domain Archaea are prokaryotes that can live in extreme environments and are not sensitive to most antibiotics.

Question: What is the role of heat in neutralization reactions?

Answer: Neutralization reactions between acids and bases release heat, making them exothermic.

Question: What happens to a light ray entering a dense medium from a rare medium?

Answer: The light ray bends towards the normal.

Question: How do ionic compounds differ from covalent compounds in terms of electrical conductivity?

Answer: Ionic compounds conduct electricity in aqueous solutions and the fused state due to the presence of free-moving ions, while covalent compounds generally do not conduct electricity because their molecules do not dissociate into ions.

Question: What is the molar mass of sodium chloride (NaCl)?

Answer: The molar mass of sodium chloride is 58.5 grams per mole, calculated as 23 for sodium plus 35.5 for chlorine.

Question: What is the maximum number of electrons in the L shell?

Answer: The maximum number of electrons in the L shell is 8.

Question: How do you find the mean speed of an object that has traveled different distances in equal intervals of time?

Answer: Mean speed = Total distance / Total time.

Question: How does a solid oxide fuel cell (SOFC) differ from other fuel cells?

Answer: A solid oxide fuel cell (SOFC) operates at high temperatures (800-1000°C) using a solid ceramic electrolyte. It offers high efficiency, fuel flexibility, and durability, making it suitable for stationary power generation.

Question: What factors determine the magnitude of induced voltage in a coil?

Answer: Factors determining the magnitude of induced voltage include the number of coil turns, magnetic field strength, and speed of motion.

Question: Calculate the energy consumption of a 1500W water heater used for 30 minutes daily over a month.

Answer: The energy consumption is  $(1500\text{W} \times 0.5 \text{ hours} \times 30 \text{ days}) / 1000 = 22.5 \text{ kWh}$ .

Question: How does the electrolysis of acidulated water produce hydrogen gas?

Answer: Hydrogen gas is produced at the cathode by the reduction of  $\text{H}^+$  ions:  $2\text{H}^+ (\text{aq}) + 2\text{e}^- \rightarrow \text{H}_2 (\text{g})$ .

Question: What are the challenges associated with scaling up electrochemical processes for industrial applications?

Answer: Challenges associated with scaling up electrochemical processes include maintaining efficiency and selectivity, managing heat and mass transfer, ensuring material durability, optimizing reactor design, and reducing costs to achieve commercial viability.

Question: What are the environmental impacts of improper disposal of batteries?

Answer: Improper disposal of batteries can lead to the release of toxic metals and chemicals into the environment, contaminating soil and water, harming wildlife, and posing health risks to humans.

Question: How does the release of chlorofluorocarbons (CFCs) impact the environment?

Answer: Chlorofluorocarbons deplete the ozone layer, increasing exposure to harmful ultraviolet radiation. They contribute to environmental degradation and health risks.

Question: How do gaps between railway tracks accommodate thermal expansion?

Answer: Gaps between railway tracks accommodate thermal expansion by providing space for the tracks to expand when temperatures rise, preventing buckling and ensuring safe operation.

Question: What are the potential impacts of climate change on ecosystems?

Answer: Potential impacts of climate change on ecosystems include shifts in species distribution, changes in phenology (timing of biological events), increased frequency of extreme weather events, and disruptions to ecosystem services.

Question: How do ultrasound waves help in medical imaging of internal organs?

Answer: Ultrasound waves are emitted and reflected back from internal structures, creating images used for diagnostic purposes.

Question: How does genetic diversity arise in populations?

Answer: Genetic diversity arises through mutations, genetic recombination during meiosis, and gene flow between populations. These processes introduce new genetic variations that contribute to the overall genetic diversity of a population.

Question: What are some examples of monosaccharides?

Answer: Examples of monosaccharides include glucose, fructose, and galactose.

Question: Explain the single displacement reaction of aluminum with copper sulfate.

Answer: Aluminum displaces copper from copper sulfate, forming aluminum sulfate and copper:  $2\text{Al} + 3\text{CuSO}_4 \rightarrow \text{Al}_2(\text{SO}_4)_3 + 3\text{Cu}$ .

Question: What are the two types of vitamins based on solubility?

Answer: The two types of vitamins based on solubility are water-soluble (B and C) and fat-soluble (A, D, E, and K).

Question: How does the release of nitrogen oxides (NO<sub>x</sub>) contribute to the formation of photochemical smog?

Answer: The release of nitrogen oxides (NO<sub>x</sub>) contributes to the formation of photochemical smog by reacting with volatile organic compounds (VOCs) in the presence of sunlight, forming ozone and other harmful pollutants.

Question: What causes herpes, and what are its symptoms?

Answer: Herpes is caused by the virus Herpes simplex and is characterized by painful blisters on sex organs and nervous system inactivation.

Question: Why is a medium essential for sound propagation?

Answer: Sound waves are mechanical waves that require a medium to travel, as they involve the vibration of particles in the medium.

Question: How does the sieve plate function in phloem tissue?

Answer: The sieve plate, found in sieve tubes, allows for the efficient transport of food materials through the plant by providing a porous structure for nutrient flow.

Question: How do you convert a temperature from Celsius to Kelvin?

Answer: To convert a temperature from Celsius to Kelvin, add 273 to the Celsius temperature.

Question: Describe the experiment to show that chlorophyll is required for photosynthesis.

Answer: Use a mosaic leaf with green and white areas, conduct a starch test, and observe that only the green areas (with chlorophyll) show a color change, indicating photosynthesis.

Question: Explain the importance of using the appropriate cross-sectional area for connecting wires.

Answer: Using the appropriate cross-sectional area for connecting wires ensures they can safely carry the required current without overheating or causing electrical faults.

Question: How does body temperature change during the menstrual cycle?

Answer: Body temperature slightly increases during the secretory phase of the menstrual cycle due to the influence of progesterone.

Question: Explain the difference between passive and active transport.

Answer: Passive transport involves the movement of substances across the cell membrane without energy input, following the concentration gradient, while active transport requires energy to move substances against the gradient.

Question: How should a voltmeter be connected in a circuit?

Answer: A voltmeter should be connected in parallel with the component or points across which the potential difference is to be measured.

Question: Describe the relationship between kinetic and potential energy in a closed system.

Answer: In a closed system, kinetic and potential energy transform into each other while the total mechanical energy remains constant.

Question: What is the role of antibodies in immune response?

Answer: Antibodies bind to antigens on pathogens, neutralizing them and marking them for destruction by immune cells.

Question: What is the function of the hypothalamus in hunger and thirst regulation?

Answer: The hypothalamus detects nutrient and water levels, triggering hunger and thirst sensations to maintain energy and hydration balance.

Question: What is the chemical formula for methane?

Answer: The chemical formula for methane is CH<sub>4</sub>.

Question: How does the structure of covalent compounds influence their physical state at room temperature?

Answer: The structure of covalent compounds, with weaker intermolecular forces compared to ionic compounds, results in many being liquids or gases at room temperature.

Question: How is the molar mass of sulfuric acid (H<sub>2</sub>SO<sub>4</sub>) calculated?

Answer: The molar mass of sulfuric acid is calculated by summing the molar masses of its constituent atoms: 2 x 1 for hydrogen, 32 for sulfur, and 4 x 16 for oxygen, resulting in 98 grams per mole.

Question: What is the valency of phosphorus?

Answer: The valency of phosphorus is 5 and 3.

Question: What are the benefits of using organic fertilizers?

Answer: Organic fertilizers, made from decomposed plant and animal matter, improve soil structure and porosity, enhancing the activity of soil organisms. They are environmentally friendly and help sustain agricultural productivity.

Question: How does friction affect the motion of a carom disc on a carom board?

Answer: Friction opposes the motion of the carom disc. Applying talcum powder reduces friction, allowing the disc to move further before stopping.

Question: What happens during the menstrual phase of the uterine cycle?

Answer: During the menstrual phase, the uterine lining degrades and is expelled from the body as menstrual flow, typically lasting about four days.

Question: What is the role of a separator in a battery?

Answer: A separator in a battery physically separates the anode and cathode while allowing the flow of ions through the electrolyte, preventing short circuits and ensuring efficient electrochemical reactions.

Question: What are some methods to reduce friction?

Answer: Methods to reduce friction include reducing the roughness of contact surfaces, applying lubricants like graphite or grease, and using ball bearings.

Question: How do ultraviolet rays affect human health?

Answer: Ultraviolet rays can cause skin tanning, burning, and increase the risk of skin cancer with prolonged exposure.

Question: What is the average speed of an object that travels 100 meters in 20 seconds?

Answer: The average speed is 5 m/s.

Question: How does renal failure affect overall health?

Answer: Renal failure leads to the accumulation of waste products, fluid imbalance, electrolyte disturbances, and can cause hypertension, anemia, and cardiovascular problems.



Question: What is the role of magnetic poles in generating force on a conductor?

Answer: The poles create a field that interacts with the current in the conductor, generating a force that causes movement.

Question: Explain the concept of coulombic efficiency in batteries.

Answer: Coulombic efficiency in batteries is the ratio of the charge extracted during discharge to the charge input during charging. It indicates the efficiency of charge storage and retrieval, with higher values representing better battery performance and lower losses.

Question: What is the effect of connecting the positive terminals of two dry cells to a bulb?

Answer: Connecting the positive terminals of two dry cells to a bulb results in no potential difference across the bulb, and therefore, no current flow.

Question: How does the body compensate for reduced kidney function in early stages of kidney disease?

Answer: The body compensates by increasing the filtration rate in remaining healthy nephrons, but over time, this can lead to further kidney damage.

Question: What is the significance of the electrochemical series in predicting the outcome of electrolysis?

Answer: The electrochemical series ranks elements based on their tendency to lose or gain electrons, helping predict which ions will be reduced or oxidized during electrolysis and guiding the selection of suitable electrodes and electrolytes.

Question: What is the reaction between calcium and hydrochloric acid?

Answer: Calcium reacts with hydrochloric acid to form calcium chloride and hydrogen gas:  $\text{Ca} + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2$ .

Question: How does the mass of an object affect its weight on different celestial bodies?

Answer: The mass of an object remains constant, but its weight changes depending on the gravitational acceleration of the celestial body. For example, an object weighs less on the moon than on Earth due to the lower gravitational acceleration on the moon.

Question: What is the atomic number of carbon?

Answer: The atomic number of carbon is 6.

Question: What energy transformation occurs in a DC motor?

Answer: In a DC motor, electrical energy is converted into mechanical energy.

Question: How does the electrochemical series help in predicting the feasibility of redox reactions?

Answer: The electrochemical series lists elements and their standard electrode potentials, helping predict the feasibility of redox reactions by indicating which species are more likely to be reduced or oxidized. A

reaction is feasible if the cell potential is positive.

Question: How is the chemical formula of sodium oxide written?

Answer: The chemical formula of sodium oxide is  $\text{Na}_2\text{O}$ , indicating two sodium ions and one oxide ion.

Question: How do bacteria contribute to nutrient cycling in ecosystems?

Answer: Bacteria contribute to nutrient cycling by decomposing organic matter, fixing nitrogen, and participating in various biochemical processes that recycle nutrients within ecosystems.

Question: What is the use of antacid tablets in neutralization?

Answer: Antacid tablets, which contain a weak base, neutralize stomach acidity and relieve discomfort.

Question: What is the reactivity of magnesium with dilute sulfuric acid?

Answer: Magnesium reacts vigorously with dilute sulfuric acid, producing magnesium sulfate and hydrogen gas:  $\text{Mg} + \text{H}_2\text{SO}_4 \rightarrow \text{MgSO}_4 + \text{H}_2$ .

Question: Why is the use of glass-mercury thermometers declining?

Answer: The use of glass-mercury thermometers is declining due to the toxicity of mercury.

Question: What is the difference between a carrier and an affected individual in genetic disorders?

Answer: A carrier possesses one copy of a recessive gene for a genetic disorder but does not show symptoms. An affected individual has two copies of the recessive gene and exhibits the disorder.

Question: What happens to the momentum of an object if its velocity is doubled?

Answer: If the velocity of an object is doubled, its momentum also doubles, as momentum is directly proportional to velocity.

Question: What causes the depletion of the ozone layer?

Answer: The depletion of the ozone layer is caused by gases like chlorofluorocarbons (CFCs) and nitric oxide (NO) that react with ozone molecules, breaking them down.

Question: How does the electrolysis of sodium chloride solution produce chlorine gas?

Answer: Chlorine gas is produced at the anode by the oxidation of  $\text{Cl}^-$  ions:  $2\text{Cl}^- (\text{aq}) \rightarrow \text{Cl}_2 (\text{g}) + 2\text{e}^-$ .

Question: What is the Sudan III test for lipids?

Answer: The Sudan III test involves adding gingelly or coconut oil into a test tube, adding Sudan III reagent, and observing the appearance of red fat globules.

Question: How is the distance fallen by a body during free fall calculated using the velocity-time graph?

Answer: The distance fallen is equal to the shaded area under the velocity-time graph.

Question: What is the significance of the Nyquist sampling theorem in digital signal processing?

Answer: The Nyquist sampling theorem states that to accurately reconstruct a signal, it must be sampled at least twice the frequency of its highest component, preventing aliasing and ensuring faithful signal representation.

Question: What is the principle behind the operation of a bicycle dynamo?

Answer: The principle behind a bicycle dynamo is electromagnetic induction, where mechanical rotation induces an electromotive force in the coil.

Question: How does the reaction of potassium with water demonstrate its high reactivity?

Answer: Potassium reacts vigorously with water, producing potassium hydroxide and hydrogen gas, often catching fire:  $2K + 2H_2O \rightarrow 2KOH + H_2$ .

Question: What is the function of bile in digestion?

Answer: Bile emulsifies lipids, aiding in their digestion.

Question: How do you determine the total distance traveled from a displacement-time graph?

Answer: The total distance traveled is the sum of the absolute values of the displacements over the intervals.

Question: What are frictional forces?

Answer: Frictional forces are the forces that act between the surfaces of two objects in contact, opposing relative motion or the tendency to move.

Question: How is the relative atomic mass of an element defined?

Answer: The relative atomic mass of an element is defined as the weighted average mass of the atoms in a naturally occurring sample of the element, compared to 1/12 of the mass of a carbon-12 atom.

Question: How does the electronic configuration of chlorine influence its reactivity?

Answer: The electronic configuration of chlorine (2, 8, 7) makes it highly reactive, as it needs to gain one electron to achieve a stable configuration, readily forming bonds with other elements.

Question: How does a lead-acid battery work?

Answer: A lead-acid battery consists of lead dioxide ( $PbO_2$ ) as the cathode, sponge lead ( $Pb$ ) as the anode, and sulfuric acid ( $H_2SO_4$ ) as the electrolyte. During discharge, lead dioxide and sponge lead react with sulfuric acid to produce lead sulfate ( $PbSO_4$ ) and water, generating electrical energy.

Question: How does a Zener diode regulate voltage?

Answer: A Zener diode regulates voltage by allowing current to flow in the reverse direction when the voltage exceeds a certain value (Zener breakdown voltage), maintaining a stable output voltage.

Question: How does the nervous tissue facilitate rapid communication in the body?

Answer: Nervous tissue uses neurons to transmit electrical impulses quickly, coordinating responses and maintaining homeostasis.

Question: What is the role of Newton's third law in the formation of a force couple?

Answer: Newton's third law states that for every action force, there is an equal and opposite reaction force. This principle is applied in the formation of a force couple, where the reaction force at the pivot creates the couple.

Question: How do electronegativity values change across a period from left to right?

Answer: Electronegativity values increase from left to right across a period.

Question: How do you determine the center of gravity of an object using the method described in the document?

Answer: Hang the object from different points and mark the vertical lines along the string. The point where these lines intersect is the center of gravity, where the weight of the object acts.

Question: What are the benefits of using electrolysis for industrial metal refining?

Answer: Electrolysis for metal refining produces high-purity metals, removes impurities, and allows for the recovery of valuable by-products, enhancing the overall efficiency and profitability of the process.

Question: Explain the importance of cambium in plant growth.

Answer: Cambium, a type of lateral meristem, is essential for the secondary growth of plants, increasing the diameter of stems and roots by producing new xylem and phloem cells.

Question: Where are electrons found in an atom?

Answer: Electrons are found rotating around the nucleus of an atom.

Question: How do you determine the direction of the resultant force for two collinear forces acting in opposite directions?

Answer: The direction of the resultant force is in the direction of the larger force.

Question: What is the purpose of a vacuum pump in scientific experiments?

Answer: A vacuum pump creates a low-pressure environment by removing air and other gases from a sealed container, essential for experiments that require controlled atmospheric conditions.

Question: What is energy efficiency, and how does it benefit consumers?

Answer: Energy efficiency is the utilization of minimal energy for a particular service through effective management. It benefits consumers by reducing energy consumption, lowering costs, and providing enhanced services without compromising quality.

Question: What are the main features of the Kingdom Protista?

Answer: The Kingdom Protista includes eukaryotic organisms that can be unicellular or multicellular without specialized tissues and live in water-associated environments.

Question: Explain uniform acceleration.

Answer: Uniform acceleration means the velocity of an object changes by equal amounts in equal intervals of time.

Question: What are the stages of wound healing?

Answer: The stages include hemostasis (blood clotting), inflammation, proliferation (tissue formation), and remodeling (tissue strengthening and maturation).

Question: What is the effect of reversing current direction on the magnetic field around a conductor?

Answer: Reversing the current direction reverses the magnetic field direction, changing the field's orientation around the conductor.

Question: How does the specific latent heat of fusion relate to the melting process of a substance?

Answer: The specific latent heat of fusion quantifies the energy required to convert a solid into a liquid at its melting point, providing insight into the energy dynamics of the melting process.

Question: Describe the formation and behavior of holes and free electrons in semiconductors at different temperatures.

Answer: In semiconductors, the formation and behavior of holes and free electrons are influenced by temperature. At 0 K (Absolute Zero): Silicon Lattice: At 0 K, all covalent bonds in the silicon lattice are intact, with no free electrons or holes. The lattice structure is stable, and the material behaves as an insulator. At Higher Temperatures: Thermal Energy: As the temperature increases, thermal energy breaks some of the covalent bonds in the silicon lattice. This releases free electrons, which can move through the lattice and contribute to electrical conductivity. Holes Formation: When an electron is released from a bond, it leaves behind an electron deficiency known as a "hole." A hole behaves like a positive charge because it is associated with the absence of an electron in a normally neutral atom. Charge Carriers: In semiconductors, both free electrons and holes act as charge carriers. Electrons are negative charge carriers, while holes are positive charge carriers. Electron Movement: Electrons move from the negative potential to the positive potential when an electric potential difference is applied across the semiconductor. Hole Movement: Holes move from the positive potential to the negative potential, effectively allowing current to flow. Impact on Conductivity: Increased Conductivity: As the temperature rises, more covalent bonds break, generating more free electrons and holes, which increases the conductivity of the semiconductor (decreasing resistivity). Electrical Neutrality: Despite the presence of free electrons and holes, the overall lattice remains electrically neutral as the number of free electrons is equal to the number of holes.

Question: What happens when the applied force exceeds the static frictional force?

Answer: When the applied force exceeds the static frictional force, the object begins to move, and the frictional force acting on it becomes dynamic friction.

Question: How does reducing friction affect the distance traveled by a moving object on a smooth surface?

Answer: Reducing friction increases the distance traveled by a moving object on a smooth surface, as less resistive force opposes its motion, allowing it to move further before coming to rest.

Question: How does the induced voltage waveform look in an alternating current dynamo?

Answer: The induced voltage waveform in an alternating current dynamo is sinusoidal, alternating between positive and negative values.

Question: How does the solubility of a gas in a liquid change with temperature?

Answer: The solubility of a gas in a liquid decreases with an increase in temperature, as higher temperatures cause gases to escape from the solution.

Question: How does the concept of heat capacity relate to the heat change in a reaction?

Answer: Heat capacity determines the amount of heat needed to change the temperature of a substance, affecting the overall heat change in the reaction.

Question: Differentiate between aerobic and anaerobic respiration.

Answer: Aerobic respiration requires oxygen and produces more energy by completely breaking down glucose, while anaerobic respiration occurs without oxygen and produces less energy.

Question: How do catalysts benefit industrial chemical reactions?

Answer: Catalysts enhance reaction rates, lower energy costs, and improve product yield in industrial chemical reactions.

Question: What are the potential impacts of climate change on human health?

Answer: Potential impacts of climate change on human health include heat-related illnesses, respiratory problems, vector-borne diseases, and food and water insecurity.

Question: What is Fleming's right-hand rule used for?

Answer: Fleming's right-hand rule is used to determine the direction of the induced current in a conductor moving in a magnetic field.

Question: How do electromagnetic waves enable wireless technology?

Answer: Electromagnetic waves transmit data wirelessly through the air, enabling communication technologies such as Wi-Fi, Bluetooth, and cellular networks.

Question: How can you measure the volume of gases produced during electrolysis?

Answer: The volume of gases can be measured by collecting them in inverted test tubes and observing the displacement of water.

Question: What is an invasive species?

Answer: An invasive species is a non-native species that spreads rapidly and causes harm to the environment, economy, or human health.

Question: Why is it important to understand the factors influencing reaction rates?

Answer: Understanding these factors helps optimize chemical reactions for industrial, laboratory, and everyday applications.

Question: Explain the concept of "gene expression" in genetics.

Answer: Gene expression refers to the combination of alleles (genes) that an organism possesses for a particular trait, determining the organism's phenotype.

Question: What is the relationship between the potential difference and current in a nichrome wire coil?

Answer: The potential difference and current in a nichrome wire coil are directly proportional, as described by Ohm's Law, provided the temperature remains constant.

Question: What is thermal equilibrium?

Answer: Thermal equilibrium is the state when two objects in contact no longer transfer heat between them, having reached the same temperature.

Question: How can a system remain in equilibrium under the action of more than three forces?

Answer: A system can remain in equilibrium under the action of more than three forces by ensuring that the forces are applied in such a way that their resultant is zero, meaning the sum of the forces and moments balance out.

Question: How does the use of catalysts impact industrial chemical processes?

Answer: Catalysts increase the efficiency of reactions, reducing energy requirements and production costs in industrial processes.

Question: How is the blast furnace operated in iron extraction?

Answer: The blast furnace is operated by feeding raw materials from the top, blowing hot air from the bottom, and maintaining high temperatures to facilitate the reduction reactions that produce liquid iron.

Question: What is the chemical formula for ethyl alcohol?

Answer: The chemical formula for ethyl alcohol is  $C_2H_5OH$ .

Question: How does a moving coil microphone generate electrical signals?

Answer: A moving coil microphone generates electrical signals by vibrating a coil within a magnetic field, inducing an electromotive force corresponding to sound waves.

Question: What is the purpose of a signal booster in communication systems?

Answer: A signal booster amplifies weak signals in communication systems, extending the range and improving the quality of transmissions for better reception.

Question: How do the characteristics of meristematic cells differ from those of mature plant cells?

Answer: Meristematic cells are small, undifferentiated, and actively dividing, with a distinct nucleus and numerous mitochondria, whereas mature plant cells are specialized and may have large vacuoles and thickened walls.

Question: What role does electronegativity play in chemical bonding?

Answer: Electronegativity determines an atom's ability to attract and hold onto electrons in a chemical bond, affecting bond polarity and bond strength.

Question: How is the chemical formula of hydrochloric acid written?

Answer: The chemical formula of hydrochloric acid is HCl, indicating one hydrogen atom and one chlorine atom.

Question: How many molecules are there in 0.2 moles of water (H<sub>2</sub>O)?

Answer: There are  $1.204 \times 10^{23}$  molecules in 0.2 moles of water, calculated as  $0.2 \times 6.022 \times 10^{23}$ .

Question: How do you convert a temperature from Kelvin to Celsius?

Answer: To convert a temperature from Kelvin to Celsius, subtract 273 from the Kelvin temperature.

Question: How is body temperature regulated during exercise?

Answer: During exercise, the body increases sweat production and dilates blood vessels in the skin to release heat and maintain temperature.

Question: What adaptations do alveoli have for efficient gas exchange?

Answer: Alveoli have thin walls, moist surfaces, a rich blood supply, and a large number of sacs to maximize the surface area for gas exchange.

Question: Describe the role of an electricity meter in monitoring energy consumption.

Answer: An electricity meter monitors energy consumption by recording the total kilowatt hours (kWh) of electricity used by the household, providing data for billing and energy management.

Question: What is the role of hydrogen bonds in the structure and function of proteins?

Answer: Hydrogen bonds play a crucial role in the structure and function of proteins by stabilizing their three-dimensional shapes, facilitating folding, and enabling specific interactions with other molecules.

Question: What are the benefits of using renewable energy sources for electricity generation?

Answer: Renewable energy sources, such as solar, wind, and hydro, reduce dependence on fossil fuels, lower greenhouse gas emissions, and provide sustainable energy solutions.



Question: What are the goals of the United Nations Sustainable Development Goals (SDGs)?

Answer: The goals of the United Nations Sustainable Development Goals (SDGs) are to end poverty, protect the planet, and ensure prosperity for all by 2030.

Question: How does the specific heat capacity of water contribute to its use in heating systems?

Answer: Water's high specific heat capacity allows it to absorb and store large amounts of heat with minimal temperature change, making it ideal for use in heating systems to maintain consistent temperatures.

Question: What are the laws of refraction?

Answer: The incident ray, refracted ray, and the normal to the surface lie on the same plane, and the ratio of the sine of the incident angle to the sine of the refracted angle is constant (Snell's law).

Question: What are the implications of genetic testing for inherited disorders?

Answer: Genetic testing for inherited disorders can provide information about an individual's risk of developing certain diseases, guide medical management and treatment decisions, and inform family planning and reproductive choices.

Question: What is the atomic number of magnesium?

Answer: The atomic number of magnesium is 12.

Question: How is the chemical formula of magnesium nitrate written?

Answer: The chemical formula of magnesium nitrate is  $\text{Mg}(\text{NO}_3)_2$ , indicating one magnesium ion and two nitrate ions.

Question: How is the chemical formula of phosphine written?

Answer: The chemical formula of phosphine is  $\text{PH}_3$ , indicating one phosphorus atom and three hydrogen atoms.

Question: How do bacteria reproduce?

Answer: Bacteria reproduce asexually through binary fission, and cyanobacteria can reproduce by fragmentation and budding.

Question: What is the resistance of a bulb connected to a 9 V power supply with a current of 1.5 A?

Answer: Using Ohm's Law,  $R = V/I$ , the resistance is  $R = 9 \text{ V} / 1.5 \text{ A} = 6 \Omega$ .

Question: Why is the image formed by a convex mirror always virtual and upright?

Answer: Convex mirrors cause reflected rays to diverge, making them appear to originate from a point behind the mirror, resulting in a virtual and upright image.

Question: Why is it dangerous to drive with worn-out tire grooves on rainy days?

Answer: It is dangerous because worn-out tire grooves reduce friction between the tires and the wet road surface, increasing the risk of skidding and accidents.

Question: How do geneticists use CRISPR technology in genetic research?

Answer: CRISPR technology allows geneticists to precisely edit genes by targeting specific DNA sequences, enabling the study of gene function and the development of gene therapies for genetic disorders.

Question: What are common diseases of the digestive system?

Answer: Common diseases include gastritis, ulcers, constipation, and irritable bowel syndrome.

Question: How do you achieve equilibrium in a rod with weights at different points using the principle of moments?

Answer: Achieve equilibrium by adjusting the positions and magnitudes of the weights such that the moments on either side of the pivot are equal, resulting in no net rotation.

Question: What are the potential health risks of untreated urinary tract infections (UTIs)?

Answer: Untreated UTIs can lead to kidney infections, sepsis, and long-term kidney damage.

Question: What is the significance of the coelom in Annelids?

Answer: The coelom provides an independent movement for the gut wall irrespective of the body movements.

Question: What is the function of the juxtaglomerular apparatus in the nephron?

Answer: The juxtaglomerular apparatus regulates blood pressure and glomerular filtration rate by secreting renin and controlling the diameter of afferent arterioles.

Question: How do musical instruments create different pitches?

Answer: Different pitches are created by varying the frequency of vibrations produced by strings, air columns, or membranes in the instrument.

Question: How does a moving coil microphone generate electrical signals?

Answer: A moving coil microphone generates electrical signals by vibrating a coil within a magnetic field, inducing an electromotive force corresponding to sound waves.

Question: Why does the rate of reaction increase with higher concentration of reactants?

Answer: Higher concentration increases the number of reactant particles, leading to more collisions and a faster reaction rate.

Question: How is the chemical formula of potassium hydroxide written?

Answer: The chemical formula of potassium hydroxide is KOH, indicating one potassium ion and one hydroxide ion.

Question: What are chemoautotrophic organisms?

Answer: Chemoautotrophic organisms are those that produce their own food using energy obtained from chemical reactions. Most bacteria are chemoautotrophic.

Question: What are the features of vertebrates in the class Reptilia?

Answer: Vertebrates in the class Reptilia have dry skin with scales, pentadactyle limbs, a heart with two atria and an incompletely divided ventricle, lungs for respiration, and are cold-blooded with internal fertilization.

Question: What is the relationship between the speed of coil rotation and the output voltage of a dynamo?

Answer: The output voltage of a dynamo increases with the speed of coil rotation, as a higher speed induces a greater electromotive force.

Question: What are the uses of oxygen gas in respiration?

Answer: Oxygen gas is essential for the respiration of all organisms, supporting cellular respiration and energy production.

Question: What are some examples of skeletal muscles?

Answer: Examples of skeletal muscles include the biceps, triceps, leg muscles, and facial muscles.

Question: How do you balance a uniform rod with different weights suspended at varying distances from the pivot?

Answer: Balance the rod by ensuring that the clockwise moments due to the weights on one side equal the anti-clockwise moments due to the weights on the other side, achieving equilibrium.

Question: How is sodium metal obtained industrially using the Downs cell?

Answer: Sodium metal is obtained by the electrolysis of fused sodium chloride, producing chlorine gas as a by-product.

Question: How do you determine the direction of the resultant force for two collinear forces acting in opposite directions?

Answer: The direction of the resultant force is in the direction of the larger force.

Question: What is the chemical formula for carbon tetrachloride?

Answer: The chemical formula for carbon tetrachloride is  $\text{CCl}_4$ .

Question: What are the deficiency symptoms of calcium in plants?

Answer: Deficiency symptoms of calcium in plants include dying of tissues at the tips of the leaves.

Question: How do muscle tissues contribute to thermoregulation in the body?

Answer: Muscle tissues generate heat through contractions, helping to maintain body temperature and thermoregulation.

Question: How do you calculate the total power dissipated by multiple resistors in a circuit?

Answer: Calculate the power dissipated by each resistor using  $P=I^2R$  or  $P=V^2/R$ , then sum the individual power values to find the total power dissipated.

Question: What are some uses of steam distillation in the industry?

Answer: Steam distillation is used to extract essential oils, flavors, and fragrances from plant materials in the food, cosmetics, and pharmaceutical industries.

Question: What is the role of the radicle in seed germination?

Answer: The radicle is the first part of the seedling to emerge from the seed during germination, developing into the primary root.

Question: Explain limiting friction with an example.

Answer: Limiting friction is the maximum frictional force just before an object starts moving. For example, the force required to start moving a heavy box across the floor is the limiting frictional force.

Question: Describe the motion of a body moving at a constant velocity of 6 m/s for 5 seconds.

Answer: The displacement after 5 seconds is 30 m.

Question: How does the varying electric current in a loudspeaker produce sound?

Answer: The varying current causes the coil and attached cone to vibrate, generating sound waves corresponding to the current's waveform.

Question: What is the effect of temperature on the solubility of gases in water?

Answer: The solubility of gases in water decreases with an increase in temperature, as observed when gas bubbles form upon heating water.

Question: How does a nichrome wire coil behave when connected to a power supply?

Answer: A nichrome wire coil exhibits resistance and allows current to flow through it when connected to a power supply, producing heat.

Question: What is an example of a compound where the octet of electrons is incomplete?

Answer: Aluminium chloride ( $\text{AlCl}_3$ ) is an example where the octet of electrons in the aluminium atom is incomplete, containing only six electrons in the valence shell.

Question: What is the role of a frequency counter in electronic measurements?

Answer: A frequency counter measures the frequency of an input signal by counting the number of cycles per second, providing accurate frequency measurements for electronic applications.

Question: How do concave mirrors produce enlarged images?

Answer: Concave mirrors produce enlarged images when the object is placed between the focal point and the mirror, resulting in a virtual and upright image larger than the object.

Question: What is the importance of the principal axis in ray diagrams for spherical mirrors?

Answer: The principal axis serves as a baseline for measuring angles of incidence and reflection, helping to construct accurate ray diagrams and analyze reflections.

Question: What are the products of the reaction between zinc and sulfuric acid?

Answer: The reaction between zinc and sulfuric acid produces zinc sulfate ( $\text{ZnSO}_4$ ) and hydrogen gas ( $\text{H}_2$ ).

Question: What factors determine the magnitude of induced voltage in a coil?

Answer: Factors determining the magnitude of induced voltage include the number of coil turns, magnetic field strength, and speed of motion.

Question: How much heat is required to increase the temperature of 2 kg of water by 10 K?

Answer: The heat required is 84,000 J, calculated using the formula  $Q = mc\Delta T = 2 \times 4200 \times 10$ .

Question: How does a hydrogen-oxygen fuel cell work?

Answer: In a hydrogen-oxygen fuel cell, hydrogen gas is oxidized at the anode to produce protons and electrons. The protons pass through an electrolyte, while the electrons travel through an external circuit, generating electricity. At the cathode, oxygen gas reacts with the protons and electrons to form water.

Question: What are the advantages of tissue culture?

Answer: Tissue culture produces identical offspring, propagates a large number of plants quickly, and generates healthy plants in limited space.

Question: What are the benefits of using organic fertilizers in agriculture?

Answer: Organic fertilizers improve soil health, enhance biodiversity, reduce chemical input dependency, and support sustainable agricultural practices. They contribute to long-term soil fertility and environmental sustainability.

Question: What is the mass of a sodium (Na) atom in grams?

Answer: The mass of a sodium (Na) atom is  $3.819 \times 10^{-23}$  grams.

Question: What is Teflon, and how is it produced?

Answer: Teflon, or polytetrafluoroethene, is produced by the polymerization of tetrafluoroethene, resulting in long chains of repeating units of  $-\text{CF}_2-\text{CF}_2-$ .

Question: What are some methods to prevent the corrosion of iron?

Answer: Methods include applying paint, grease, or oil; coating iron with tin; and using cathodic protection.

Question: How does the sharing of electrons between nitrogen and hydrogen atoms result in the formation of an ammonia molecule?

Answer: The sharing of three pairs of electrons between a nitrogen atom (2, 5) and three hydrogen atoms results in the formation of an ammonia molecule (NH<sub>3</sub>), with each atom achieving a stable configuration.

Question: What is the role of a vacuum gauge in measuring low pressures?

Answer: A vacuum gauge measures low pressures by comparing the pressure inside a system to atmospheric pressure, often used in vacuum systems and applications.

Question: How does the force on a current-carrying conductor change with magnetic field strength?

Answer: The force increases with stronger magnetic fields, as it is directly proportional to the magnetic field strength.

Question: What is the significance of Mendel's choice of the garden pea plant for his experiments?

Answer: The garden pea plant's ease of cultivation, short generation time, and clear contrasting traits made it an ideal choice for Mendel's genetic experiments.

Question: How does a rechargeable battery differ from a primary battery?

Answer: A rechargeable battery can be recharged and used multiple times by reversing the electrochemical reactions through an external power source, while a primary battery is designed for single use and cannot be recharged.

Question: What is the displacement of a body that starts from rest and acquires a velocity of 12 m/s after moving with a constant acceleration for 4 seconds?

Answer: The displacement is calculated as:  $\text{Displacement} = \frac{1}{2} \times 12 \text{ m/s} \times 4 \text{ s} = 24 \text{ meters}$ .

Question: Describe the structure and function of chloroplasts.

Answer: Chloroplasts contain chlorophyll and are involved in photosynthesis, converting light energy into chemical energy stored in glucose, and have a double membrane structure with internal thylakoid membranes.

Question: What is the nature of the image formed by a concave mirror when the object is placed beyond the center of curvature?

Answer: The image is real, inverted, and smaller than the object, formed between the focal point and the center of curvature.

Question: Calculate the work done when a 3 N force moves an object by 1 m.

Answer: The work done is 3 Joules (J).

Question: What is the reaction between aluminum and hydrochloric acid?

Answer: Aluminum reacts with hydrochloric acid to form aluminum chloride and hydrogen gas:  $2\text{Al} + 6\text{HCl} \rightarrow 2\text{AlCl}_3 + 3\text{H}_2$ .

Question: What is the relationship between force magnitude and the moment of force in rotational motion?

Answer: The moment of force in rotational motion is directly proportional to the magnitude of the applied force. An increase in force results in a larger moment, making it easier to rotate the object.

Question: Give an example of a population.

Answer: An example of a population is the number of elephants living in Yala National Park in 2011, which was 5,879.

Question: How does the body respond to low environmental temperature?

Answer: By reducing blood supply to the skin, decreasing sweat production, erecting hairs for insulation, and generating heat through shivering.

Question: What is the relationship between liquid pressure and the depth of the liquid?

Answer: The pressure exerted by a liquid increases with the depth of the liquid because the weight of the liquid above that point increases.

Question: What is the significance of Avogadro's constant in determining the number of particles in a mole?

Answer: Avogadro's constant provides the exact number of particles (atoms, molecules, or ions) in one mole of a substance, which is  $6.022 \times 10^{23}$ , allowing for precise calculations in chemical reactions.

Question: How is the activity series of metals used in predicting reactions?

Answer: The activity series predicts which metals can displace others from solutions and their reactivity with air, water, and acids. More reactive metals displace less reactive ones.

Question: What is recrystallization?

Answer: Recrystallization is the process of dissolving an impure solid in a hot solvent and then cooling the solution to obtain pure crystals.

Question: What is the significance of the focal length in spherical mirrors?

Answer: The focal length determines the distance at which parallel rays converge (concave) or appear to diverge (convex) after reflection.

Question: How does friction affect the motion of liquids and gases?

Answer: Friction affects the motion of liquids and gases by resisting their flow, but we focus only on the frictional forces between solid bodies.

Question: How does the principle of pressure transmission apply to a hydraulic jack?

Answer: A hydraulic jack operates on the principle of pressure transmission, where a small force applied to a small piston generates pressure in the oil, which is transmitted to a larger piston, lifting the vehicle.

Question: Why is it important to use efficient electric appliances?

Answer: Using efficient electric appliances reduces energy consumption, lowers electricity bills, and minimizes environmental impact.

Question: Explain the function of a differential amplifier.

Answer: A differential amplifier amplifies the difference between two input signals while rejecting common-mode noise, providing accurate signal measurement and processing.

Question: Describe the function of the Golgi apparatus in protein modification.

Answer: The Golgi apparatus adds carbohydrates and lipids to proteins, sorts them, and packages them into vesicles for transport to their final destinations.

Question: How do different musical instruments produce unique sounds?

Answer: Unique sounds are produced by varying the waveforms, frequencies, and harmonics generated by each instrument.

Question: What is the significance of Mendel's work in the field of genetics?

Answer: Mendel's work established the foundational principles of inheritance, leading to the development of the field of genetics and our understanding of how traits are passed down through generations.

Question: Why is it important to use a non-conductive plastic cup in the electrolysis of acidulated water?

Answer: A non-conductive plastic cup prevents short circuits, ensuring that the electric current flows through the water and facilitates the electrolysis process.

Question: What is the concentration of a solution containing 0.5 mol of glucose in 500 cm<sup>3</sup> of water?

Answer: The concentration is 1 mol/dm<sup>3</sup>.

Question: Experimental determination of the heat change of the reaction between sodium hydroxide (NaOH) and hydrochloric acid (HCl) Materials required : - 50 cm<sup>3</sup> of 2 mol dm<sup>-3</sup> sodium hydroxide solution, 50 cm<sup>3</sup> of 2 mol dm<sup>-3</sup> hydrochloric acid solution, two 100 cm<sup>3</sup> beakers, a thermometer of range 0-100 °C, a polystyrene cup, a glass rod Method : - To two beakers, measure 50 cm<sup>3</sup> of the sodium hydroxide solution and 50 cm<sup>3</sup> of the hydrochloric acid solution separately using the measuring cylinder. With the thermometer, measure the initial temperatures of the two solutions. (After measuring the temperature of the solution of the base, wash the thermometer before measuring the temperature of the acid solution . Mix these two solutions in a polystyrene cup, stir with the glass rod and record the maximum temperature. How do you measure the heat change in the reaction between sodium hydroxide and hydrochloric acid in this Activity?

Answer: Mix the solutions in a polystyrene cup, stir with a glass rod, and record the maximum temperature, then calculate the heat change using the formula  $Q = mc\theta$ .

Question: How do plants perform excretion?

Answer: Plants excrete carbon dioxide during respiration and oxygen during photosynthesis through lenticels and stomata in their leaves.

Question: How does the specific heat capacity of water influence its role in the human body's temperature regulation?



Answer: Water's high specific heat capacity allows it to absorb and store large amounts of heat, helping to regulate body temperature by distributing heat throughout the body and through processes like sweating.

Question: What is the function of an operational amplifier (op-amp)?

Answer: An operational amplifier (op-amp) is an integrated circuit that amplifies the difference between two input voltages, widely used in signal processing, control systems, and analog computing.

Question: What does the slope of a velocity-time graph represent?

Answer: The slope represents the acceleration of the object.

Question: What colors of light do plants absorb during photosynthesis?

Answer: Plants absorb red and blue light of sunlight during photosynthesis.

Question: How can you observe the magnetic effect of a current?

Answer: You can observe the magnetic effect by placing a compass near a current-carrying conductor and noting the deflection of the compass needle.

Question: Explain the difference between intrinsic and extrinsic semiconductors.

Answer: Intrinsic semiconductors are pure materials with electrical properties determined by their crystal structure. Extrinsic semiconductors are doped with impurities to enhance conductivity by increasing the number of free charge carriers.

Question: What is the relative atomic mass of potassium (K)?

Answer: The relative atomic mass of potassium (K) is 39.

Question: How do organisms adapt to their environment?

Answer: Organisms adapt to their environment through various physiological, behavioral, and structural changes that enhance their survival and reproductive success.

Question: How can water conservation help address water scarcity?

Answer: Water conservation helps address water scarcity by reducing water waste, improving water use efficiency, and promoting sustainable water management practices.

Question: What are the main features of the Kingdom Animalia?

Answer: The Kingdom Animalia includes multicellular animals that are unable to produce their own food and are heterotrophic.

Question: What is the role of hydrochloric acid in food technology?

Answer: Hydrochloric acid is used to make gelatin from bony materials in food processing.

Question: What is the role of fruits and seeds in plant reproduction?

Answer: Fruits and seeds play a crucial role in plant reproduction by facilitating the dispersal and germination of new plants.

Question: How can typhoid fever be prevented?

Answer: Typhoid fever can be prevented by consuming boiled water, avoiding contaminated food, maintaining hygiene, and getting vaccinated.

Question: How is the amount of substance deposited during electrolysis calculated?

Answer: The amount of substance deposited during electrolysis is calculated using Faraday's law:  $\text{mass} = (\text{current} \times \text{time} \times \text{molar mass}) / (n \times \text{Faraday's constant})$ , where  $n$  is the number of electrons involved in the reaction.

Question: What is the relationship between wavelength and frequency in sound waves?

Answer: Wavelength and frequency are inversely related; as frequency increases, wavelength decreases, and vice versa.

Question: What is the purpose of a voltage regulator in power supplies?

Answer: A voltage regulator maintains a constant output voltage despite variations in input voltage or load conditions, ensuring stable and reliable power supply for electronic devices.

Question: How is the total resistance of resistors in series calculated?

Answer: The total resistance of resistors in series is the sum of their individual resistances, expressed as  $R_{\text{total}} = R_1 + R_2 + R_3 + \dots$ .

Question: How can the effectiveness of a catalyst be demonstrated?

Answer: By adding manganese dioxide to hydrogen peroxide and observing an increased rate of gas bubble evolution compared to a control without the catalyst.

Question: What is the formula for calculating the mass fraction of a component in a mixture?

Answer:  $\text{Mass fraction} = \text{Mass of component} / \text{Total mass of mixture}$ .

Question: How does a convex lens form a real image?

Answer: A convex lens forms a real image when light rays converge to a point on the opposite side of the lens from the object.

Question: How are non-polar covalent bonds formed?

Answer: Non-polar covalent bonds are formed when two atoms of similar or slightly different electronegativities share electrons symmetrically.

Question: What is the importance of adjusting the final volume carefully in solution preparation?

Answer: Accurate final volume ensures the correct concentration of the solution.

Question: What is the atomic lattice structure of diamond?

Answer: Diamond has a three-dimensional lattice structure where every carbon atom forms four single bonds with four other carbon atoms, making it the hardest natural substance.

Question: What is the chemical formula for ammonia?

Answer: The chemical formula for ammonia is  $\text{NH}_3$ .

Question: What are the adverse effects of using cosmetics excessively?

Answer: The adverse effects of using cosmetics excessively include headaches, vomiting, breathing difficulties, skin dryness, cracks, and an increased risk of skin cancer due to harmful ingredients like lead and mercury.

Question: What is the most abundant organic compound on earth?

Answer: Carbohydrates are the most abundant organic compound on earth.

Question: What is an energy level diagram, and how does it illustrate exothermic and endothermic reactions?

Answer: It shows the relative energy levels of reactants and products, indicating whether energy is released (exothermic) or absorbed (endothermic).

Question: What is the significance of the valence shell in chemical reactions?

Answer: The valence shell is significant in chemical reactions because it contains the electrons that are involved in forming chemical bonds, determining the reactivity and bonding behavior of the atom.

Question: How does a digital storage oscilloscope (DSO) capture and display signals?

Answer: A digital storage oscilloscope (DSO) samples electrical signals, converts them to digital data, and stores them for analysis, displaying the waveforms on a screen for detailed examination.

Question: What is the role of a volumetric flask in preparing standard solutions?

Answer: A volumetric flask ensures precise measurement of the solution's final volume for accurate concentration.

Question: What is the significance of the direction of rotation in determining the moment of force?

Answer: The direction of rotation determines whether the moment of force is classified as clockwise or anti-clockwise, influencing the net rotational effect on the object.

Question: What type of image is formed by a convex mirror?

Answer: A convex mirror forms a virtual, upright, and smaller-than-object image.

Question: What is the general trend in the solubility of ionic compounds in water?

Answer: Ionic compounds are generally soluble in water due to the attraction between the ions and the polar water molecules.

Question: How is the chyme formed in the stomach?

Answer: Chyme is formed by the mixing and breaking down of food with gastric juice, resulting in a semi-liquid mixture that moves to the small intestine.

Question: What is the chemical formula for ammonia?

Answer: The chemical formula for ammonia is  $\text{NH}_3$ .

Question: What is the result of connecting the negative terminals of two dry cells to a bulb?

Answer: Connecting the negative terminals of two dry cells to a bulb results in no potential difference across the bulb, and therefore, no current flow.

Question: What causes diarrhea and how can it be managed?

Answer: Diarrhea is caused by infections from viruses, bacteria, or parasites, leading to liquid stools and dehydration. It can be managed by consuming more water and seeking medical treatment.

Question: How is oxygen gas prepared by heating potassium nitrate?

Answer: Heating potassium nitrate decomposes it into potassium nitrite and oxygen gas:  $2\text{KNO}_3 \rightarrow 2\text{KNO}_2 + \text{O}_2$ .

Question: How is the molar mass of sodium chloride ( $\text{NaCl}$ ) calculated?

Answer: The molar mass of sodium chloride is calculated by summing the relative atomic masses of sodium and chlorine, resulting in 58.5 grams per mole.

Question: What does the equation  $Q = mc\theta$  represent in the context of heat changes in reactions?

Answer: It represents the calculation of heat change ( $Q$ ) based on mass ( $m$ ), specific heat capacity ( $c$ ), and temperature change ( $\theta$ ).

Question: What is the potential energy of a 7 kg object at a height of 3 m?

Answer: The potential energy is 210 Joules (J).

Question: What is observed when solid naphthalene melts and vaporizes?

Answer: When solid naphthalene melts and vaporizes, it changes from a solid to a liquid to a gas. On a cold surface, the vapor solidifies again, forming a thin solid layer of naphthalene, indicating a physical change.

Question: How does gravitational acceleration vary with altitude?

Answer: Gravitational acceleration decreases with altitude, causing the weight of an object to decrease as it moves to higher altitudes, while its mass remains constant.

Question: What half-reactions occur during the rusting of iron?

Answer: The half-reactions are:  $\text{Fe (s)} \rightarrow \text{Fe}^{2+} \text{ (aq)} + 2\text{e}^-$  (oxidation) and  $2\text{H}_2\text{O (l)} + \text{O}_2 \text{ (g)} + 4\text{e}^- \rightarrow 4\text{OH}^- \text{ (aq)}$  (reduction).

Question: How does an electrochemical gradient drive the production of ATP in chloroplasts?

Answer: In chloroplasts, an electrochemical gradient created by the transport of protons across the thylakoid membrane during photosynthesis drives the production of ATP through chemiosmosis, where protons flow back into the stroma through ATP synthase, generating ATP.

Question: How does pressure affect the rate of reaction for gaseous reactants?

Answer: Higher pressure increases the rate of reaction because it increases the number of collisions of reactants per unit time.

Question: What is the significance of carbon dioxide in Earth's atmosphere?

Answer: Carbon dioxide contributes to maintaining Earth's temperature, supporting the greenhouse effect, and is a crucial raw material for photosynthesis.

Question: What is the significance of the ionic lattice structure in ionic compounds?

Answer: The ionic lattice structure provides stability and strength to ionic compounds by organizing ions in a regular, repeating pattern, maximizing electrostatic attraction.

Question: How does temperature affect the solubility of gases in water?

Answer: The solubility of gases in water decreases with an increase in temperature.

Question: How do you calculate the current passing through a circuit with resistors connected in series?

Answer: The current passing through a circuit with resistors connected in series is the same through all resistors and is calculated using Ohm's Law:  $I = V/R$ , where  $V$  is the total voltage and  $R$  is the equivalent resistance.

Question: What causes AIDS, and what are its symptoms?

Answer: AIDS is caused by the Human Immunodeficiency Virus (HIV) and can be fatal. Symptoms may appear 2-15 years after infection.

Question: What is the difference between artificial and natural classification?

Answer: Artificial classification groups organisms based on observable features without considering evolutionary relationships, while natural classification considers evolutionary relationships and various biological features.

Question: How does the color and texture of a surface affect its ability to absorb or reflect thermal radiation?

Answer: Dark, rough surfaces absorb more thermal radiation, while light, shiny surfaces reflect more radiation. This affects the surface's ability to gain or lose heat through radiation.

Question: How does the resistance of a conductor depend on its material composition?

Answer: Different materials have different resistivities, which determine the resistance of the conductor. Conductors with lower resistivity have lower resistance.

Question: How does a lead-acid battery work?

Answer: A lead-acid battery consists of lead dioxide ( $\text{PbO}_2$ ) as the cathode, sponge lead ( $\text{Pb}$ ) as the anode, and sulfuric acid ( $\text{H}_2\text{SO}_4$ ) as the electrolyte. During discharge, lead dioxide and sponge lead react with sulfuric acid to produce lead sulfate ( $\text{PbSO}_4$ ) and water, generating electrical energy.

Question: What are the features of collenchyma tissue?

Answer: Collenchyma tissue consists of living cells with a cytoplasm, nucleus, central vacuole, elongated polygonal cells in cross-section, and thickened corners of the cell walls.

Question: What are the three domains of life?

Answer: The three domains of life are Archaea, Bacteria, and Eukarya.

Question: What is the purpose of using indicators in acid-base identification?

Answer: Indicators help identify whether a substance is an acid or a base by changing color in their presence.

Question: How do you achieve equilibrium in an object under the action of two equal and opposite forces?

Answer: Achieve equilibrium by ensuring that the forces have equal magnitudes, act in opposite directions, and lie along the same line of action, resulting in no net force.

Question: What is the significance of the compressibility factor in real gases?

Answer: The compressibility factor accounts for deviations of real gases from ideal behavior, providing a correction factor for accurate calculations of gas properties.

Question: Why is it important to use a non-conductive plastic cup in the electrolysis of acidulated water?

Answer: A non-conductive plastic cup prevents short circuits, ensuring that the electric current flows through the water and facilitates the electrolysis process.

Question: What safety precautions should be taken when using electric irons?

Answer: Safety precautions include using rubber slippers or mats, ensuring the iron is unplugged when not in use, and keeping the iron away from flammable materials.

Question: How does the structure of the small intestine aid in nutrient absorption?

Answer: The small intestine's long length, circular folds, villi, and microvilli increase the surface area for efficient nutrient absorption.

Question: What is the epididymis?

Answer: The epididymis is a single convoluted tube where sperms are temporarily stored after emerging from the testes.

Question: What is the role of vegetative propagation in plant reproduction?

Answer: Vegetative propagation allows for the reproduction of plants using vegetative parts such as stems, roots, and leaves, rather than seeds.

Question: Why is it important to control cooling conditions in fractional distillation?

Answer: Controlling cooling conditions ensures the efficient separation of components with close boiling points by maintaining appropriate temperatures at different levels of the fractionating column.

Question: How do you maintain equilibrium in an object under the action of more than three forces?

Answer: Maintain equilibrium by applying the forces in such a way that their resultant is zero, meaning the sum of the forces and moments balance out, resulting in no net force or moment acting on the object.

Question: How does the conductivity of an electrolyte influence the performance of an electrochemical cell?

Answer: The conductivity of an electrolyte influences the performance of an electrochemical cell by affecting ion transport and reaction rates. High conductivity ensures efficient ion migration, reducing internal resistance and improving cell efficiency and power output.

Question: What is silicosis, and how is it caused?

Answer: Silicosis is a disease caused by inhaling silicon-containing compounds, which accumulate in the alveoli and deteriorate lung tissue.

Question: How does the principle of pressure transmission apply to a hydraulic jack?

Answer: A hydraulic jack operates on the principle of pressure transmission, where a small force applied to a small piston generates pressure in the oil, which is transmitted to a larger piston, lifting the vehicle.

Question: How do you investigate the equilibrium of an object under the action of two forces using a block of wood and Newton balances?

Answer: Attach the Newton balances to the block of wood and pull in opposite directions with varying forces. The object remains in equilibrium when the forces are equal in magnitude and opposite in direction, resulting in no net movement.

Question: Explain the process of cellular respiration in mitochondria.

Answer: Cellular respiration in mitochondria involves glycolysis, the citric acid cycle, and oxidative phosphorylation, where glucose is broken down to produce ATP, carbon dioxide, and water.

Question: What is a base according to the document?

Answer: A base is a chemical compound that increases the hydroxyl ion ( $\text{OH}^-$ ) concentration in an aqueous solution.

Question: What are the principal components of a spherical mirror?

Answer: The principal components include the center of curvature (C), pole (P), and principal axis (the line joining the pole and center of curvature).

Question: What enzymes are present in pancreatic juice, and what are their functions?

Answer: Pancreatic juice contains trypsin (digests proteins), amylase (digests starch), and lipase (digests lipids), aiding in the chemical breakdown of food in the small intestine.

Question: Describe the cytoplasm.

Answer: The cytoplasm is the gelatinous liquid part of the cell that excludes organelles and contains inorganic and organic substances, maintaining the shape of the cell and housing cell organelles.

Question: What is the significance of a triple bond in a nitrogen (N<sub>2</sub>) molecule?

Answer: A triple bond in a nitrogen (N<sub>2</sub>) molecule involves the sharing of three pairs of electrons between two nitrogen atoms, resulting in a very strong and stable bond.

Question: What is the corolla?

Answer: The corolla is the whorl of petals located inner to the calyx, which protects the inner flower parts in the bud stage and attracts insects for pollination when the flower blooms.

Question: What observation is made in the leaf exposed to KOH during the CO<sub>2</sub> experiment?

Answer: The leaf exposed to KOH shows no color change with iodine solution, indicating no photosynthesis due to the absence of CO<sub>2</sub>.

Question: What is the speed of an object that travels 15 meters in 5 seconds?

Answer: Speed = 15 m / 5 s = 3 m/s.

Question: What does a horizontal line on a velocity-time graph represent?

Answer: It represents uniform velocity.

Question: What role does the magnetic field play in the operation of a bicycle dynamo?

Answer: The magnetic field interacts with the rotating coil, inducing an electromotive force that generates electrical power for the bicycle's lights.

Question: How does a ring circuit differ from a radial circuit in domestic wiring?

Answer: A ring circuit loops back to the distribution box, providing two paths for current flow, while a radial circuit extends in a single line from the distribution box to the appliances.

Question: What observation confirms that water is essential for rusting in the experiment with iron nails?

Answer: The observation that nails in the tube with anhydrous calcium chloride do not rust, while those in the tube without it do, confirms that water is essential for rusting.

Question: What are the deficiency symptoms of sodium?

Answer: Deficiency symptoms of sodium include respiratory disorders, cramps, nausea, and diarrhea.

Question: What are the potential benefits of gene therapy?

Answer: Gene therapy has the potential to treat or cure genetic disorders by replacing faulty genes with healthy ones, correcting genetic defects at



their source, and providing long-lasting or permanent therapeutic effects.

Question: What are the deficiency symptoms of zinc in plants?

Answer: Deficiency symptoms of zinc in plants include dead cells and tissues throughout the plant and extra thickness in leaves.

Question: How does velocity affect kinetic energy?

Answer: Velocity affects kinetic energy quadratically; doubling the velocity results in a fourfold increase in kinetic energy.

Question: What is the relationship between the speed of coil rotation and the output voltage of a dynamo?

Answer: The output voltage of a dynamo increases with the speed of coil rotation, as a higher speed induces a greater electromotive force.

Question: How can sexually transmitted diseases be prevented?

Answer: Sexually transmitted diseases can be prevented by avoiding risky sexual activities, using protection during intercourse, and avoiding blood transmission from infected individuals.

Question: What is the role of Newton's third law in the formation of a force couple?

Answer: Newton's third law states that for every action force, there is an equal and opposite reaction force. This principle is applied in the formation of a force couple, where the reaction force at the pivot creates the couple.

Question: Explain the process of electrolysis of aqueous sodium chloride, including the reactions at each electrode and the overall outcome.

Answer: The electrolysis of aqueous sodium chloride involves passing an electric current through a solution of sodium chloride (NaCl) using carbon electrodes. This process decomposes the compound into its constituent elements. Materials Required: A solution of sodium chloride, carbon rods, conducting wires, and a 9V battery. Method: Connect the two carbon rods to the terminals of the battery using wires. Immerse the electrodes in the aqueous sodium chloride solution. Observe the liberation of gas bubbles at the electrodes. Reactions: At the Cathode (Negative Electrode): Reduction of hydrogen ions occurs because hydrogen is below sodium in the activity series, making it easier to reduce. Reaction:  $2\text{H}^+(\text{aq}) + 2\text{e}^- \rightarrow \text{H}_2(\text{g})$  Hydrogen gas bubbles evolve at the cathode. At the Anode (Positive Electrode): Oxidation of chloride ions occurs because they have a greater tendency to oxidize. Reaction:  $2\text{Cl}^-(\text{l}) \rightarrow \text{Cl}_2(\text{g}) + 2\text{e}^-$  Chlorine gas bubbles evolve at the anode. Overall Reaction:  $2\text{H}^+(\text{aq}) + 2\text{Cl}^-(\text{aq}) \rightarrow \text{H}_2(\text{g}) + \text{Cl}_2(\text{g})$  Outcome: The sodium ions ( $\text{Na}^+$ ) and hydroxide ions ( $\text{OH}^-$ ) remain in the solution, producing sodium hydroxide (NaOH) as a by-product. This process demonstrates how electrolysis can be used to produce chlorine gas, hydrogen gas, and sodium hydroxide from aqueous sodium chloride.

Question: How does the structure of water contribute to its high specific heat capacity?

Answer: The structure of water, with hydrogen bonds between molecules, allows it to absorb and retain a large amount of heat without a significant change in temperature, contributing to its high specific heat capacity.

Question: What is the function of secretion in the nephron?

Answer: Secretion involves the transfer of materials like hydrogen ions, potassium ions, and drugs from the blood into the nephron tubules to be excreted in urine.

Question: How do you find the resultant force when two collinear forces act in opposite directions?

Answer: The resultant force is found by subtracting the smaller force from the larger force, in the direction of the larger force.

Question: What are the three domains of life?

Answer: The three domains of life are Archaea, Bacteria, and Eukarya.

Question: How does habitat fragmentation affect biodiversity?

Answer: Habitat fragmentation affects biodiversity by isolating populations, reducing genetic diversity, limiting species' ability to move and find resources, and increasing vulnerability to environmental changes and human activities.

Question: How does the structure of leaves facilitate efficient photosynthesis?

Answer: Leaves have a large surface area, thin structure, and numerous chloroplasts, maximizing light absorption and gas exchange for photosynthesis.

Question: What is the role of the centrioles in animal cells?

Answer: Centrioles play a crucial role in cell division by forming the spindle fibers that separate chromosomes during mitosis and meiosis.

Question: How do you find the displacement of an object from a velocity-time graph?

Answer: Displacement is found by calculating the area under the velocity-time graph.

Question: What is carbon footprint, and why is it important?

Answer: Carbon footprint is the amount of carbon dioxide released into the atmosphere due to the activities of an individual, organization, or community. It is important to measure and reduce carbon footprints to mitigate climate change.

Question: What is an experiment that illustrates the need for a medium for sound propagation?

Answer: An electric bell in a vacuum jar experiment shows that as air is removed, the sound becomes fainter, demonstrating that sound cannot travel through a vacuum.

Question: What is the shape of a water (H<sub>2</sub>O) molecule in three-dimensional space?

Answer: In three-dimensional space, a water (H<sub>2</sub>O) molecule assumes an angular or bent shape.

Question: How should a voltmeter be connected in a circuit?

Answer: A voltmeter should be connected in parallel with the component or points across which the potential difference is to be measured.

Question: How do atoms with high electronegativity form covalent bonds?

Answer: Atoms with high electronegativity tend to attract electrons strongly and form covalent bonds by sharing electrons with other atoms to achieve a stable electronic configuration.

Question: How does the type of electrolyte influence the products of electrolysis?

Answer: The type of electrolyte influences the products of electrolysis by determining which ions are present and available to participate in the reactions. Different electrolytes can produce different gases, metals, or other compounds.

Question: What is the role of connective tissue in the skin?

Answer: Connective tissue in the skin provides support, elasticity, and strength, helping to protect the body from external forces and maintain its shape.

Question: How does bile aid in lipid digestion?

Answer: Bile emulsifies lipids, breaking them into small droplets, increasing the surface area for digestive enzymes to act on them.

Question: How does protein intake affect kidney function?

Answer: Excessive protein intake can increase the workload on kidneys, potentially leading to kidney damage in individuals with pre-existing kidney conditions.

Question: How do Hyla tree frogs amplify their calls?

Answer: Hyla tree frogs use an inflatable balloon-like organ under their throat to amplify their calls, with sound generated by air passing through stretched membranes.

Question: How much heat is required to increase the temperature of 2 kg of iron from 25°C to 65°C?

Answer: The heat required is 36,800 J, calculated using the formula  $Q = mc\Delta T = 2 \times 460 \times (65 - 25)$ .

Question: How do plant cells utilize the central vacuole for storage?

Answer: The central vacuole stores water, nutrients, waste products, and pigments, maintaining turgor pressure and contributing to cell growth and structural integrity.

Question: What is the balanced chemical equation for the reaction between aluminum and oxygen?

Answer: The balanced chemical equation for aluminum reacting with oxygen is:  $4\text{Al} + 3\text{O}_2 \rightarrow 2\text{Al}_2\text{O}_3$ .

Question: How does the production of slaked lime from quicklime illustrate an exothermic reaction?

Answer: Adding water to quicklime releases a lot of heat:  $\text{CaO (s)} + \text{H}_2\text{O (l)} \rightarrow \text{Ca(OH)}_2 \text{ (s)}$ .

Question: What precautions should be taken when boiling a leaf in alcohol for starch testing?

Answer: Boil the leaf in alcohol in a water bath to avoid the risk of fire, as alcohol is highly flammable.

Question: How does the division of a large marble cube into smaller cubes affect its reaction with acid?

Answer: Dividing the large cube increases the total surface area, enhancing the reaction rate with acid.

Question: What method is used to examine the effect of bases on rusting?

Answer: Put the cleaned nails in separate boiling tubes, add ordinary cold water to one tube and sodium hydroxide solution to the other. Observe after one day.

Question: How does the use of renewable energy sources enhance the sustainability of electrochemical processes?

Answer: The use of renewable energy sources enhances the sustainability of electrochemical processes by providing clean and abundant energy, reducing reliance on fossil fuels, lowering carbon emissions, and enabling the development of environmentally friendly technologies.

Question: What is the effect of a convex mirror on the image of an object placed at infinity?

Answer: The image formed is virtual, upright, and significantly smaller than the object, located at the focal point behind the mirror.

Question: How does diabetes impact kidney function over time?

Answer: Diabetes can damage blood vessels in the kidneys, leading to diabetic nephropathy, reduced filtration ability, and potential kidney failure.

Question: What is the function of a proximity sensor in automation?

Answer: A proximity sensor detects the presence of objects by emitting an electromagnetic field or light beam and sensing changes when an object enters the field or reflects the light.

Question: How does the speed of a rotating coil influence the dynamo's output?

Answer: A faster rotating coil increases the rate of change of the magnetic field, generating higher voltage and more electrical power.

Question: What is the latent heat of fusion?

Answer: The latent heat of fusion is the amount of heat required to convert a unit mass of a solid into a liquid at its melting point without changing its temperature.

Question: Calculate the relative molecular mass of carbon dioxide (CO<sub>2</sub>).

Answer: The relative molecular mass of carbon dioxide is 44, calculated as 12 for carbon plus 2 x 16 for oxygen.

Question: What does Table 5.2 summarize about images formed by convex lenses?

Answer: It shows the positions, nature, and size of images at different object distances, including virtual and real images and their characteristics.

Question: How does a moving coil microphone generate electrical signals?

Answer: A moving coil microphone generates electrical signals by vibrating a coil within a magnetic field, inducing an electromotive force corresponding to sound waves.

Question: How many molecules are there in 0.2 moles of water (H<sub>2</sub>O)?

Answer: There are  $1.204 \times 10^{23}$  molecules in 0.2 moles of water, calculated as  $0.2 \times 6.022 \times 10^{23}$ .

Question: How does the force on a conductor vary with current strength?

Answer: The force increases with higher current strength, as it is directly proportional to the current in the conductor.

Question: What is the role of the nuclear envelope?

Answer: The nuclear envelope surrounds the nucleus, separating it from the cytoplasm and controlling the exchange of materials between the nucleus and the cytoplasm.

Question: What is the role of temperature in the solubility of solid solutes in liquids?

Answer: Generally, the solubility of solid solutes in liquids increases with an increase in temperature.

Question: What is the relationship between atomic radius and ionisation energy within a period?

Answer: Within a period, as atomic radius decreases, ionisation energy increases.

Question: What is the chemical formula for ammonia?

Answer: The chemical formula for ammonia is NH<sub>3</sub>.

Question: What is the relative formula mass of potassium sulfate (K<sub>2</sub>SO<sub>4</sub>)?

Answer: The relative formula mass of potassium sulfate is 174, calculated as  $2 \times 39$  for potassium, 32 for sulfur, and  $4 \times 16$  for oxygen.

Question: What happens when a moving bus suddenly stops and a passenger is not holding onto anything?

Answer: When a moving bus suddenly stops, the passenger is thrust forward due to inertia. The lower part of the body stops with the bus, but the upper part continues moving forward.

Question: What is diabetes, and what are its types?

Answer: Diabetes is a condition characterized by high blood glucose levels due to insulin deficiency (Type 1) or insulin resistance (Type 2).

Question: How does the specific heat capacity of water make it an effective coolant?

Answer: Water's high specific heat capacity allows it to absorb and store large amounts of heat with minimal temperature change, making it effective for cooling applications.

Question: How can the displacement be found using the area under the velocity-time graph?

Answer: The displacement is equal to the area under the velocity-time graph. For a constant velocity, it is calculated by multiplying the length along the x-axis (time) by the length along the y-axis (velocity).

Question: What is the function of phloem in transporting photosynthetic products?

Answer: Phloem transports sucrose, a product of glucose conversion, from the leaves to other parts of the plant for storage or use.

Question: What conclusion can be drawn from the experiment with a plastic bottle filled with water and holes at different levels?

Answer: The experiment shows that the pressure at the same level of a liquid is the same.

Question: What is the role of the plasma membrane in cells?

Answer: The plasma membrane regulates the movement of substances in and out of the cell, maintaining homeostasis and enabling communication with the external environment.

Question: What is the ozone layer?

Answer: The ozone layer is a region of the Earth's stratosphere that contains a high concentration of ozone and protects life by absorbing most of the sun's harmful ultraviolet radiation.

Question: What is the activity series, and how is it built?

Answer: The activity series ranks metals based on their reactivity with air, water, dilute acids, and salt solutions. It helps predict reaction outcomes and metal extraction methods.

Question: How do you find the gradient of a velocity-time graph?

Answer:  $\text{Gradient} = (\text{Change in velocity}) / (\text{Change in time})$ .

Question: How does changing battery terminals affect a DC motor?

Answer: Changing the battery terminals reverses the current flow, changing the direction of forces on the coil, and causing the motor to rotate in the opposite direction.

Question: What observation confirms that bases decrease the speed of rusting?

Answer: The nail in the sodium hydroxide solution rusts less than the nail in ordinary water.

Question: How do plants manage the balance between photosynthesis and respiration?

Answer: Plants adjust stomatal opening, chloroplast activity, and metabolic pathways to balance photosynthesis and respiration, optimizing energy production and usage.

Question: What is the role of an electrolyte in a lithium-ion battery?

Answer: The electrolyte in a lithium-ion battery facilitates the movement of lithium ions between the anode and cathode during charging and discharging, enabling the electrochemical reactions that store and release energy.

Question: How does reducing the mass of a vehicle affect its acceleration for a given force?

Answer: Reducing the mass of a vehicle increases its acceleration for a given force, as acceleration is inversely proportional to mass.

Question: What is the reaction between aluminum and copper sulfate solution?

Answer: Aluminum displaces copper from copper sulfate, forming aluminum sulfate and copper:  $2\text{Al} + 3\text{CuSO}_4 \rightarrow \text{Al}_2(\text{SO}_4)_3 + 3\text{Cu}$ .

Question: What components are essential for the operation of a bicycle dynamo?

Answer: Essential components of a bicycle dynamo include the rotating coil, magnetic field, mechanical connection to the tire, and electrical circuit.

Question: How does the direction of the applied force affect the velocity of an object?

Answer: The direction of the applied force determines the change in velocity. A force applied in the direction of motion increases velocity, while a force applied opposite to the direction of motion decreases velocity.

Question: What is the group number of magnesium?

Answer: Magnesium belongs to Group II.

Question: How is oxygen gas used in the production of sulfuric acid?

Answer: Oxygen gas is a raw material in the industrial production of sulfuric acid, reacting with sulfur dioxide in the contact process.

Question: How does splitting a solid reactant into smaller pieces affect its interaction with a liquid reactant?

Answer: Splitting a solid reactant into smaller pieces increases the surface area available for interaction, speeding up the reaction.

Question: What are the functions of white blood cells?

Answer: White blood cells protect the body from infections by destroying pathogens and producing antibodies.

Question: What are electrical conductors and provide examples?

Answer: Electrical conductors are materials that allow electricity to flow through them easily due to the free movement of electrons. Examples include copper, aluminum, iron, and lead.

Question: How is the focal length of a convex lens defined?

Answer: The focal length is the distance between the lens and the point where parallel rays converge after passing through the lens.

Question: What are some examples of objects that use cathodic protection?  
Answer: Examples include galvanized buckets, barbed wire, roofing sheets, and GI pipes.

Question: How does the orientation of the coil affect the output of an alternating current dynamo?  
Answer: The coil's orientation affects the output, with maximum voltage generated when the coil is perpendicular to the magnetic field lines.

Question: How does the difference in densities affect the separation of components in mechanical methods?  
Answer: Components with different densities can be separated by methods such as winnowing, where lighter components are separated from heavier ones.

Question: What is the role of the cytoskeleton in vesicle transport?  
Answer: The cytoskeleton provides tracks for motor proteins to transport vesicles within the cell, ensuring the proper distribution of proteins, lipids, and other molecules.

Question: How can mixtures be classified based on their uniformity?  
Answer: Mixtures can be classified as homogeneous (uniform distribution) or heterogeneous (non-uniform distribution).

Question: What are the three factors that affect solubility mentioned in the document?  
Answer: The three factors are temperature, the nature of the solute, and the nature of the solvent.

Question: How are ammonium compounds converted to nitrites and nitrates in the nitrogen cycle?  
Answer: Nitrifying bacteria, such as Nitrosomonas, convert ammonium compounds into nitrites, and Nitrobacter bacteria convert nitrites into nitrates.

Question: What are the reproductive structures of fungi?  
Answer: Fungi reproduce through structures like spores, which can be observed under a microscope.

Question: How is zinc used to demonstrate a single displacement reaction with hydrochloric acid?  
Answer: Zinc displaces hydrogen from hydrochloric acid, forming zinc chloride and hydrogen gas:  $\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$ .

Question: What are flowering plants?  
Answer: Flowering plants are plants that produce flowers and have seeds covered by a fruit. They are also known as angiosperms.

Question: Why are LED bulbs considered more advantageous despite their high initial cost?  
Answer: LED bulbs are more advantageous due to their higher efficiency, lower power consumption, and significantly longer lifespan compared to other light sources.



Question: How does the structure of covalent compounds affect their melting and boiling points?

Answer: The structure of covalent compounds, with weaker intermolecular forces compared to ionic bonds, results in generally lower melting and boiling points.

Question: How do you investigate the dependence of the moment on the magnitude of the force?

Answer: To investigate the dependence of the moment on the magnitude of the force, apply different forces at the same perpendicular distance from the axis of rotation and measure the resulting moments.

Question: How does collenchyma tissue provide support to herbaceous plants?

Answer: Collenchyma tissue absorbs water into vacuoles, becoming turgid and providing mechanical support to herbaceous plants before wood formation.

Question: What is the role of hormones in living organisms?

Answer: Hormones act as chemical messengers that regulate various physiological processes, including growth, development, metabolism, and reproduction.

Question: How does solubility affect the environmental fate of pollutants?

Answer: Solubility affects the environmental fate of pollutants by determining their mobility, bioavailability, and potential for bioaccumulation and degradation.

Question: What is the role of a slinky in demonstrating wave motion?

Answer: A slinky can be used to demonstrate both transverse and longitudinal waves by shaking it to create visible wave patterns.

Question: How does the presence of solute particles affect the boiling point of a solution?

Answer: The presence of solute particles raises the boiling point of a solution, a phenomenon known as boiling point elevation.

Question: How do you find the center of gravity of a lamina using the method described in Activity ?

Answer: To find the center of gravity of a lamina, hang it from three different points and mark the vertical lines that go along the string each time. The point where these lines intersect is the center of gravity, where the weight of the lamina acts.

Question: What is the significance of the high specific heat capacity of water in regulating climate?

Answer: Water's high specific heat capacity moderates temperature fluctuations, contributing to stable and mild climates by absorbing and releasing heat with minimal temperature change.

Question: How is the chemical formula of methane written?

Answer: The chemical formula of methane is CH<sub>4</sub>, indicating one carbon atom and four hydrogen atoms.

Question: What is the significance of the angular shape of the water molecule?

Answer: The angular shape of the water molecule, caused by the two lone pairs on the oxygen atom, creates a dipole moment, making water a polar molecule with unique properties such as high surface tension and solubility.

Question: What is the purpose of a rectifier diode in power supplies?

Answer: A rectifier diode converts AC to DC by allowing current to flow in only one direction, providing the necessary DC voltage for electronic devices.

Question: How is oxygen gas prepared from hydrogen peroxide?

Answer: Oxygen gas is prepared by the decomposition of hydrogen peroxide, producing water and oxygen:  $2\text{H}_2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{O}_2$ .

Question: What do the fingers represent in Fleming's left-hand rule?

Answer: In Fleming's left-hand rule, the thumb represents the direction of force, the index finger represents the direction of the magnetic field, and the middle finger represents the direction of current flow.

Question: What is the relationship between surface area and reaction rate?

Answer: A larger surface area increases the rate of reaction by providing more sites for reactant collisions.

Question: What is the effect of applying a force opposite to the direction of motion?

Answer: Applying a force opposite to the direction of motion results in deceleration, causing the object to slow down.

Question: What is the function of a signal booster in wireless communication?

Answer: A signal booster amplifies weak signals in wireless communication systems, extending the range and improving the quality of transmissions for better reception.

Question: How do you investigate the effect of force magnitude on the moment using a stick and Newton balance?

Answer: Investigate the effect by applying different magnitudes of force at a constant perpendicular distance from the axis of rotation and measuring the resulting moments to observe the relationship.

Question: Describe the process of electrochemical water splitting and its significance.

Answer: Electrochemical water splitting involves the use of electricity to split water into hydrogen and oxygen gases. It is significant for producing clean hydrogen fuel and oxygen, providing a sustainable energy solution and reducing dependence on fossil fuels.

Question: What are the stages of bone healing after a fracture?

Answer: The stages include inflammation, soft callus formation, hard callus formation, and bone remodeling.

Question: How do hybrid and electric cars utilize DC motors?

Answer: Hybrid and electric cars use DC motors to convert electrical energy into mechanical energy, driving the vehicle's wheels.

Question: Why do noble gases like helium, neon, and argon not form compounds under normal conditions?

Answer: Noble gases do not form compounds under normal conditions because they have a stable electronic configuration with eight electrons in their valence shells, making them chemically inert.

Question: How does the activity series help prevent metal corrosion?

Answer: The activity series helps in selecting more reactive metals to coat or alloy with less reactive metals, preventing corrosion through sacrificial protection.

Question: What is biological pest control?

Answer: Biological pest control involves using another plant, animal, or microorganism that does not harm the cultivation to destroy pests. For example, the coconut caterpillar *Promecotheca cumingii* was successfully controlled using a larval parasitoid *Dimokia javanica*.

Question: Explain the concept of uniform motion.

Answer: Uniform motion occurs when an object travels equal distances in equal time intervals, maintaining a constant speed.

Question: What is the work done in lifting a 4 kg object to a height of 5 m?

Answer: The work done is 200 Joules (J).

Question: What is a typical cell?

Answer: A typical cell is a conceptual model that includes all the organelles found in cells, though such cells do not exist in reality.

Question: Describe the energy transformation in a swinging pendulum.

Answer: In a swinging pendulum, potential energy is converted into kinetic energy as it moves downward, and kinetic energy is converted back into potential energy as it moves upward.

Question: What is the main elemental composition of carbohydrates?

Answer: The main elemental composition of carbohydrates is Carbon (C), Hydrogen (H), and Oxygen (O).

Question: How do proteins contribute to the immune system?

Answer: Proteins function as antibodies, which help protect the body against pathogens by recognizing and neutralizing foreign invaders.

Question: What are the implications of genetic testing for inherited disorders?

Answer: Genetic testing for inherited disorders can provide information about an individual's risk of developing certain diseases, guide medical management and treatment decisions, and inform family planning and

reproductive choices.

Question: What is electronegativity?

Answer: Electronegativity is the tendency of an atom to attract electrons of a chemical bond towards itself.

Question: How does the efficiency of electric appliances impact energy consumption?

Answer: Efficient electric appliances convert more of the supplied energy into useful work, reducing overall energy consumption and lowering electricity bills.

Question: Calculate the molar mass of sulfuric acid ( $\text{H}_2\text{SO}_4$ ).

Answer: The molar mass of sulfuric acid is 98 grams per mole, calculated as  $2 \times 1$  for hydrogen, 32 for sulfur, and  $4 \times 16$  for oxygen.

Question: Explain the process of electrolysis of aqueous sodium chloride, including the industrial applications and the chemical reactions at the electrodes.

Answer: Electrolysis of aqueous sodium chloride (brine) produces chlorine gas, hydrogen gas, and sodium hydroxide, all of which are industrially valuable. Materials Required: Brine solution (aqueous  $\text{NaCl}$ ), carbon electrodes, power supply. Method: Connect the carbon electrodes to the power supply. Immerse the electrodes in the brine solution. Turn on the power supply and observe the reactions at the electrodes. Reactions at the Electrodes: At the Cathode (Negative Electrode): Reduction of hydrogen ions:  $2\text{H}^+(\text{aq}) + 2\text{e}^- \rightarrow \text{H}_2(\text{g})$  Hydrogen gas is evolved at the cathode. At the Anode (Positive Electrode): Oxidation of chloride ions:  $2\text{Cl}^-(\text{l}) \rightarrow \text{Cl}_2(\text{g}) + 2\text{e}^-$  Chlorine gas is evolved at the anode. Overall Reaction:  $2\text{NaCl}(\text{aq}) + 2\text{H}_2\text{O}(\text{l}) \rightarrow \text{H}_2(\text{g}) + \text{Cl}_2(\text{g}) + 2\text{NaOH}(\text{aq})$  Industrial Applications: Chlorine Gas: Used in the production of PVC, disinfectants, and other chemicals. Hydrogen Gas: Used in hydrogenation processes, fuel cells, and as a clean fuel. Sodium Hydroxide: Used in soap making, paper manufacturing, and various chemical processes.

Question: Describe the principles and applications of electrochemical cells, including their components and how they generate electricity.

Answer: Electrochemical cells are devices that convert chemical energy into electrical energy through redox reactions. They are commonly used in everyday devices such as toy cars, electric torches, calculators, computers, and mobile phones. The fundamental components and principles of these cells are as follows: Components: Electrodes: Two conductive materials, typically metals, that serve as the sites for oxidation and reduction reactions. Electrolyte: A solution containing ions that facilitates the movement of electrons between the electrodes. External Circuit: A pathway that allows electrons to flow from one electrode to the other, generating an electric current. Principle: In an electrochemical cell, chemical reactions at the electrodes create a flow of electrons through an external circuit. This process can be demonstrated through the following experiment: Experiment: Materials Required: Small beaker, dilute sulfuric acid, zinc metal sheet. Method: Add dilute sulfuric acid to the beaker. Place a zinc metal strip in the beaker, partially immersed in the acid. Observe gas bubbles near the zinc strip and the gradual dissolution of the zinc.

Observations: Zinc atoms lose electrons and become zinc ions ( $\text{Zn}^{2+}$ ), accumulating electrons on the zinc strip. Sulfuric acid dissociates into hydrogen ions ( $\text{H}^+$ ) and sulfate ions ( $\text{SO}_4^{2-}$ ). Hydrogen ions gain electrons from the zinc strip, forming hydrogen gas ( $\text{H}_2$ ). Reactions: Oxidation at the zinc strip:  $\text{Zn(s)} \rightarrow \text{Zn}^{2+}(\text{aq}) + 2\text{e}^-$  Reduction at the hydrogen ions:  $2\text{H}^+(\text{aq}) + 2\text{e}^- \rightarrow \text{H}_2(\text{g})$  Combining these half-reactions, the overall cell reaction is:  $\text{Zn(s)} + 2\text{H}^+(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{H}_2(\text{g})$  Applications: Electrochemical cells are used in various applications, from small batteries in portable devices to large batteries for starting vehicles. They are also essential in industrial processes for electroplating and metal extraction.

Question: What is the speed of light in water compared to air?

Answer: The speed of light in water is 225,000 km/s, slower than in air, which is 300,000 km/s.

Question: What is the kinetic energy of a 5 kg object moving at 2 m/s?

Answer: The kinetic energy is 10 Joules (J).

Question: How is oxygen gas prepared from hydrogen peroxide?

Answer: Oxygen gas is prepared by the decomposition of hydrogen peroxide, producing water and oxygen:  $2\text{H}_2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{O}_2$ .

Question: How does the thermal conductivity of a material influence its use in cooking utensils?

Answer: Materials with high thermal conductivity, like metals, are used in cooking utensils because they transfer heat efficiently, ensuring even cooking and quick heating.

Question: What are the applications of electrochemical sensors in environmental monitoring?

Answer: Electrochemical sensors in environmental monitoring detect pollutants like heavy metals, gases, and organic compounds, providing real-time data on air, water, and soil quality, essential for regulatory compliance and environmental protection.

Question: How does the conductivity of an electrolyte influence the performance of an electrochemical cell?

Answer: The conductivity of an electrolyte influences the performance of an electrochemical cell by affecting ion transport and reaction rates. High conductivity ensures efficient ion migration, reducing internal resistance and improving cell efficiency and power output.

Question: What are the conditions for equilibrium in an object under the action of three non-parallel coplanar forces?

Answer: The three forces must be coplanar, their lines of action must intersect at a common point, and the resultant of any two forces must be equal in magnitude and opposite in direction to the third force.

Question: How is aerial layering performed?

Answer: Aerial layering involves removing a ring of bark from a twig high above the ground, placing a mixture of compost and coir dust around the area, and tying it with polythene until roots develop.

Question: What is the significance of the extracellular matrix in tissue organization?

Answer: The extracellular matrix provides structural support, facilitates cell adhesion, and regulates intercellular communication, playing a crucial role in tissue organization and function.

Question: How does the accumulation of heavy metals in the environment affect wildlife?

Answer: The accumulation of heavy metals in the environment affects wildlife by causing toxicity, bioaccumulation in the food chain, and harmful effects on reproduction, growth, and survival.

Question: What are the deficiency symptoms of phosphorous?

Answer: Deficiency symptoms of phosphorous include weakening of bones and becoming fragile.

Question: What is the significance of the electron microscopic view of a chloroplast?

Answer: The electron microscopic view of a chloroplast shows the structure of chloroplasts, which contain chlorophyll and are the sites of photosynthesis in plant cells.

Question: What is the specific heat capacity of water used in the calculation for the reaction between vinegar and lime water?

Answer:  $4200 \text{ J kg}^{-1}\text{C}^{-1}$ .

Question: What forms the basis for the formation of a large number of words in the English alphabet?

Answer: The combination of the 26 letters in the English alphabet forms the basis for the formation of a large number of words.

Question: How do geneticists predict the outcomes of genetic crosses?

Answer: Geneticists use Punnett squares and probability calculations to predict the outcomes of genetic crosses, estimating the likelihood of different genotypes and phenotypes in offspring.

Question: What is momentum?

Answer: Momentum is the product of an object's mass and velocity and is a measure of how difficult it is to stop the object.

Question: What is the role of carbon brushes in an alternating current dynamo?

Answer: Carbon brushes maintain contact with the rotating brushing rings, allowing current to flow to the external circuit without wearing out quickly.

Question: What is selective reabsorption in the nephron?

Answer: Selective reabsorption occurs as glomerular filtrate moves along the nephron, where essential substances like water, glucose, and amino acids are reabsorbed into the blood.

Question: What is the significance of using carbon electrodes in the electrolysis of aqueous sodium chloride?

Answer: Carbon electrodes are inert and ensure that only the desired ions are involved in the electrolysis, preventing contamination.

Question: How does the body maintain pH balance?

Answer: The body maintains pH balance through buffer systems, respiratory regulation of CO<sub>2</sub>, and renal regulation of hydrogen and bicarbonate ions.

Question: What are the properties of salts?

Answer: Salts are crystalline solids, usually dissolve in water, and have high melting and boiling points.

Question: What is hypertension, and how can it be managed?

Answer: Hypertension is high blood pressure, managed by reducing salt and saturated fat intake, avoiding smoking and alcohol, managing stress, and maintaining a healthy weight.

Question: What is the significance of electron sharing in the formation of heteroatomic molecules?

Answer: Electron sharing allows atoms of different elements to combine and form stable heteroatomic molecules with unique chemical properties and functions.

Question: What is the Biurete test for proteins?

Answer: The Biurete test involves grinding dhal or egg white into a solution, adding sodium hydroxide, and then adding copper sulfate to observe a purple color change.

Question: What is a heterogeneous mixture?

Answer: A heterogeneous mixture is one in which the components can be distinguished from one another and the physical properties such as color, transparency, and density are different from place to place.

Question: How are hydrocarbons classified based on their structure?

Answer: Hydrocarbons are classified into alkanes, alkenes, and alkynes based on the type of bonds between carbon atoms.

Question: What is the potential difference across a bulb connected to two dry cells with a total voltage of 3 V and a resistance of 6  $\Omega$ ?

Answer: The potential difference is 3 V, assuming the power supply voltage is the same as the voltage across the bulb.

Question: Explain the relationship between voltage, current, and power in an electric circuit.

Answer: Power (P) in an electric circuit is the product of voltage (V) and current (I), expressed as  $P = VI$ . Higher voltage or current results in higher power output.

Question: What are the environmental impacts of industrial waste disposal?

Answer: Industrial waste disposal contaminates soil and water, harms wildlife, and poses health risks to humans. It contributes to long-term environmental degradation and pollution.

Question: What is lateral inversion in the context of plane mirrors?

Answer: Lateral inversion refers to the reversal of the left and right sides in the image formed by a plane mirror.

Question: What protects the brain and spinal cord?

Answer: The skull protects the brain, and the vertebral column protects the spinal cord. They are also covered by meninges and cerebrospinal fluid.

Question: What is the reaction between calcium carbonate and hydrochloric acid?

Answer: Calcium carbonate reacts with hydrochloric acid to form calcium chloride, water, and carbon dioxide:  $\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$ .

Question: What is the role of bone tissue?

Answer: Bone tissue provides structural support, protection to internal organs, and serves as a site for blood cell formation (hematopoiesis) in the bone marrow.

Question: What is grafting?

Answer: Grafting involves connecting a twig or a bud (scion) of one plant to the rooted part (stock) of another plant of the same or closely related species. The stock and scion are fused together by their cambium tissues.

Question: What is the resultant force of two forces applied along the same line but in opposite directions?

Answer: The resultant force of two forces applied along the same line but in opposite directions is the difference between their magnitudes, acting in the direction of the larger force.

Question: What is the charge of a proton?

Answer: A proton has a positive charge.

Question: What is air pollution?

Answer: Air pollution is the presence of harmful substances in the air, affecting the health of living organisms and the environment.

Question: What is the significance of the right-hand grip rule in electromagnetism?

Answer: The rule helps visualize and determine the field direction around a current-carrying conductor, aiding in understanding electromagnetic effects.

Question: How does atmospheric pressure affect the flight of airplanes?

Answer: Atmospheric pressure affects the flight of airplanes by influencing lift, drag, and engine performance. Pilots must adjust for pressure changes to maintain stable flight.

Question: What is the role of the soft iron core in a transformer?

Answer: The soft iron core links the magnetic field between the primary and secondary coils, enhancing the efficiency of the transformer.

Question: What is the momentum of a 10 kg object moving at 6 m/s?

Answer: The momentum is  $p = m \times v = 10 \times 6 = 60$  kg m/s.



Question: What factors contribute to the efficiency of modern electric cookers?

Answer: Factors contributing to the efficiency of modern electric cookers include better heat transfer, reduced heat loss, and advanced technologies like induction heating.

Question: What is the function of a commutator in a DC motor?

Answer: The commutator in a DC motor consists of two metallic split rings that connect the ends of the coil to an external circuit. It ensures the current flows in the correct direction to maintain the motor's rotation.

Question: Explain the difference between conductors, insulators, and semiconductors, including examples and their electrical properties.

Answer: Conductors, insulators, and semiconductors are materials classified based on their ability to conduct electricity. Conductors:

Properties: Conductors have free electrons that can move easily through the material, allowing electricity to flow. These free electrons are usually found in the outer shells of the atoms in the material and are not tightly bound to the nucleus. Examples: Common conductors include metals like copper, aluminum, iron, and lead. Mixed conductors such as brass, nichrome, and manganin also exhibit good electrical conductivity.

Applications: Conductors are widely used in electrical wiring, components of electronic devices, and transmission of electric power. Insulators:

Properties: Insulators have very few free electrons because the electrons are tightly bound to the atoms due to strong covalent bonds. This restricts the flow of electricity. Examples: Insulating materials include ebonite, polythene, plastic, dry wood, asbestos, and glass. Applications: Insulators are used to coat or separate conductors to prevent accidental contact and to provide protection against electric shocks. Semiconductors: Properties:

Semiconductors have electrical properties between those of conductors and insulators. They can conduct a small amount of electricity. Their conductivity increases with temperature as thermal energy breaks the covalent bonds, releasing electrons. Examples: Silicon (Si) and germanium (Ge) are common semiconductors. In their crystalline form, they have four electrons in their outermost shell, forming covalent bonds with four neighboring atoms to create a stable lattice structure. Applications: Semiconductors are essential in the manufacturing of electronic devices such as diodes, transistors, and integrated circuits.

Question: What is the importance of the Calvin cycle in photosynthesis?

Answer: The Calvin cycle uses ATP and NADPH from light-dependent reactions to fix CO<sub>2</sub> and produce glucose, completing the photosynthesis process.

Question: How are elements in the Periodic Table arranged?

Answer: Elements in the Periodic Table are arranged in ascending order of their atomic numbers.

Question: How does a photodiode convert light into electrical current?

Answer: A photodiode generates electron-hole pairs when exposed to light, creating a current proportional to the light intensity, used in light detection and solar energy applications.

Question: How do you calculate the average velocity of an object that has traveled 40 meters in 8 seconds?

Answer: Average velocity =  $40 \text{ m} / 8 \text{ s} = 5 \text{ m/s}$ .

Question: Calculate the relative molecular mass of carbon dioxide (CO<sub>2</sub>).

Answer: The relative molecular mass of carbon dioxide is 44, calculated as 12 for carbon plus 2 x 16 for oxygen.

Question: How does water contribute to the respiration of aquatic organisms?

Answer: Water is important in the respiration of aquatic organisms as Oxygen (O<sub>2</sub>) is soluble in water.

Question: How is the resultant force of two parallel forces acting in the same direction found?

Answer: The resultant force is found by adding the magnitudes of the two forces.

Question: Describe the equilibrium of a rod resting on two supports.

Answer: The rod is in equilibrium because the weight of the rod is balanced by the perpendicular reaction forces exerted by the supports. The forces are coplanar and parallel, and their magnitudes add up to equal the weight of the rod.

Question: How do geneticists use twin studies to understand the heritability of traits?

Answer: Geneticists use twin studies to compare the similarities and differences between monozygotic (identical) and dizygotic (fraternal) twins, helping to estimate the genetic and environmental contributions to the heritability of traits.

Question: What is the magnitude and direction of the resultant force if two collinear forces of 10 N and 6 N act in opposite directions?

Answer: The magnitude of the resultant force is 4 N in the direction of the 10 N force.

Question: What is the significance of the vertical line passing through the center of gravity in maintaining equilibrium?

Answer: The vertical line passing through the center of gravity indicates the line of action of the weight. For equilibrium, the lines of action of other forces must intersect this vertical line and lie in the same plane.

Question: What is the effect of solubility on the performance of cleaning agents?

Answer: Solubility affects the performance of cleaning agents by influencing their ability to dissolve and remove dirt, grease, and other contaminants from surfaces.

Question: How do hydrogen bonds influence the properties of water as a solvent?

Answer: Hydrogen bonds influence the properties of water as a solvent by allowing water molecules to surround and interact with various solutes,

breaking ionic and molecular bonds and facilitating dissolution.

Question: How do catalysts affect the activation energy of a reaction?

Answer: Catalysts lower the activation energy, making it easier for reactant particles to collide and react, thereby increasing the reaction rate.

Question: Name some common conductors.

Answer: Common conductors include metals such as copper, aluminum, and iron.

Question: What is the relationship between mass and weight in different gravitational fields?

Answer: Mass remains constant, but weight varies depending on the gravitational acceleration of the field. An object weighs more in a stronger gravitational field and less in a weaker gravitational field.

Question: How does temperature affect the kinetic energy of reactants?

Answer: Higher temperatures increase the kinetic energy of reactants, resulting in more frequent and energetic collisions, and a faster reaction rate.

Question: What is the reaction between sodium hydroxide and hydrochloric acid in aqueous solution?

Answer:  $\text{HCl (aq)} + \text{NaOH (aq)} \rightarrow \text{NaCl (aq)} + \text{H}_2\text{O (l)}$ .

Question: What is meant by the turning effect of a force?

Answer: The turning effect of a force refers to the tendency of an object to rotate around an axis due to the application of a force at a certain distance from the axis.

Question: What is the role of the cytoskeleton in vesicle transport?

Answer: The cytoskeleton provides tracks for motor proteins to transport vesicles within the cell, ensuring the proper distribution of proteins, lipids, and other molecules.

Question: What is the function of a pre-adjustment resistor?

Answer: A pre-adjustment resistor is a type of variable resistor used to make fine adjustments to the resistance value in electronic circuits for calibration and tuning purposes.

Question: Why is it difficult to stop a moving vehicle with high momentum?

Answer: It is difficult to stop a moving vehicle with high momentum because it has a large mass and velocity, requiring a significant force to reduce its momentum to zero.

Question: Give an example of calculating momentum.

Answer: If a body of mass 2000 kg is moving at a velocity of 20 m/s, its momentum is  $p = 2000 \times 20 = 40000 \text{ kg m/s}$ .

Question: What are some examples of monocots and their features?

Answer: Examples of monocots include paddy, grass, and arecanut. They have parallel venation, trimerous flowers, and no secondary growth.

Question: What is the significance of water in living organisms?

Answer: Water provides a medium for bio-chemical reactions, transportation of nutrients, removal of waste, and maintaining body temperature.

Question: How is acceleration related to force and mass?

Answer: Acceleration is directly proportional to the force applied and inversely proportional to the mass of the object, as described by Newton's second law ( $a = F/m$ ).

Question: What is the significance of the magnetic field in a transformer?

Answer: The magnetic field links the primary and secondary coils, allowing for the transfer of energy through electromagnetic induction.

Question: What is the difference between genotype and phenotype?

Answer: Genotype is the genetic makeup of an organism, while phenotype is the observable expression of traits determined by the genotype.

Question: What are some examples of organisms in the Domain Archaea?

Answer: Examples of organisms in the Domain Archaea include Methanogens and Halophiles.

Question: What is the difference between a cation and an anion?

Answer: A cation is a positively charged ion formed by the loss of electrons, while an anion is a negatively charged ion formed by the gain of electrons.

Question: What are the key features of Echinoderms?

Answer: Echinoderms are marine, triploblastic, coelomic organisms with bodies separated into 5 radial arms, a sharp spiny body covering, a water vascular system, tube feet for locomotion and respiration, and penta-radial symmetry.

Question: How is electrochemical corrosion protection achieved using sacrificial anodes?

Answer: Electrochemical corrosion protection using sacrificial anodes involves attaching a more reactive metal (sacrificial anode) to the metal structure to be protected. The sacrificial anode corrodes preferentially, protecting the main structure from corrosion.

Question: What is the function of the chloroplast in photosynthesis?

Answer: The chloroplast contains chlorophyll and other pigments that capture light energy, facilitating the conversion of carbon dioxide and water into glucose and oxygen during photosynthesis.

Question: What is the effect of surface area on the limiting frictional force?

Answer: Surface area does not affect the limiting frictional force. The force remains the same regardless of the contact surface area.

Question: What is the significance of the perpendicular distance in the moment of a couple of forces?

Answer: The perpendicular distance in the moment of a couple of forces determines the magnitude of the moment. A greater distance results in a larger moment for the same force, enhancing the rotational effect.

Question: How does the reaction of iron with hydrochloric acid compare to that of zinc?

Answer: Iron reacts slowly with hydrochloric acid, forming iron chloride and hydrogen gas, while zinc reacts more vigorously, forming zinc chloride and hydrogen gas:  $\text{Fe} + 2\text{HCl} \rightarrow \text{FeCl}_2 + \text{H}_2$ ;  $\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$ .

Question: How do alkali metals react with water?

Answer: Alkali metals react vigorously with water to produce a hydroxide and hydrogen gas.

Question: How does the release of nitrous oxide ( $\text{N}_2\text{O}$ ) impact climate change?

Answer: Nitrous oxide is a potent greenhouse gas that traps heat in the atmosphere, contributing to global warming. It is released from agricultural activities, fossil fuel combustion, and industrial processes.

Question: How does water pollution affect aquatic ecosystems?

Answer: Water pollution harms aquatic organisms, disrupts reproductive processes, reduces biodiversity, and degrades water quality. It poses significant threats to the health and stability of aquatic ecosystems.

Question: How do you convert a temperature from Kelvin to Celsius?

Answer: To convert a temperature from Kelvin to Celsius, subtract 273 from the Kelvin temperature.

Question: What are the features of gymnosperms?

Answer: Gymnosperms have true tissue differentiation, possess vascular tissues, reproduce sexually by seeds, and are autotrophic and photosynthetic.

Question: How does genetic engineering improve the nutritional content of crops?

Answer: Genetic engineering improves the nutritional content of crops by introducing genes that enhance the production of vitamins, minerals, and other essential nutrients, creating biofortified crops that address nutrient deficiencies in populations.

Question: How does the boiling point of a liquid affect its separation in fractional distillation?

Answer: Components with lower boiling points vaporize first and are separated earlier in the distillation process, while those with higher boiling points are separated later.

Question: What activity demonstrates the formation of real images by convex lenses?

Answer: Holding a convex lens towards a window and adjusting the distance to a screen until a clear, inverted image of the scene outside is formed.

Question: What are the two types of mixtures based on the distribution of components?

Answer: The two types are homogeneous mixtures, where the components are uniformly distributed, and heterogeneous mixtures, where the components are not uniformly distributed.

Question: What is the significance of the direction of rotation in determining the moment of force?

Answer: The direction of rotation determines whether the moment of force is classified as clockwise or anti-clockwise, influencing the net rotational effect on the object.

Question: How do water waves demonstrate the propagation of energy?

Answer: Water waves show energy transmission as the disturbance caused by an object like a pebble spreads over the water surface, causing ripples without moving the water particles along with the wave.

Question: What is the significance of the electromagnetic spectrum in modern technology?

Answer: The electromagnetic spectrum is crucial for various technologies, including communication, medical imaging, remote sensing, and astronomy.

Question: How is the Kingdom Plantae divided?

Answer: The Kingdom Plantae is divided into flowering and non-flowering plants.

Question: How do sound waves interact with different materials?

Answer: Sound waves can be absorbed, reflected, or transmitted depending on the material's properties and the frequency of the waves.

Question: Describe the reaction of magnesium with hot water.

Answer: Magnesium reacts with hot water to form magnesium hydroxide and hydrogen gas:  $\text{Mg} + 2\text{H}_2\text{O} \rightarrow \text{Mg}(\text{OH})_2 + \text{H}_2$ .

Question: Describe the principle of electromagnetic induction and its application in generating electricity.

Answer: Electromagnetic induction is the process of generating an electromotive force (emf) across a conductor placed in a changing magnetic field or moving relative to a magnetic field. This principle was first discovered by Michael Faraday and is governed by Faraday's Law of Induction. Principle: When a conductor such as a coil of wire is moved through a magnetic field, or when the magnetic field around the conductor changes, an emf is induced in the conductor. If the conductor forms a closed circuit, this emf causes a current to flow. The magnitude of the induced emf is proportional to the rate of change of the magnetic flux through the conductor. Application in Generating Electricity: Alternating Current (AC) Dynamo: An AC dynamo generates alternating current by rotating a coil within a magnetic field. The coil, connected to brushing rings, rotates, causing the magnetic flux through the coil to change periodically. As the coil rotates, the magnetic flux linkage changes, inducing an emf. The direction of the induced current alternates with each half turn of the coil, producing an AC voltage. Bicycle Dynamo: A bicycle dynamo uses the rotation of the bicycle tire to spin a magnet inside a coil, inducing an emf that generates electricity to power lights. Electric

Generators: Large-scale power generation uses similar principles, with turbines (driven by steam, water, or wind) rotating coils within magnetic fields to produce electricity. Electromagnetic induction is fundamental to modern electricity generation, enabling the conversion of mechanical energy into electrical energy for widespread use.

Question: How are components identified in paper chromatography?

Answer: By observing the separated bands of different colors on the paper strip, indicating different components.

Question: How can the knowledge of exothermic and endothermic reactions be used in everyday life?

Answer: It can be applied in activities like cooking, heating, cooling, and understanding natural processes like respiration and photosynthesis

Question: Why is it important to understand the factors influencing reaction rates?

Answer: Understanding these factors helps optimize chemical reactions for industrial, laboratory, and everyday applications.

Question: What is the force required to accelerate a 4 kg object at 5 m/s<sup>2</sup>?

Answer: The force required is  $F=ma=4\times5=20$  N.

Question: How does the curvature of a mirror affect its focal length?

Answer: The curvature of the mirror determines the focal length, with more curved mirrors having shorter focal lengths.

Question: How do mutations contribute to genetic variation?

Answer: Mutations introduce new genetic variations by altering DNA sequences. These variations can lead to new traits, some of which may provide a survival advantage.

Question: Calculate the energy consumption of a 1500W water heater used for 30 minutes daily over a month.

Answer: The energy consumption is  $(1500\text{W} \times 0.5 \text{ hours} \times 30 \text{ days}) / 1000 = 22.5 \text{ kWh}$ .

Question: Define nutrition in the context of living organisms.

Answer: Nutrition is the process by which organisms obtain energy and materials to maintain life. This energy is needed for cell growth and to repair worn-out structures.

Question: What instrument is used to measure electric current?

Answer: An ammeter is used to measure electric current.

Question: How does the induced voltage in a coil vary with time?

Answer: The induced voltage in a coil varies sinusoidally with time as the coil rotates in the magnetic field, reaching maximum values when the coil is horizontal and zero when vertical.

Question: How does the magnetic field around a solenoid differ from that around a straight conductor?

Answer: The field inside a solenoid is uniform and parallel, while the field around a straight conductor forms concentric circles.

Question: How does ionisation energy vary across a period?

Answer: Ionisation energy increases from left to right across a period.

Question: What is the frequency range of human hearing?

Answer: The frequency range of human hearing is typically from 20 Hz to 20,000 Hz.

Question: How do you balance a uniform rod with different weights using the principle of moments?

Answer: Balance the rod by adjusting the positions and magnitudes of the weights such that the moments on either side of the pivot are equal, resulting in equilibrium.

Question: Explain the decomposition reaction of potassium permanganate when heated.

Answer: When potassium permanganate is heated, it decomposes to form potassium manganate, manganese dioxide, and oxygen gas:  $2\text{KMnO}_4 \rightarrow \text{K}_2\text{MnO}_4 + \text{MnO}_2 + \text{O}_2$ .

Question: How does the specific heat capacity of a substance affect its temperature change?

Answer: Substances with higher specific heat capacities experience smaller temperature changes when the same amount of heat is supplied compared to substances with lower specific heat capacities.

Question: What is a solution?

Answer: A solution is a homogeneous mixture where the components are uniformly distributed.

Question: What is the role of a microphone in studying sound waves?

Answer: A microphone converts sound waves into electrical signals, which can be visualized using an oscilloscope to study their characteristics.

Question: What is the specific heat capacity of water?

Answer: The specific heat capacity of water is  $4200 \text{ J kg}^{-1} \text{ K}^{-1}$ .

Question: How does the power output of a machine relate to its efficiency?

Answer: The power output of a machine relates to its efficiency by indicating how effectively the machine converts energy into work over time.

Question: How does increasing the mass of an object affect its momentum for a constant velocity?

Answer: Increasing the mass of an object increases its momentum for a constant velocity, as momentum is the product of mass and velocity.

Question: How do you apply a couple of forces to rotate a steering wheel?

Answer: Apply a couple of forces by using both hands to exert equal and opposite forces on opposite sides of the steering wheel, creating a moment that rotates the wheel.



Question: What is Milk of Magnesia and its use?

Answer: Milk of Magnesia is a suspension of Magnesium hydroxide used as an antacid to relieve stomach acidity.

Question: What is the significance of the glowing splinter test in the oxygen production experiment?

Answer: The glowing splinter test confirms that the gas collected is oxygen, produced during photosynthesis.

Question: What is the chemical formula for sodium nitrate?

Answer: The chemical formula for sodium nitrate is  $\text{NaNO}_3$ , indicating one sodium ion and one nitrate ion.

Question: What is the relationship between liquid pressure and the depth of the liquid?

Answer: The pressure exerted by a liquid increases with the depth of the liquid because the weight of the liquid above that point increases.

Question: How is sex determined in humans?

Answer: Sex is determined by the combination of sex chromosomes during fertilization. Females have two X chromosomes, while males have one X and one Y chromosome. The Y chromosome from the father determines male offspring.

Question: How do the electronic configurations of calcium and carbonate ions lead to the formation of calcium carbonate?

Answer: Calcium atoms lose electrons to form  $\text{Ca}^{2+}$  ions, and carbonate ions ( $\text{CO}_3^{2-}$ ) have a negative charge. The electrostatic attraction between these ions forms calcium carbonate ( $\text{CaCO}_3$ ).

Question: What is the significance of the speed of sound in water being higher than in air?

Answer: The higher speed of sound in water allows for more efficient transmission of sound waves, which is utilized by marine animals for communication.

Question: How does the excessive use of fossil fuels contribute to environmental pollution?

Answer: The excessive use of fossil fuels contributes to environmental pollution by releasing greenhouse gases, sulfur dioxide ( $\text{SO}_2$ ), nitrogen oxides ( $\text{NO}_x$ ), and particulate matter into the air, leading to climate change, acid rain, and health issues.

Question: How does bile aid in lipid digestion?

Answer: Bile emulsifies lipids, breaking them into small droplets, increasing the surface area for digestive enzymes to act on them.

Question: What is the greenhouse effect, and how do human activities contribute to it?

Answer: The greenhouse effect is a natural process where certain gases in the earth's atmosphere trap heat, keeping the planet warm enough to support life. The primary greenhouse gases include carbon dioxide ( $\text{CO}_2$ ),

methane (CH<sub>4</sub>), water vapor (H<sub>2</sub>O), and chlorofluorocarbons (CFCs). These gases absorb infrared radiation emitted by the earth and re-radiate it back, warming the earth's surface. Human activities significantly enhance the greenhouse effect by increasing the concentration of greenhouse gases in the atmosphere. The main contributors are: Burning Fossil Fuels: The combustion of coal, oil, and natural gas for energy and transportation releases large amounts of CO<sub>2</sub>. For instance, power plants, cars, and factories are major sources of CO<sub>2</sub> emissions. Deforestation: Cutting down forests reduces the number of trees that can absorb CO<sub>2</sub> from the atmosphere, leading to higher CO<sub>2</sub> levels. Forests act as carbon sinks, and their destruction contributes to increased atmospheric CO<sub>2</sub>. Agriculture: Agricultural activities produce methane through livestock digestion and manure management. Rice paddies and landfills are also significant sources of methane emissions due to anaerobic decomposition of organic matter. Industrial Processes: Certain industrial processes release CFCs, which are used in refrigeration, air conditioning, and aerosol propellants. CFCs are potent greenhouse gases that also contribute to ozone layer depletion. The enhanced greenhouse effect leads to global warming, causing a rise in global temperatures. This results in melting polar ice caps, rising sea levels, and changing weather patterns, which can have devastating effects on ecosystems and human societies.

Question: How does the number of coil turns affect the dynamo's performance?

Answer: More coil turns increase the induced electromotive force, enhancing the dynamo's efficiency and electricity generation.

Question: How do digital thermometers work?

Answer: Digital thermometers measure temperature using an electrical property such as resistance, which depends on temperature, instead of the expansion caused by an increase in temperature.

Question: How are dud seeds removed from seed paddy?

Answer: By floating on water, which uses the difference in densities between the components and water.

Question: How can typhoid fever be prevented?

Answer: Typhoid fever can be prevented by consuming boiled water, avoiding contaminated food, maintaining hygiene, and getting vaccinated.

Question: What is the weight of a 5 kg object on Earth?

Answer: The weight of a 5 kg object on Earth is  $5 \times 9.8 = 49$  N.

Question: How are fatty acids and glycerol absorbed in the small intestine?

Answer: Fatty acids and glycerol are absorbed into lacteals within the villi and transported to the lymphatic system before entering the bloodstream.

Question: What is the role of iron in the human body?

Answer: Iron is essential for the synthesis of hemoglobin, storage of oxygen in muscles, and as a constituent of enzymes.

Question: How do Molluscs reproduce?

Answer: Molluscs show sexual reproduction and most of them are unisexual (produce one type of gamete).

Question: What is the upthrust experienced by an object immersed in a liquid?

Answer: Upthrust is the upward force exerted by a liquid on an object immersed in it. This force is equal to the weight of the liquid displaced by the object.

Question: What is the valency of silicon?

Answer: The valency of silicon is 4.

Question: What is the function of a relay in an electrical circuit?

Answer: A relay is an electrically operated switch that uses a small control current to open or close a larger load circuit, providing isolation and control in various applications.

Question: What are the uses of hydrogen gas in industry?

Answer: Hydrogen gas is used as a fuel in rocketry, in the hydrogenation of oils to produce margarine, in the production of ammonia, and in the reduction of organic compounds.

Question: How do microtubules facilitate chromosome movement during cell division?

Answer: Microtubules form the mitotic spindle, attaching to chromosomes and moving them to opposite poles of the cell, ensuring accurate segregation during division.

Question: Describe the equilibrium of a framed picture hanging on the wall.

Answer: The framed picture is in equilibrium because the tensions in the two strings balance the weight of the picture. The three forces are coplanar, and their lines of action intersect at a common point.

Question: What is the role of glycogen in the human body?

Answer: Glycogen serves as a storage form of glucose in the liver and muscles, providing a readily available source of energy when needed.

Question: What is Archimedes' principle and its significance?

Answer: Archimedes' principle states that when an object is partially or completely submerged in a fluid, the upthrust acting on it is equal to the weight of the fluid displaced by the object. It explains why objects float or sink.

Question: How do companion cells regulate the function of sieve tube elements in phloem tissue?

Answer: Companion cells regulate the metabolic activities of sieve tube elements, facilitating the loading and unloading of nutrients and ensuring efficient transport within the phloem.

Question: What are some examples of contrasting traits studied by Mendel?

Answer: Examples include flower color (purple vs. white), seed color (yellow vs. green), seed shape (round vs. wrinkled), and plant height (tall vs. short).

short).

Question: What is the primary function of collenchyma tissue?

Answer: Collenchyma tissue provides mechanical strength and support to the plant body, especially in dicot plant stems and leaves before the formation of wood.

Question: What is the resultant force of two forces of 8 N and 16 N acting on a trolley?

Answer: The resultant force is 24 N.

Question: How do bacteria develop antibiotic resistance?

Answer: Bacteria develop antibiotic resistance through genetic mutations and acquiring resistance genes via horizontal gene transfer, enabling them to survive and proliferate despite antibiotic treatment.

Question: What does a decrease in temperature indicate in a chemical reaction?

Answer: A decrease in temperature indicates an endothermic reaction where heat is absorbed.

Question: How do spherical mirrors differ in their reflecting surfaces?

Answer: Concave mirrors have inward-curved reflecting surfaces, focusing light rays to a point, while convex mirrors have outward-curved surfaces, causing rays to diverge.

Question: What is the purpose of an energy meter in households?

Answer: An energy meter measures the amount of electrical energy consumed by household appliances, providing data for billing and energy management.

Question: What is the resultant force if one child pushes an object with 5 N and another child pulls it with 7 N in the same direction?

Answer: The resultant force is 12 N in the same direction.

Question: What are the effects of growth hormone on the body?

Answer: Growth hormone promotes growth of tissues and bones, increases protein synthesis, and stimulates cell division.

Question: What are some examples of artificial classification?

Answer: Examples include grouping plants as ornamental, herbal, and poisonous, and grouping animals with wings and without wings.

Question: How is the power of an electric appliance related to its energy consumption?

Answer: The power of an electric appliance determines the rate at which it consumes energy. Higher power appliances consume more energy over a given time period.

Question: What types of mirrors always produce virtual images?

Answer: Plane mirrors and convex mirrors always produce virtual images.

Question: What is the acceleration of a 6 kg object when a force of 24 N is applied?

Answer: The acceleration is  $F/m = 24/6 = 4 \text{ m/s}^2$ .

Question: Who introduced the concept of electromagnetic induction?

Answer: Michael Faraday introduced the concept of electromagnetic induction in 1831.

Question: What is the function of the magnetic poles in a DC motor?

Answer: The magnetic poles provide the magnetic field necessary to exert force on the coil, causing it to rotate.

Question: What is the maximum height reached by an object projected vertically upwards at 30 m/s?

Answer: Maximum height =  $\frac{1}{2} \times \text{Initial velocity} \times \text{Time} = \frac{1}{2} \times 30 \text{ m/s} \times 3 \text{ s} = 45 \text{ meters}$ .

Question: What is the reaction between potassium and water?

Answer: Potassium reacts vigorously with water to form potassium hydroxide and hydrogen gas:  $2\text{K} + 2\text{H}_2\text{O} \rightarrow 2\text{KOH} + \text{H}_2$ .

Question: What is an energy pyramid?

Answer: An energy pyramid is a graphical representation showing the amount of energy flow through different trophic levels, expressed as kilojoules per square meter per year.

Question: What is the first ionisation energy of nitrogen?

Answer: The first ionisation energy of nitrogen is 1402 kJ/mol.

Question: How is the chemical formula of sodium hydroxide written?

Answer: The chemical formula of sodium hydroxide is NaOH, indicating one sodium ion and one hydroxide ion.

Question: What is the role of magnetic poles in generating force on a conductor?

Answer: The poles create a field that interacts with the current in the conductor, generating a force that causes movement.

Question: What are nucleic acids?

Answer: Nucleic acids are linear polymers made up of nucleotides.

Question: How do you determine the equilibrium of an object under the action of two forces using a ring and spring balances?

Answer: Attach the spring balances to the ring and pull in opposite directions with varying forces. The object remains in equilibrium when the forces are equal in magnitude and opposite in direction, resulting in no net movement.

Question: What are the four principal parts of a flower?

Answer: The four principal parts of a flower are the calyx, corolla, androecium (stamen), and gynoecium (pistil).

Question: What is the role of compressions and rarefactions in sound waves?

Answer: Compressions and rarefactions represent regions of high and low pressure, respectively, and are essential for sound wave propagation.

Question: What are essential amino acids?

Answer: Essential amino acids are those that cannot be synthesized within the body and must be obtained from food.

Question: What happens during atmospheric nitrogen fixation?

Answer: During lightning, atmospheric nitrogen is converted to nitric oxide and nitrogen dioxide.

Question: What is the significance of the electrochemical series in predicting the outcome of electrolysis?

Answer: The electrochemical series ranks elements based on their tendency to lose or gain electrons, helping predict which ions will be reduced or oxidized during electrolysis and guiding the selection of suitable electrodes and electrolytes.

Question: What is the chemical formula for potassium chloride?

Answer: The chemical formula for potassium chloride is KCl.

Question: What is the acceleration of an object that goes from 0 to 50 m/s in 10 seconds?

Answer:  $\text{Acceleration} = 50 \text{ m/s} / 10 \text{ s} = 5 \text{ m/s}^2$ .

Question: What is the displacement of a body with an initial velocity of 8 m/s that comes to rest after 4 seconds of constant deceleration?

Answer: The displacement is calculated as:  $\text{Displacement} = \frac{1}{2} \times 8 \text{ m/s} \times 4 \text{ s} = 16 \text{ meters}$ .

Question: Explain the process of electrochemical polymerization and its applications.

Answer: Electrochemical polymerization involves the formation of conductive polymers on an electrode surface through the electrochemical oxidation or reduction of monomers. Applications include sensors, batteries, supercapacitors, and corrosion-resistant coatings.

Question: Describe the image formed when an object is placed between the center of curvature and the focal point of a concave mirror.

Answer: The image is real, inverted, larger than the object, and formed beyond the center of curvature.

Question: How does a tuning fork generate sound?

Answer: A tuning fork generates sound by vibrating at a specific frequency when struck, creating sound waves in the surrounding air.

Question: How does the electronic configuration of phosphorus influence its ability to form multiple bonds?

Answer: The electronic configuration of phosphorus (2, 8, 5) allows it to form multiple bonds by sharing its five valence electrons with other atoms, enabling the formation of compounds like phosphorus pentachloride (PCl<sub>5</sub>).

Question: What are the advantages of using electrochemical methods for carbon capture and utilization?

Answer: Electrochemical methods for carbon capture and utilization offer advantages like high efficiency, selective conversion of CO<sub>2</sub> to valuable products, integration with renewable energy sources, and reduced environmental impact compared to traditional methods.

Question: How do the root systems of monocots and dicots differ?

Answer: Monocots have a fibrous root system, while dicots have a root system with a tap root and lateral roots.

Question: What is the significance of using proper grounding in electric circuits?

Answer: Proper grounding provides a safe path for electric current to flow to the earth in case of a fault, preventing electric shocks and protecting appliances from damage.

Question: What is the role of genes in determining an organism's traits?

Answer: Genes are specific segments of DNA that code for particular traits, determining the physical and physiological characteristics of an organism.

Question: How does the brightness of an LED relate to the current passing through it?

Answer: The brightness of an LED increases with the current passing through it; however, its lifetime decreases with increased brightness.

Question: What is a biomass pyramid?

Answer: A biomass pyramid represents the total mass of living organisms at each trophic level in an ecosystem.

Question: How is the extraction of iron demonstrated by the reaction with carbon monoxide?

Answer: Iron ore (haematite) reacts with carbon monoxide in the blast furnace to produce iron and carbon dioxide:  $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$ .

Question: How is carbon dioxide gas used in fire extinguishers?

Answer: Carbon dioxide, being a non-supporter of combustion, is used in fire extinguishers to smother flames and prevent fires from spreading.

Question: Explain the concept of electrode potential and its importance in electrochemical reactions.

Answer: Electrode potential is the measure of the ability of an electrode to gain or lose electrons relative to a reference electrode. It is important in electrochemical reactions as it determines the direction and feasibility of redox reactions.

Question: How does a vacuum pump create a vacuum?

Answer: A vacuum pump removes air and other gases from a sealed container, reducing the pressure inside to create a vacuum.

Question: What is a stimulus and response in the context of body coordination?

Answer: A stimulus is a detectable change in the environment, and a response is the reaction to this stimulus, often carried out by effectors like muscles and glands.

Question: How does the rate of change of the magnetic field affect the induced voltage?

Answer: A faster rate of change of the magnetic field induces a higher voltage, as the induced electromotive force is directly proportional to the rate of change.

Question: What are the three main characteristics of sound?

Answer: The three main characteristics are pitch, loudness, and quality of sound.

Question: How does a loudspeaker operate?

Answer: A loudspeaker operates by converting electrical signals into sound. The current passing through the coil creates a magnetic field, causing the diaphragm to vibrate and produce sound waves.

Question: What is the importance of hydrogen gas?

Answer: Hydrogen gas is used as a fuel in rocketry, in the production of margarine from vegetable oils, in the production of ammonia for fertilizers, and in the reduction of organic compounds.

Question: How is the chemical formula of water written?

Answer: The chemical formula of water is  $\text{H}_2\text{O}$ , indicating two hydrogen atoms and one oxygen atom.

Question: What is pollination?

Answer: Pollination is the process of transferring pollen from the anther to the stigma of a flower, enabling fertilization and the production of seeds.

Question: Describe the use of a heat sink in power electronics.

Answer: A heat sink dissipates heat generated by power electronic components, such as transistors and ICs, preventing overheating and ensuring reliable operation.

Question: How does the specific heat capacity of mercury affect its use in thermometers?

Answer: The specific heat capacity of mercury allows it to respond quickly to temperature changes, making it suitable for use in thermometers.

Question: What is the purpose of using a Liebig condenser in distillation?

Answer: To cool and condense the vapor produced during distillation, converting it back into liquid form for collection.

Question: How does the structure of the small intestine aid in nutrient absorption?

Answer: The small intestine's long length, circular folds, villi, and microvilli increase the surface area for efficient nutrient absorption.

Question: What are the benefits of using sustainable farming practices?



Answer: Sustainable farming practices enhance soil health, reduce chemical inputs, promote biodiversity, and support long-term agricultural productivity. They contribute to environmental sustainability and food security.

Question: How does the use of nanomaterials enhance the performance of electrochemical sensors?

Answer: The use of nanomaterials enhances the performance of electrochemical sensors by providing a high surface area, improved conductivity, and increased sensitivity, enabling the detection of low concentrations of analytes and rapid response times.

Question: How is electrochemical corrosion protection achieved using sacrificial anodes?

Answer: Electrochemical corrosion protection using sacrificial anodes involves attaching a more reactive metal (sacrificial anode) to the metal structure to be protected. The sacrificial anode corrodes preferentially, protecting the main structure from corrosion.

Question: How do connective tissues provide structural support in the body?

Answer: Connective tissues, such as bone and cartilage, provide a framework that supports and protects organs, facilitates movement, and stores minerals.

Question: How does the thermal conductivity of a material influence its use in cooking utensils?

Answer: Materials with high thermal conductivity, like metals, are used in cooking utensils because they transfer heat efficiently, ensuring even cooking and quick heating.

Question: How do you calculate the mean velocity of an object?

Answer: Mean velocity is calculated by dividing the total displacement by the total time taken.

Question: How does the right-hand grip rule apply to determining field direction?

Answer: The rule helps visualize the field direction around a conductor, with the thumb indicating current flow and fingers showing the field.

Question: Describe the function of a Schmitt trigger in digital circuits.

Answer: A Schmitt trigger converts analog signals into digital signals with hysteresis, providing noise immunity and stable switching in digital circuits.

Question: Where are intercalary meristems found, and what is their function?

Answer: Intercalary meristems are found at nodes and are responsible for increasing the length of internodes in plants, especially in the grass family.

Question: What is the significance of the lines of action of forces in maintaining equilibrium in a system of three non-parallel forces?

Answer: The lines of action of the three non-parallel forces must intersect at a common point for equilibrium to be maintained. This ensures that the

resultant of any two forces is equal in magnitude and opposite in direction to the third force.

Question: What is an ionic lattice?

Answer: An ionic lattice is a regular three-dimensional array of alternating positive and negative ions, as seen in the crystal structure of sodium chloride.

Question: How do plants adapt to varying light conditions to optimize photosynthesis?

Answer: Plants adjust the orientation of leaves, chloroplast distribution, and opening of stomata to optimize light capture and gas exchange.

Question: What is the total current in a circuit with resistors of  $10\ \Omega$ ,  $20\ \Omega$ , and  $30\ \Omega$  connected in parallel with a  $12\ \text{V}$  power supply?

Answer: Calculate the current through each resistor using  $I = V/R$ , then sum the currents to find the total current.

Question: What are the essential factors for seed germination?

Answer: The essential factors for seed germination are seed viability, air (oxygen), water or moisture, and optimum temperature.

Question: What is the voltage drop across a  $5\ \Omega$  resistor with a current of  $2\ \text{A}$  flowing through it?

Answer: Using Ohm's Law,  $V = IR$ , the voltage drop is  $V = 2\ \text{A} \times 5\ \Omega = 10\ \text{V}$ .

Question: What is the role of bimetallic strips in temperature regulation devices?

Answer: Bimetallic strips in temperature regulation devices use the differential expansion of two metals to bend and make or break electrical contacts, regulating the temperature by controlling the power supply.

Question: What are the applications of acid-base neutralization reactions?

Answer: Applications include using antacids to relieve stomach acidity, reducing soil acidity with basic substances, and treating stings with appropriate neutralizing agents.

Question: How do you achieve equilibrium in a rod with weights at different points using the principle of moments?

Answer: Achieve equilibrium by adjusting the positions and magnitudes of the weights such that the moments on either side of the pivot are equal, resulting in no net rotation.

Question: How do electromagnetic waves enable wireless communication?

Answer: Electromagnetic waves, such as radio and microwaves, carry signals through the air, enabling wireless communication for devices like radios, cell phones, and Wi-Fi.

Question: How does a proximity sensor detect the presence of objects?

Answer: A proximity sensor detects the presence of objects by emitting an electromagnetic field or light beam and sensing changes when an object enters the field or reflects the light.

Question: What is the modern Periodic Table based on?

Answer: The modern Periodic Table is based on the atomic number and the electronic configuration of elements.

Question: What are the main features of bacteria, protists, and fungi according to Table 13.1?

Answer: Bacteria are unicellular and prokaryotic, protists are mostly unicellular eukaryotes, and fungi can be unicellular or multicellular eukaryotes with a mycelium structure.

Question: How does a circuit breaker differ from a fuse?

Answer: A circuit breaker can be reset and reused after it trips, while a fuse must be replaced once it has blown.

Question: What is the effect of pressure on the solubility of gases in liquids?

Answer: Increasing pressure increases the solubility of gases in liquids.

Question: What are the benefits of using electrolysis for industrial metal refining?

Answer: Electrolysis for metal refining produces high-purity metals, removes impurities, and allows for the recovery of valuable by-products, enhancing the overall efficiency and profitability of the process.

Question: How does reducing the mass of an object affect its acceleration for a constant force?

Answer: Reducing the mass of an object increases its acceleration for a constant force, as acceleration is inversely proportional to mass.

Question: What is the role of genetic engineering in developing new medical treatments?

Answer: Genetic engineering is used to develop new medical treatments by producing therapeutic proteins, creating gene therapies, and engineering cells to target and treat specific diseases.

Question: What is the speed of an object that travels 15 meters in 5 seconds?

Answer: The speed is 3 m/s.

Question: Compare the power consumption and lifespan of filament bulbs, fluorescent tubes, CFL bulbs, and LED lights.

Answer: Filament bulbs consume 60W and last 1200 hours, fluorescent tubes consume 22W and last 3000 hours, CFL bulbs consume 11-13W and last 8000 hours, and LED lights consume 6-8W and last 50,000 hours.

Question: Describe the structure and function of the plasma membrane.

Answer: The plasma membrane is a phospholipid bilayer with embedded proteins, controlling the movement of substances in and out of the cell and facilitating cell communication.

Question: How does the epiglottis function during swallowing?

Answer: The epiglottis closes the trachea during swallowing, preventing food from entering the respiratory tract and directing it into the esophagus.

Question: How is the chemical formula of carbon dioxide written?

Answer: The chemical formula of carbon dioxide is  $\text{CO}_2$ , indicating one carbon atom and two oxygen atoms.

Question: What is upthrust and how is it experienced by objects in a liquid?

Answer: Upthrust is the upward force exerted by a liquid on an object immersed in it. It is experienced as a reduction in the apparent weight of the object due to the liquid's buoyant force.

Question: How does a commutator improve the performance of a DC motor?

Answer: A commutator ensures continuous rotation by alternating the current direction in the coil, preventing reverse motion and enhancing efficiency.

Question: Describe the use of a heat sink in power electronics.

Answer: A heat sink dissipates heat generated by power electronic components, such as transistors and ICs, preventing overheating and ensuring reliable operation.

Question: What is the effect of temperature on the solubility of gases in water?

Answer: As temperature increases, the solubility of gases in water decreases.

Question: How does bile aid in lipid digestion?

Answer: Bile emulsifies lipids, breaking them into small droplets, increasing the surface area for digestive enzymes to act on them.

Question: Explain the concept of energy conservation in mechanical systems.

Answer: In mechanical systems, energy conservation means that the total mechanical energy (kinetic + potential) remains constant, with energy transforming between kinetic and potential forms without loss.

Question: How are images formed in cameras using convex lenses?

Answer: Convex lenses in cameras form real, inverted images on a film, with the lens's distance adjusted to focus objects at different distances.

Question: What happens to the induced current when the coil in a dynamo is parallel to the magnetic field?

Answer: When the coil is parallel to the magnetic field, the induced current becomes zero as there is no intersection of field lines.

Question: What is the role of genetic engineering in developing new medical treatments?

Answer: Genetic engineering is used to develop new medical treatments by producing therapeutic proteins, creating gene therapies, and engineering cells to target and treat specific diseases.

Question: How does the length of the air column in wind instruments affect the pitch of the sound?

Answer: The pitch of the sound is inversely proportional to the length of the air column; longer air columns produce lower pitches, while shorter air columns produce higher pitches.

Question: What occurs during the secretory phase of the uterine cycle?

Answer: During the secretory phase, the uterine lining thickens and blood supply increases, becoming secretory under the influence of progesterone, typically lasting about 14 days.

Question: What is the texture of bases, and why should they be handled with care?

Answer: Bases have a slimy texture, and they should be handled with care because they can be corrosive and harmful to the skin.

Question: Calculate the molar mass of magnesium oxide (MgO).

Answer: The molar mass of magnesium oxide is 40 grams per mole, calculated as 24 for magnesium plus 16 for oxygen.

Question: How is the resultant force of two parallel forces acting in the same direction found?

Answer: The resultant force is found by adding the magnitudes of the two forces.

Question: How do you measure the resistance of a nichrome wire coil in a circuit?

Answer: Connect the nichrome wire coil in series with an ammeter and a power supply, measure the current, and use a voltmeter to measure the voltage across the coil. Calculate the resistance using Ohm's Law.

Question: How does the presence of impurities affect the performance of an electrochemical cell?

Answer: The presence of impurities can affect the performance of an electrochemical cell by interfering with electrode reactions, causing side reactions, reducing conductivity, and leading to electrode degradation. Purity of materials is crucial for optimal cell performance.

Question: How do you determine the center of gravity of an object by hanging it on a string?

Answer: Hang the object from different points and mark the vertical lines along the string. The point where these lines intersect is the center of gravity, where the weight of the object acts.

Question: How does the reactivity of Group I elements compare to Group II elements?

Answer: Group I elements are more reactive than Group II elements due to their lower ionisation energies.

Question: What is thalassemia, and how is it inherited?

Answer: Thalassemia is a genetic disorder caused by mutations in the genes responsible for haemoglobin production. It leads to anaemia due to reduced haemoglobin levels. It is inherited in an autosomal recessive manner.

Question: How can the experimental determination of heat change be applied in real-world scenarios?

Answer: It can be used in industrial processes, environmental monitoring, and developing energy-efficient systems.

Question: How does a concave mirror form an image when the object is placed at the center of curvature?

Answer: The image is real, inverted, and the same size as the object, formed at the center of curvature.

Question: How does friction cause a loss of energy in machines?

Answer: Friction causes a loss of energy in machines by converting some of the work done against frictional forces into heat, raising the temperature of the object.

Question: What is the effect of particle size on the rate of reaction?

Answer: Smaller particle size increases the surface area, leading to a higher rate of reaction.

Question: What is the role of a force couple in rotating an object without causing linear motion?

Answer: A force couple rotates an object without causing linear motion by applying two equal and opposite forces, resulting in rotation around a point between the forces while the net linear force is zero.

Question: What are the main parts of a flower involved in sexual reproduction?

Answer: The main parts of a flower involved in sexual reproduction are the calyx, corolla, androecium, and gynoecium.

Question: What is dynamic friction?

Answer: Dynamic friction is the frictional force acting on bodies that are in relative motion.

Question: What is the resistance of a nichrome wire coil if a current of 0.5 A flows through it with a potential difference of 3 V?

Answer: Using Ohm's Law,  $R = V/I$ , the resistance is  $R = 3 \text{ V} / 0.5 \text{ A} = 6 \Omega$ .

Question: How does electronegativity vary down a group?

Answer: Electronegativity decreases from top to bottom down a group.

Question: What is the role of the principal axis in a lens?

Answer: The principal axis is the line passing through the center of curvature and the optical center, used as a reference for ray diagrams.

Question: What is the role of smooth muscle tissue in the body?

Answer: Smooth muscle tissue controls involuntary movements in organs with cavities, such as the digestive tract, blood vessels, and bladder.

Question: What is the mass number of an atom?

Answer: The mass number is the sum of the number of protons and neutrons in the nucleus of an atom.

Question: What is the significance of state institutions in environmental management?

Answer: State institutions such as the Ministry of Environment, Central Environment Authority, Marine Environment Protection Authority, and Geological Survey and Mines Bureau implement laws, rules, and regulations related to environmental management.

Question: How do magnesium and sulfur atoms achieve a stable electronic configuration in magnesium sulfide?

Answer: Magnesium atoms lose electrons to form  $Mg^{2+}$  ions, and sulfur atoms gain electrons to form  $S^{2-}$  ions. The electrostatic attraction between these ions forms magnesium sulfide ( $MgS$ ).

Question: Give examples of scalar quantities.

Answer: Examples of scalar quantities include speed, mass, time, and distance.

Question: Describe the role of an electricity meter in monitoring energy consumption.

Answer: An electricity meter monitors energy consumption by recording the total kilowatt hours (kWh) of electricity used by the household, providing data for billing and energy management.

Question: What happens during the process of vaporization in the extraction of salt from seawater?

Answer: Water evaporates due to solar heat, leaving dissolved salts to precipitate.

Question: What is the function of the hepatic portal vein in blood circulation?

Answer: The hepatic portal vein transports nutrient-rich blood from the digestive organs to the liver for processing before it enters the systemic circulation.

Question: How is the chemical formula of nitrogen dioxide written?

Answer: The chemical formula of nitrogen dioxide is  $NO_2$ , indicating one nitrogen atom and two oxygen atoms.

Question: How does the design of an electrochemical cell impact its performance?

Answer: The design of an electrochemical cell impacts its performance by influencing factors like electrode configuration, electrolyte composition, ion transport, and heat management. Optimal design ensures efficient reactions, high power output, and long cell life.

Question: Describe the process of electrochemical reduction of carbon dioxide to useful chemicals.

Answer: The electrochemical reduction of carbon dioxide involves converting  $CO_2$  into valuable chemicals like methane, ethylene, or formic acid using an electrochemical cell with suitable catalysts. This process offers a sustainable approach to utilizing  $CO_2$  as a feedstock.

Question: What is the speed of sound in dry air at  $0^\circ C$ ?

Answer: The speed of sound in dry air at 0°C is about 330 m/s.

Question: What are some examples of dicots?

Answer: Examples of dicots include chillies, jak, and blue lotus.

Question: What is the relationship between relative atomic mass and molar mass?

Answer: The relative atomic mass is a dimensionless quantity, while the molar mass is the mass of one mole of the element, expressed in grams per mole. They are numerically equal but have different units.

Question: How are plants divided based on their ability to produce flowers?

Answer: Plants are divided into non-flowering plants and flowering plants based on their ability to produce flowers.

Question: What is binomial nomenclature?

Answer: Binomial nomenclature is a system of naming organisms using two epithets (a generic name and a specific epithet) introduced by Carolus Linnaeus in 1753. It is regulated by the International Commission on Botanical Nomenclature (ICBN) and the International Commission on Zoological Nomenclature (ICZN).

Question: What is asbestosis, and how does it occur?

Answer: Asbestosis is a disorder caused by inhaling asbestos particles and fibers, leading to the destruction of respiratory tissues.

Question: How does the use of steam prevent the decomposition of essential oils during extraction?

Answer: Steam distillation occurs at temperatures below the boiling points of essential oils, preventing thermal degradation.

Question: What is the significance of the lines of action of forces in maintaining equilibrium?

Answer: The lines of action of forces must be aligned for equilibrium to be maintained. Forces that are not aligned along the same line will result in a net moment, causing the object to rotate or move.

Question: What is the chemical formula for lithium oxide?

Answer: The chemical formula for lithium oxide is  $\text{Li}_2\text{O}$ .

Question: What is the significance of the right-hand grip rule in electromagnetism?

Answer: The rule helps visualize and determine the field direction around a current-carrying conductor, aiding in understanding electromagnetic effects.

Question: How do you calculate the number of atoms in a given mass of an element?

Answer: The number of atoms in a given mass of an element is calculated by dividing the mass by the molar mass to find the number of moles, then multiplying by Avogadro's constant.



Question: How does the diaphragm movement in a microphone relate to sound waves?

Answer: The diaphragm moves in response to sound waves, causing the attached coil to move within a magnetic field and generate an alternating current corresponding to the sound.

Question: What is the reaction between aluminum and hydrochloric acid?

Answer: Aluminum reacts with hydrochloric acid to form aluminum chloride and hydrogen gas:  $2\text{Al} + 6\text{HCl} \rightarrow 2\text{AlCl}_3 + 3\text{H}_2$ .

Question: What is the effect of a plano-convex lens on light rays?

Answer: A plano-convex lens converges light rays to a focal point on the convex side.

Question: How is the chemical formula of carbon dioxide represented?

Answer: The chemical formula of carbon dioxide is  $\text{CO}_2$ , indicating one carbon atom and two oxygen atoms.

Question: What is the chemical formula for sulfur dioxide?

Answer: The chemical formula for sulfur dioxide is  $\text{SO}_2$ .

Question: What is the role of bacteria in the nitrogen cycle?

Answer: Bacteria fix atmospheric nitrogen to increase soil nitrate levels, which is essential for plant growth.

Question: What is the effect of temperature on the rate of reaction?

Answer: Increasing temperature generally increases the rate of reaction by providing more kinetic energy for reactant collisions.

Question: Explain the concept of coulombic efficiency in batteries and its significance.

Answer: Coulombic efficiency in batteries is the ratio of the charge extracted during discharge to the charge input during charging. It indicates the efficiency of charge storage and retrieval, with higher values representing better battery performance and lower losses.

Question: What is the function of a signal generator in electronics?

Answer: A signal generator produces electronic signals with specific frequencies, waveforms, and amplitudes, used for testing and calibrating electronic devices and systems.

Question: How does the nature of the solvent affect solubility?

Answer: Solubility varies in different solvents based on their chemical properties, such as polarity.

Question: How does the modern Periodic Table arrange elements?

Answer: The modern Periodic Table arranges elements in ascending order of their atomic numbers.

Question: How do you achieve equilibrium in a uniform rod suspended and balanced at its center with weights at different points?

Answer: Achieve equilibrium by adjusting the positions and magnitudes of the weights such that the moments on either side of the pivot are equal,

resulting in no net rotation.

Question: What are some common greenhouse gases?

Answer: Common greenhouse gases include carbon dioxide (CO<sub>2</sub>), sulfur dioxide (SO<sub>2</sub>), oxides of nitrogen (NO<sub>x</sub>), methane (CH<sub>4</sub>), chlorofluorocarbons (CFCs), and water vapor (H<sub>2</sub>O).

Question: How does a function generator assist in electronic testing?

Answer: A function generator produces various waveform signals, such as sine, square, and triangle waves, used for testing, troubleshooting, and developing electronic circuits.

Question: What are the main parts of a flower involved in sexual reproduction?

Answer: The main parts of a flower involved in sexual reproduction are the calyx, corolla, androecium, and gynoecium.

Question: How do you measure the force required to initiate the turning effect using a Newton balance and a stick?

Answer: Measure the force by attaching the Newton balance to the stick, applying a perpendicular force, and recording the minimum force required to slightly move the stick.

Question: Materials required :- Two beakers, a glass rod, a funnel, a filter paper, hand lens. Method :- Transfer the mixture made in activity 3.1.1 above into a small 100 ml beaker, add about 50 ml of water to it and stir well. Then, place a filter paper in a glass funnel and filter this solution into another beaker. Allow the residue on the filter paper to dry and observe with a hand lens. Observe the filtrate as well. What is the purpose of filtering a mixture in this Activity ?

Answer: The purpose is to separate the components of the mixture by dissolving one component in water and filtering out the other, demonstrating that the chemical nature of the components remains unchanged.

Question: How is distilled water obtained using a Liebig condenser?

Answer: By condensing the vapor produced during the distillation of water, resulting in purified distilled water.

Question: How does genetic engineering contribute to environmental conservation?

Answer: Genetic engineering contributes to environmental conservation by developing crops that require fewer chemical inputs, creating bioengineered organisms to clean up pollution, and preserving genetic diversity through biobanking and genetic rescue efforts.

Question: What are the functions of cerebrospinal fluid?

Answer: It provides buoyancy, absorbs shocks, protects against infections, and helps regulate temperature.

Question: What is the formula to calculate the pressure exerted by a liquid column?

Answer: The formula to calculate the pressure exerted by a liquid column is  $P = h\rho g$ , where  $h$  is the height of the column,  $\rho$  is the density of the liquid, and  $g$  is gravitational acceleration.

Question: What is the role of hydrogen bonds in determining the properties of water?

Answer: Hydrogen bonds are responsible for many of water's unique properties, such as high boiling point, high specific heat capacity, and its ability to act as a solvent for many substances.

Question: What is the role of carbon dioxide in photosynthesis?

Answer: Carbon dioxide acts as a raw material for photosynthesis, enabling plants to produce food and supporting the food chain for all living beings.

Question: How does Newton's second law apply to pushing a car?

Answer: When pushing a car, the force applied by the person determines the car's acceleration. The mass of the car and the applied force determine the car's motion according to Newton's second law.

Question: What is the role of a cathode ray oscilloscope in visualizing sound waves?

Answer: A cathode ray oscilloscope displays the waveform of sound waves, allowing analysis of their frequency, amplitude, and shape.

Question: What is the balanced chemical equation for the reaction between sodium and chlorine?

Answer: The balanced chemical equation for sodium reacting with chlorine is:  $2\text{Na} + \text{Cl}_2 \rightarrow 2\text{NaCl}$ .

Question: What precautions should be taken to minimize errors in heat change experiments?

Answer: Using insulating materials like polystyrene cups, stirring the mixture well, and accounting for heat loss to the surroundings.

Question: What is the charge of a neutron?

Answer: A neutron has no charge; it is neutral.

Question: How does the RCCB protect against electric shocks?

Answer: The RCCB detects current leaks to the ground and automatically disconnects the power supply, preventing electric shocks and potential injuries.

Question: What test can be conducted to identify lipids?

Answer: The Sudan III test involves adding gingelly or coconut oil into a test tube, adding Sudan III reagent, and observing the appearance of red fat globules.

Question: What is the valency of phosphorus?

Answer: The valency of phosphorus is 5 and 3.

Question: What is the significance of using circuit diagrams in electrical installations?

Answer: Circuit diagrams provide a clear and systematic representation of electrical connections and components, aiding in the design, installation, and troubleshooting of circuits.

Question: What is the velocity-time graph for a body moving at a constant velocity of 6 m/s?

Answer: The velocity-time graph is a straight line parallel to the x-axis, indicating constant velocity.

Question: What is the principle of operation of a thermocouple in measuring temperature?

Answer: A thermocouple measures temperature based on the thermoelectric effect, where a voltage is generated at the junction of two different metals, proportional to the temperature difference.

Question: How does the position of an object affect the image formed by a concave mirror?

Answer: The image position, size, and nature (real or virtual) vary depending on whether the object is placed between the mirror and focal point, at the focal point, or beyond the center of curvature.

Question: What is the atomic number of calcium?

Answer: The atomic number of calcium is 20.

Question: What happens to light rays incident on a concave mirror parallel to the principal axis?

Answer: These rays converge at the focal point after reflection.

Question: What is the power dissipated by a  $5\ \Omega$  resistor with a current of 2 A flowing through it?

Answer: The power dissipated is  $P = (2\text{ A})^2 \times 5\ \Omega = 20\text{ W}$ .

Question: How do sound waves travel through the air?

Answer: Sound waves travel through the air as longitudinal waves, with particles oscillating back and forth in the direction of wave propagation.

Question: How does the concentration of reactants affect the rate of reaction?

Answer: The rate of reaction increases with the increase in concentration of the reactants, as demonstrated by faster gas evolution in the presence of higher concentrations of hydrochloric acid.

Question: How do corrective lenses work for nearsightedness?

Answer: Corrective lenses for nearsightedness use concave lenses to diverge light rays before they enter the eye, aiding in clear vision of distant objects.

Question: What is the significance of genetic linkage maps?

Answer: Genetic linkage maps show the relative positions of genes on a chromosome, helping geneticists understand how traits are inherited and identify genes associated with specific disorders.

Question: Explain the electrolysis of aqueous sodium chloride.

Answer: During the electrolysis of aqueous sodium chloride, sodium ions ( $\text{Na}^+$ ) are reduced at the cathode to form sodium, and chloride ions ( $\text{Cl}^-$ ) are oxidized at the anode to form chlorine gas. Hydrogen ions ( $\text{H}^+$ ) in the solution may also be reduced to form hydrogen gas, depending on the conditions.

Question: How do sieve tube elements function in phloem tissue?

Answer: Sieve tube elements fuse end to end to form sieve tubes, with cross walls called sieve plates. They transport food throughout the plant.

Question: What are the features of invertebrates in the phylum Cnidaria?

Answer: Invertebrates in the phylum Cnidaria are aquatic, mostly marine, diploblastic with a coelenteron, have radial symmetry, and are predators with nematocysts.

Question: What is the role of mitochondria in energy production?

Answer: Mitochondria are the powerhouses of the cell, generating ATP through cellular respiration by breaking down glucose and other nutrients.

Question: How does a transistor amplify current?

Answer: A transistor amplifies current by using a small base current ( $I_B$ ) to control a larger collector current ( $I_C$ ).

Question: What is an acid according to the document?

Answer: An acid is a compound that releases hydrogen ions ( $\text{H}^+$ ) in an aqueous medium.

Question: What is the principle behind the operation of a barometer?

Answer: A barometer operates on the principle that atmospheric pressure can support a column of liquid, such as mercury, with the height of the column indicating the pressure.

Question: What are the adaptations of the alveoli for efficient gas exchange?

Answer: Alveoli have thin walls, moist surfaces, a rich blood supply, and a large number of sacs to maximize the surface area for gas exchange.

Question: How do you convert a temperature from Kelvin to Celsius?

Answer: To convert a temperature from Kelvin to Celsius, subtract 273 from the Kelvin temperature.

Question: Materials required :- An unopened bottle of soda water (plastic), an empty bottle of the same type. Method :- Take an unopened bottle of soda water available in the market. To an identical empty bottle, add water equal in quantity to that of soda water and close the cap tightly. Now squeeze both bottles with hand and select the harder bottle. What does Activity investigate about the solubility of gases?

Answer: Activity investigates how temperature and pressure affect the solubility of gases in water, using an unopened bottle of soda water as an example.

Question: Why is it important to understand the behavior and applications of magnets?

Answer: Understanding magnets is essential for designing and operating various devices, from household appliances to advanced medical and scientific instruments.

Question: How does water regulate body temperature?

Answer: Water helps regulate body temperature through its high specific heat capacity, which allows it to absorb and release heat slowly, preventing rapid temperature fluctuations.

Question: What is electronic waste?

Answer: Electronic waste, or e-waste, is discarded electronic devices and components that can release harmful substances into the environment.

Question: What are pH papers and how are they used?

Answer: pH papers are used to determine the pH value of a solution by dipping them into the solution and comparing the color change to a reference chart.

Question: What is the acceleration of a 6 kg object when a force of 18 N is applied?

Answer: The acceleration is  $F/m = 18/6 = 3 \text{ m/s}^2$ .

Question: What are the effects of photochemical smog on human health?

Answer: The effects of photochemical smog on human health include respiratory problems, eye irritation, reduced lung function, and an increased risk of asthma and other respiratory diseases.

Question: How does the surface area of a reactant influence the rate of a chemical reaction?

Answer: A larger surface area provides more collision sites for reactants, increasing the rate of reaction.

Question: What is the relationship between the speed of light, frequency, and wavelength?

Answer: The speed of light ( $c$ ) is equal to the product of frequency ( $f$ ) and wavelength ( $\lambda$ ), expressed as  $c = f\lambda$ .

Question: What are the features of invertebrates in the phylum Mollusca?

Answer: Invertebrates in the phylum Mollusca are triploblastic, soft-bodied animals with a body divided into head, visceral mass, and muscular foot, and some have internal and external shells made of  $\text{CaCO}_3$ .

Question: How do inhibitors influence chemical reactions?

Answer: Inhibitors decrease the rate of chemical reactions by interfering with the reactant collisions, making reactions slower.

Question: What are the environmental impacts of plastic pollution in oceans?

Answer: Plastic pollution harms marine life through ingestion and entanglement, introduces toxic substances into the food web, and degrades marine ecosystems. It poses significant environmental and health risks.

Question: How do xylem fibers contribute to the structural integrity of xylem tissue?

Answer: Xylem fibers provide additional mechanical support to xylem tissue, helping maintain its structure and function during water transport.

Question: What energy transformation occurs in a bicycle dynamo?

Answer: In a bicycle dynamo, mechanical energy from the rotating bicycle wheel is converted into electrical energy through electromagnetic induction.

Question: How does the magnetic field direction affect the force on a conductor?

Answer: The force direction is perpendicular to both the field and current direction, following the right-hand rule for positive charges.

Question: Explain the role of a voltage divider in electronic circuits.

Answer: A voltage divider divides the input voltage into smaller fractions using two resistors connected in series, providing a desired output voltage for various applications.

Question: How do the melting points of metals and non-metals generally compare?

Answer: Metals generally have higher melting points compared to non-metals.

Question: What are intrinsic semiconductors?

Answer: Intrinsic semiconductors are pure semiconductor materials, such as silicon or germanium, that have not been doped with any impurities. Their electrical properties are determined by the intrinsic structure of the semiconductor material itself.

Question: How does the induced voltage waveform look in an alternating current dynamo?

Answer: The induced voltage waveform in an alternating current dynamo is sinusoidal, alternating between positive and negative values.

Question: What is the role of the retina in the human eye?

Answer: The retina detects light and converts it into electrical signals sent to the brain for visual perception.

Question: What is the role of carbon dioxide in photosynthesis?

Answer: Carbon dioxide acts as a raw material for photosynthesis, enabling plants to produce food and supporting the food chain for all living beings.

Question: Describe the role of the cell wall in plant cells.

Answer: The cell wall is a rigid structure made of cellulose that surrounds plant cells, providing protection, structural support, and maintaining cell shape.

Question: What is the power dissipated by a  $10\ \Omega$  resistor with a current of 3 A flowing through it?

Answer: Using  $P = I^2 R$ , the power dissipated is  $P = (3\text{ A})^2 \times 10\ \Omega = 90\text{ W}$ .

Question: How is a water (H<sub>2</sub>O) molecule formed?

Answer: A water (H<sub>2</sub>O) molecule is formed when an oxygen atom shares two pairs of electrons with two hydrogen atoms, forming two single bonds.

Question: What is the formula to find the displacement of a body moving with uniform acceleration?

Answer: Displacement = (Initial velocity + Final velocity) / 2 × Time.

Question: What are cosmetics, and what are some common ingredients?

Answer: Cosmetics are products used for cleanliness, beauty, health, and pleasantness. Common ingredients include natural or artificial oils, colorings, fragrances, distilled substances, and preservatives.

Question: What are some examples of organisms in the phylum Echinodermata?

Answer: Examples of organisms in the phylum Echinodermata include Starfish, Sea urchin, and Sea cucumber.

Question: What safety precautions should be taken when working with electrical circuits?

Answer: Safety precautions include turning off the power before making any changes, using insulated tools, avoiding contact with live wires, and following proper grounding procedures.

Question: Materials required ; - Two small beakers about 100 cm<sup>3</sup> , A thermometer, a glass rod, solid sodium hydroxide (NaOH), solid ammonium chloride (NH<sub>4</sub>Cl) Method; - Add about half full of water to a beaker, measure its temperature and note it down. Add a little amount of solid sodium hydroxide to the same beaker, stir with the glass rod and again measure and record the temperature. State your observations. Fill half of a beaker with water and record its temperature. Add a little amount of solid ammonium chloride to this beaker. Stir with the glass rod and record the temperature again. State your observations. What is observed when solid sodium hydroxide dissolves in water during Activity?

Answer: The temperature rises.

Question: How do root hairs contribute to water absorption in plants?

Answer: Root hairs absorb water from the soil through osmosis, which is then transported to the leaves for photosynthesis.

Question: How does the power output of an electric appliance relate to its energy consumption?

Answer: The power output of an electric appliance determines the rate at which it consumes energy. Higher power output results in higher energy consumption over time.

Question: How is the molar mass of sulfuric acid (H<sub>2</sub>SO<sub>4</sub>) calculated?

Answer: The molar mass of sulfuric acid is calculated by summing the molar masses of its constituent atoms: 2 × 1 for hydrogen, 32 for sulfur, and 4 × 16 for oxygen, resulting in 98 grams per mole.

Question: How does genetic engineering improve livestock production?



Answer: Genetic engineering improves livestock production by creating animals with desirable traits such as faster growth rates, disease resistance, and improved milk or meat quality.

Question: What is the specific heat capacity of water?

Answer: The specific heat capacity of water is  $4200 \text{ J kg}^{-1}\text{K}^{-1}$ .

Question: What happens to the induced current when the coil in a dynamo moves parallel to the magnetic field?

Answer: When the coil moves parallel to the magnetic field, the induced current becomes zero as there is no intersection of field lines.

Question: How does the reaction between sodium hydroxide and hydrochloric acid illustrate an exothermic reaction?

Answer: The reaction releases heat, increasing the temperature of the solution.

Question: What are the applications of electroplating?

Answer: Electroplating is used to coat objects with a thin layer of metal to improve appearance, prevent corrosion, reduce friction, and enhance electrical conductivity.

Question: What is the structure of a typical neuron?

Answer: A typical neuron consists of a cell body with a nucleus, dendrites that receive signals, and an axon that transmits impulses away from the cell body. The axon is often myelinated.

Question: How is the chemical formula of phosphoric acid written?

Answer: The chemical formula of phosphoric acid is  $\text{H}_3\text{PO}_4$ , indicating three hydrogen atoms, one phosphorus atom, and four oxygen atoms.

Question: How is carbon dioxide used in fizzy drinks?

Answer: Carbon dioxide dissolves in water to form carbonic acid, giving fizzy drinks their characteristic effervescence and taste.

Question: What is the average velocity of an object that travels 20 meters north in 5 seconds?

Answer: The average velocity is  $4 \text{ m/s}$  north.

Question: What is the potential hazard of high-voltage electricity?

Answer: High-voltage electricity has a high potential for causing a large amount of current to flow through the body, leading to severe injury or death.

Question: Calculate the power required to do 200 J of work in 4 seconds.

Answer: The power required is 50 Watts (W).

Question: What is the role of chromosomes in genetic inheritance?

Answer: Chromosomes carry genes that determine traits and transmit genetic information from one generation to the next, playing a crucial role in inheritance.

Question: What are the advantages of cross-pollination?

Answer: Cross-pollination allows for the mixing of characteristics from two plants, leading to stronger new generations with new characteristics.

Question: What are some applications of electromagnets in modern devices?

Answer: Applications include electric motors, magnetic locks, MRI machines, and magnetic separation equipment.

Question: What is the acceleration of a 3 kg object when a force of 9 N is applied?

Answer: The acceleration is  $a = F/m = 3 \text{ m/s}^2$ .

Question: What is the significance of using a boiling tube in paper chromatography?

Answer: The boiling tube holds the solvent and paper strip, allowing the solvent to rise and separate the components.

Question: What are the key features of the Domain Archaea?

Answer: The Domain Archaea includes prokaryotes that can live in extreme environments and are not sensitive to most antibiotics.

Question: How does the body prevent infections in the urinary system?

Answer: The body prevents infections through mechanisms like regular urine flow, acidic urine pH, immune responses, and physical barriers like the urethra's structure.

Question: What is a standard solution?

Answer: A standard solution is one with a concentration that is very accurately known.

Question: How does the specific heat capacity of a substance affect its temperature regulation properties?

Answer: Substances with high specific heat capacities can absorb and release large amounts of heat with minimal temperature change, making them effective for temperature regulation in various applications.

Question: How does the magnetic field direction affect the force on a conductor?

Answer: The force direction is perpendicular to both the field and current direction, following the right-hand rule for positive charges.

Question: What are some common physical properties of metals?

Answer: Metals are typically lustrous, malleable, ductile, good conductors of heat and electricity, and have high density.

Question: What are the environmental benefits of recycling?

Answer: Recycling reduces waste, conserves natural resources, lowers greenhouse gas emissions, and decreases energy consumption. It supports sustainable resource management and environmental protection.

Question: How does the coil's position affect the electromotive force in an alternating current dynamo?

Answer: The electromotive force varies with the coil's position, reaching maximum values when the coil intersects the magnetic field lines perpendicularly.

Question: How is atmospheric pressure measured using a mercury barometer?

Answer: Atmospheric pressure is measured using a mercury barometer by the height of the mercury column in a glass tube. The height of the column represents the atmospheric pressure exerted on the mercury in the container.

Question: What is the purpose of coloring ethanol in glass-alcohol thermometers?

Answer: Ethanol is colored with a coloring material in glass-alcohol thermometers to make the alcohol column clearly visible since purified ethanol is colorless.

Question: What is the importance of neutralization in everyday life?

Answer: Neutralization reactions are important for maintaining pH balance in various contexts, such as in medicine, agriculture, and household remedies.

Question: What are the potential impacts of climate change on human health?

Answer: Potential impacts of climate change on human health include heat-related illnesses, respiratory problems, vector-borne diseases, and food and water insecurity.

Question: How does Newton's third law apply to rocket propulsion?

Answer: In rocket propulsion, the expulsion of exhaust gases (action) generates a force that propels the rocket forward (reaction) due to the equal and opposite force exerted by the gases.

Question: What are dioecious plants?

Answer: Dioecious plants have staminate and pistillate flowers on separate plants. Examples include papaw and vallisneria.

Question: How do virtual images differ from real images in terms of light rays?

Answer: Virtual images are formed by light rays that appear to converge, while real images are formed by actual converging light rays.

Question: What are common endocrine disorders?

Answer: Common disorders include diabetes, hyperthyroidism, hypothyroidism, and adrenal insufficiency.

Question: What are the effects of nuclear waste on the environment?

Answer: The effects of nuclear waste on the environment include long-term radioactive contamination and potential harm to living organisms due to the release of toxic materials.

Question: What is the effect of gravitational acceleration on weight?

Answer: Weight is the force exerted by gravity on an object, and it is calculated as  $\text{Weight} = mg$ . The weight depends on the gravitational acceleration.

Question: What is the purpose of using ice in recrystallization?

Answer: Cooling the filtrate in ice promotes the formation of pure crystals by reducing the solubility of the solute.

Question: How do inhibitors affect the rate of chemical reactions?

Answer: Inhibitors slow down reactions by decreasing the frequency of effective collisions between reactant particles.

Question: How does a concave mirror form an image when the object is beyond the center of curvature?

Answer: The image is real, inverted, smaller than the object, and formed between the center of curvature and the focal point.

Question: What are food additives, and why are they used?

Answer: Food additives are substances added to food to enhance taste, odor, appearance, nutrition, and shelf life. They include pigments, sweeteners, taste enhancers, preservatives, stabilizers, leavening agents, bleaching agents, and nutrients.

Question: What changes occur in the fetus during the fifth month of development?

Answer: During the fifth month, the fetus is completely covered with hair, the mother can feel fetal movements, and the fetal heartbeat can be observed.

Question: What is the principal focus of a concave mirror?

Answer: The principal focus is the point on the principal axis where parallel rays converge after reflecting off the concave mirror.

Question: Describe the typical growth curve of a population.

Answer: The typical growth curve of a population is sigmoid-shaped and consists of four main phases: lag phase, exponential phase, deceleration phase, and stationary phase.

Question: What is the chemical formula for lithium oxide?

Answer: The chemical formula for lithium oxide is  $\text{Li}_2\text{O}$ .

Question: What are the factors required to maintain equilibrium in an object under three parallel forces?

Answer: The three forces must be coplanar, one force must act in the opposite direction to the other two, and the resultant of any two forces must be equal in magnitude and opposite in direction to the third force.

Question: What is the role of KOH in the  $\text{CO}_2$  experiment for photosynthesis?

Answer: KOH absorbs  $\text{CO}_2$ , preventing it from being available for photosynthesis, thus demonstrating the necessity of  $\text{CO}_2$  for the process.

Question: How does the latent heat of vaporization affect the process of boiling?

Answer: The latent heat of vaporization is the amount of heat required to convert a liquid into a gas at its boiling point without changing its temperature, making it a crucial factor in the boiling process.

Question: What is photosynthesis, and why is it considered an endothermic process?

Answer: Photosynthesis is the process by which green plants produce simple sugars by absorbing solar energy:  $6\text{CO}_2 (\text{g}) + 6\text{H}_2\text{O} (\text{l}) + \text{solar energy} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 (\text{s}) + 6\text{O}_2 (\text{g})$ .

Question: What are sensory organs, and what is their function?

Answer: Sensory organs, such as the eye, nose, ear, tongue, and skin, detect stimuli from the environment.

Question: Describe an experiment to identify electrolytes and non-electrolytes using an ammeter and carbon electrodes, including the setup, procedure, and observations.

Answer: An experiment to identify electrolytes and non-electrolytes involves testing various liquids and solutions to see if they conduct electricity. Setup: Materials Required: Carbon electrodes, two 1.5V torch cells, connecting wires, ammeter, beakers, coconut oil, kerosene, distilled water, acidified water, salt solution, ethanol. Method: Connect the carbon electrodes to the ammeter using connecting wires. Set up the torch cells in series to provide a 3V power source. Immerse the electrodes in different liquids/solutions and observe the ammeter. Procedure: Test Each Liquid/Solution: Immerse the electrodes in coconut oil and observe the ammeter. Repeat with kerosene, distilled water, acidified water, salt solution, and ethanol. Record the ammeter deflection for each liquid/solution. Observations: Electrolytes: Acidified water and salt solution cause a deflection in the ammeter, indicating they conduct electricity. Non-Electrolytes: Coconut oil, kerosene, distilled water, and ethanol show no deflection, indicating they do not conduct electricity. Conclusion: Electrolytes are substances that conduct electricity by the movement of ions. Examples include aqueous solutions of ionic compounds, molten ionic compounds, and solutions of acids and bases. Non-electrolytes are substances that do not conduct electricity. Examples include pure water and organic liquids like petrol and kerosene. This experiment demonstrates how to distinguish between electrolytes and non-electrolytes based on their ability to conduct electricity.

Question: How are flowering plants adapted to life on land?

Answer: Flowering plants have various adaptations to conserve water and can produce flowers for sexual reproduction.

Question: What is the importance of the light-harvesting complex in photosynthesis?

Answer: The light-harvesting complex captures and transfers light energy to the reaction centers of photosystems, enhancing the efficiency of photosynthesis.

Question: What are some common plant viral diseases?

Answer: Common plant viral diseases include banana bunchy top disease and curly leaf of chilies.

Question: How do parallel light beams differ from convergent and divergent beams?

Answer: Parallel light beams consist of rays that travel in parallel, without converging or diverging.

Question: How do ultrasound waves help in detecting capsized ships?

Answer: SONAR technology emits ultrasound waves that reflect back from underwater objects, helping to locate remnants of capsized ships.

Question: What is the role of buffers in maintaining pH balance?

Answer: Buffers resist changes in pH by neutralizing added acids or bases, helping to maintain a stable pH in biological and chemical systems.

Question: What is the principle of reversibility of light?

Answer: The principle states that if the direction of a light ray is reversed, it will follow the same path backward, even through multiple reflections and refractions.

Question: What are the key characteristics of non-flowering seedless plants?

Answer: Non-flowering seedless plants can have a thalloid body or small fern type, are autotrophic and photosynthetic, and reproduce asexually by spores and vegetative fragmentation.

Question: What is light required for in terms of visual sensation?

Answer: Light is required to give rise to visual sensation, allowing us to see objects when light from them reaches our eyes.

Question: State Newton's second law of motion.

Answer: Newton's second law of motion states that the acceleration of a body is directly proportional to the unbalanced force acting on it and inversely proportional to its mass.

Question: How does the mobile phase in chromatography affect the separation of components?

Answer: The mobile phase (solvent) carries the components through the stationary phase, allowing them to separate based on their movement rates.

Question: How do the stems of monocots and dicots differ?

Answer: Monocot stems have an even diameter, while dicot stems are broad at the base and thin at the tip.

Question: What is a community in the biosphere?

Answer: A community is a group of different populations interacting with each other in a particular area.

Question: What is the significance of a constant ratio of voltage to current in a conductor?

Answer: A constant ratio of voltage to current indicates that the conductor follows Ohm's Law, with a fixed resistance at constant temperature.

Question: How does the excessive use of agrochemicals contribute to environmental pollution?

Answer: The excessive use of agrochemicals contributes to environmental pollution by contaminating soil and water, harming non-target species, and causing health issues in humans and wildlife.

Question: What is an exothermic reaction, and give an example from daily life?

Answer: An exothermic reaction releases heat to the surroundings. Examples include the combustion of fuels and cellular respiration.

Question: How do minerals contribute to the structural components of the body?

Answer: Minerals such as calcium and phosphorous are essential for the growth and maintenance of bones and teeth.

Question: How does an LED produce light?

Answer: An LED produces light through electroluminescence, where electrons recombine with holes in the semiconductor material, releasing energy in the form of photons (light).

Question: What is the formula for calculating mean speed?

Answer: Mean speed = Total Distance / Total Time

Question: How is genetic engineering used to produce insulin?

Answer: Genetic engineering involves inserting the human gene for insulin production into bacteria, allowing the bacteria to produce insulin that can be harvested and used to treat diabetes.

Question: How does changing the current direction in a conductor affect its magnetic field?

Answer: Reversing the current direction in a conductor reverses the direction of the magnetic field around it.

Question: How is an endothermic reaction represented in a simple equation?

Answer: Reactants + Heat → Products.

Question: How do scientists identify the function of specific genes?

Answer: Scientists use techniques such as gene knockout, where a gene is deliberately deactivated, to study the effects on an organism and determine the gene's function.

Question: How is sodium chloride crystallized in the final stage of salt production?

Answer: The solution is transferred to small tanks, where further evaporation causes sodium chloride to crystallize and precipitate.

Question: What happens to the light rays incident on a plane mirror at an angle?

Answer: The light rays are reflected at the same angle they were incident, according to the law of reflection.

Question: What is an aneroid barometer and how does it differ from a mercury barometer?

Answer: An aneroid barometer does not contain liquid. It uses a sealed, air-evacuated cavity with flexible walls. Changes in atmospheric pressure cause the walls to flex, moving an attached indicator to show pressure on a scale.

Question: How do you plot a graph of voltage (V) against current (I) for a nichrome wire coil?

Answer: Measure multiple sets of voltage and current values, plot voltage on the y-axis and current on the x-axis, and draw a straight line through the points. The slope of the line represents the resistance.

Question: Calculate the energy consumed by a 50W headlight operating for 1.5 hours.

Answer: The energy consumed is  $E = Pt = 50\text{W} \times 1.5\text{h} \times 3600\text{s} = 270,000\text{J}$ .

Question: What are the main functions of the male reproductive system?

Answer: The male reproductive system produces sperms, ejects sperms into the female reproductive system, and produces the hormone testosterone.

Question: What is the significance of the lines of action of forces in maintaining equilibrium in a system of three non-parallel forces?

Answer: The lines of action of the three non-parallel forces must intersect at a common point for equilibrium to be maintained. This ensures that the resultant of any two forces is equal in magnitude and opposite in direction to the third force.

Question: Describe the process of electrochemical desalination and its advantages.

Answer: Electrochemical desalination involves removing salt ions from seawater or brackish water using electrochemical methods like capacitive deionization or electrodialysis. It offers advantages like low energy consumption, scalability, and minimal chemical use compared to traditional desalination methods.

Question: How do Punnett squares help geneticists visualize genetic crosses?

Answer: Punnett squares help geneticists visualize genetic crosses by showing all possible combinations of alleles from two parents, allowing predictions of genotypes and phenotypes in offspring.

Question: How does pressure affect the rate of reaction in gases, as shown in Fig. 17.1?

Answer: Higher pressure increases the number of collisions per unit time, resulting in a higher rate of reaction.



Question: How does the heat of reaction for solid sodium hydroxide differ from its aqueous solution?

Answer: The heat change is different due to the additional energy required to dissolve the solid before reacting.

Question: What is the function of bile in digestion?

Answer: Bile emulsifies fats, breaking them into small droplets to increase the surface area for enzyme action, aiding in lipid digestion.

Question: What is the role of the plumule in seed germination?

Answer: The plumule is the part of the seedling that develops into the shoot system, including the stem and leaves.

Question: Calculate the molar mass of magnesium oxide (MgO).

Answer: The molar mass of magnesium oxide is 40 grams per mole, calculated as 24 for magnesium plus 16 for oxygen.

Question: What is the relationship between atomic radius and atomic number within a period?

Answer: Within a period, the atomic radius decreases as the atomic number increases.

Question: How do you calculate the potential difference across a resistor in a parallel circuit with a total voltage of 12 V?

Answer: The potential difference across each resistor in a parallel circuit is equal to the total voltage of the circuit, which is 12 V.

Question: What are the conditions for equilibrium when two collinear forces act on an object?

Answer: The conditions for equilibrium when two collinear forces act on an object are that the forces must have equal magnitudes and act in opposite directions along the same line of action.

Question: How do geneticists study the inheritance of traits in humans?

Answer: Geneticists study the inheritance of traits in humans by analyzing family pedigrees, conducting genetic tests, and studying the genotypes and phenotypes of individuals.

Question: How do geneticists study the inheritance patterns of complex traits?

Answer: Geneticists study complex traits by analyzing large populations, using statistical methods, and identifying multiple genes and environmental factors that contribute to the trait.

Question: What is the purpose of using a slinky in wave demonstrations?

Answer: A slinky visually demonstrates wave properties, such as wave propagation and the behavior of transverse and longitudinal waves.

Question: How is the electrolysis of copper sulfate solution used in electroplating?

Answer: Electroplating with copper sulfate solution involves using a copper anode and an object to be plated as the cathode. Copper ions are reduced and deposited on the object.

Question: How does the coil's position affect the electromotive force in an alternating current dynamo?

Answer: The electromotive force varies with the coil's position, reaching maximum values when the coil intersects the magnetic field lines perpendicularly.

Question: How does the structure of ionic compounds affect their solubility in water?

Answer: The structure of ionic compounds, with positive and negative ions, makes them soluble in water because water molecules can surround and separate the ions, dissolving the compound.

Question: What is the principle behind the operation of a bicycle dynamo?

Answer: The principle behind a bicycle dynamo is electromagnetic induction, where mechanical rotation induces an electromotive force in the coil.

Question: How do plants obtain nutrients?

Answer: Plants obtain nutrients from the soil through their roots and from the air through their leaves, using processes such as absorption and photosynthesis.

Question: How does solvent extraction differ from simple distillation?

Answer: Solvent extraction involves transferring a solute from one solvent to another in which it is more soluble, whereas distillation separates components based on their boiling points.

Question: What are the four principal parts of a flower?

Answer: The four principal parts of a flower are the calyx, corolla, androecium (stamen), and gynoecium (pistil).

Question: What is the total power supplied by a 12 V power source with a current of 1.5 A?

Answer: The total power supplied is  $P = VI = 12 \text{ V} \times 1.5 \text{ A} = 18 \text{ W}$ .

Question: How does the thermal conductivity of a material affect its heat transfer properties?

Answer: The thermal conductivity of a material determines its ability to transfer heat. High thermal conductivity materials transfer heat efficiently, while low thermal conductivity materials act as insulators.

Question: How many electrons can the second energy level hold?

Answer: The second energy level can hold a maximum of 8 electrons.

Question: What is the resultant force of two forces of 8 N and 16 N acting on a trolley?

Answer: The resultant force is 24 N.

Question: How does a Zener diode regulate voltage?

Answer: A Zener diode regulates voltage by allowing current to flow in the reverse direction when the voltage exceeds a certain value (Zener breakdown voltage), maintaining a stable output voltage.

Question: What are the key factors regulated by homeostasis?

Answer: Blood glucose level, body temperature, and water balance.

Question: What is the mass number of deuterium?

Answer: The mass number of deuterium is 2.

Question: How does the number of coil turns affect the dynamo's performance?

Answer: More coil turns increase the induced electromotive force, enhancing the dynamo's efficiency and electricity generation.

Question: What is the phenomenon called when light rays bend upon entering one medium from another?

Answer: Refraction of light.

Question: How do sodium and chlorine atoms form an ionic bond?

Answer: Sodium atoms lose one electron to form  $\text{Na}^+$  ions, and chlorine atoms gain one electron to form  $\text{Cl}^-$  ions. The electrostatic attraction between these oppositely charged ions forms an ionic bond, resulting in sodium chloride ( $\text{NaCl}$ ).

Question: How can corrosion be prevented using electrochemical methods?

Answer: Corrosion can be prevented using electrochemical methods like cathodic protection, where a more easily oxidized metal (sacrificial anode) is used to protect the main metal structure, or by applying coatings to prevent exposure to corrosive environments.

Question: What is the trend in atomic radius across a period?

Answer: The atomic radius decreases across a period from left to right.

Question: What is the refractive index of water relative to air?

Answer: 1.33.

Question: Describe the function of a low-dropout regulator (LDO) in voltage regulation.

Answer: A low-dropout regulator (LDO) provides efficient and stable voltage regulation with a small difference between the input and output voltages, making it suitable for sensitive electronic circuits.

Question: How do viruses reproduce?

Answer: Viruses reproduce by infecting a host cell, releasing their nucleic acid into the host, and using the host's cellular machinery to produce new viral particles.

Question: What is the result of connecting the negative terminals of two dry cells to a bulb?

Answer: Connecting the negative terminals of two dry cells to a bulb results in no potential difference across the bulb, and therefore, no current flow.

Question: What does the area under a velocity-time graph represent?

Answer: The area under a velocity-time graph represents the displacement of the object.

Question: What is the reaction between aluminum and copper sulfate solution?

Answer: Aluminum displaces copper from copper sulfate, forming aluminum sulfate and copper:  $2\text{Al} + 3\text{CuSO}_4 \rightarrow \text{Al}_2(\text{SO}_4)_3 + 3\text{Cu}$ .

Question: What is the role of thermal expansion in the functioning of a thermometer?

Answer: Thermal expansion in a thermometer causes the liquid inside to expand or contract with temperature changes, allowing for accurate temperature measurement based on the liquid's movement in the capillary tube.

Question: What is eutrophication?

Answer: Eutrophication is the excessive enrichment of water bodies with nutrients, leading to overgrowth of algae and depletion of oxygen.

Question: What is the significance of using organic solvents in solvent extraction?

Answer: Organic solvents dissolve specific compounds more effectively than water, allowing for efficient extraction of desired substances.

Question: How does the use of pesticides affect soil health?

Answer: The use of pesticides affects soil health by killing beneficial soil microorganisms, disrupting soil nutrient cycles, and reducing soil fertility.

Question: How does friction affect the motion of a rolling object on a rough surface?

Answer: Friction opposes the motion of a rolling object on a rough surface, causing it to slow down and eventually stop. A rougher surface increases friction, reducing the distance traveled.

Question: What is the role of sodium in the human body?

Answer: Sodium activates enzymes, is a constituent of digestive juice, maintains constant osmotic pressure in cells, and aids in the transmission of nerve impulses.

Question: Describe the process of doping in semiconductor fabrication.

Answer: Doping involves adding small amounts of impurity atoms to a semiconductor to modify its electrical properties by increasing the number of free charge carriers (electrons or holes).

Question: Why is it important to consider the physical state of substances in heat change reactions?

Answer: Different physical states can significantly affect the heat change and overall energy dynamics of the reaction.

Question: Differentiate between aerobic and anaerobic respiration.

Answer: Aerobic respiration requires oxygen and produces more energy by completely breaking down glucose, while anaerobic respiration occurs without oxygen and produces less energy.

Question: How is the chemical formula of phosphine written?

Answer: The chemical formula of phosphine is  $\text{PH}_3$ , indicating one phosphorus atom and three hydrogen atoms.

Question: What is vegetative propagation by stem cuttings?

Answer: Vegetative propagation by stem cuttings involves planting stem cuttings from a mother plant to produce new plants, commonly used for plants like roses and bougainvillea.

Question: What are the primary uses of X-rays?

Answer: X-rays are used for medical imaging of internal organs, examining baggage in security, and inspecting cargo in containers.

Question: What is commercial agriculture, and what are its environmental impacts?

Answer: Commercial agriculture is large-scale agriculture aimed at producing crops for sale. Its environmental impacts include soil degradation, loss of biodiversity, and pollution from agrochemicals.

Question: How are electromagnets used to lift and remove scrap iron and steel?

Answer: Electromagnets are used to lift and remove scrap iron and steel by creating a strong magnetic field when current flows through the coil, attracting and lifting the metal pieces.

Question: How does the diaphragm in a moving coil microphone respond to sound?

Answer: The diaphragm vibrates in response to sound waves, moving the attached coil within a magnetic field and generating an alternating current.

Question: How does deforestation impact the environment?

Answer: Deforestation impacts the environment by reducing biodiversity, disrupting water cycles, increasing greenhouse gas emissions, and contributing to soil erosion and climate change.

Question: How does the period of a wave relate to its frequency?

Answer: The period of a wave is the reciprocal of its frequency, indicating the time taken for one complete oscillation.

Question: Explain the electrolysis of aqueous sodium chloride.

Answer: During the electrolysis of aqueous sodium chloride, sodium ions ( $\text{Na}^+$ ) are reduced at the cathode to form sodium, and chloride ions ( $\text{Cl}^-$ ) are oxidized at the anode to form chlorine gas. Hydrogen ions ( $\text{H}^+$ ) in the solution may also be reduced to form hydrogen gas, depending on the conditions.

Question: How do covalent bonds contribute to the diversity of chemical compounds?

Answer: Covalent bonds contribute to the diversity of chemical compounds by allowing atoms to combine in various ways through electron sharing, forming a wide range of molecular structures.

Question: What is the significance of Mendel's 3:1 ratio in the F<sub>2</sub> generation?

Answer: The 3:1 ratio in the F2 generation indicates that three-quarters of the offspring exhibit the dominant trait, while one-quarter exhibit the recessive trait, supporting Mendel's principles of inheritance.

Question: Why is binomial nomenclature important?

Answer: Binomial nomenclature provides a standardized way to name organisms, avoiding confusion caused by different common names in various languages and regions, and helps in identifying evolutionary relationships.

Question: How does the body eliminate excess creatinine through the kidneys?

Answer: The kidneys filter and excrete creatinine in urine, maintaining creatinine levels and indicating kidney function.

Question: What are the advantages of using smart meters in households?

Answer: Smart meters provide real-time monitoring of energy consumption, enabling better energy management, accurate billing, and helping to identify energy-saving opportunities.

Question: What is the work done in lifting a 7 kg object to a height of 4 m?

Answer: The work done is 280 Joules (J).

Question: How does the specific heat capacity of a substance determine its use in thermal storage systems?

Answer: Substances with high specific heat capacities are used in thermal storage systems because they can absorb and store large amounts of heat, making them effective for maintaining stable temperatures.

Question: How does a concave mirror form an image when the object is placed at the focal point?

Answer: The image is formed at infinity, appearing very large and inverted.

Question: What is the function of parenchyma tissue in photosynthesis?

Answer: Parenchyma tissue in plant leaves contains chlorophyll within chloroplasts, where photosynthesis takes place, converting light energy into chemical energy.

Question: What is blood composed of?

Answer: Blood is composed of blood cells and plasma.

Question: How does genetic engineering contribute to the development of biofuels?

Answer: Genetic engineering contributes to the development of biofuels by creating microorganisms and plants that efficiently produce biofuels from renewable resources, reducing dependence on fossil fuels and lowering greenhouse gas emissions.

Question: Describe the decomposition reaction of potassium permanganate when heated.

Answer: When potassium permanganate is heated, it decomposes to form potassium manganate, manganese dioxide, and oxygen gas:  $2\text{KMnO}_4 \rightarrow \text{K}_2\text{MnO}_4 + \text{MnO}_2 + \text{O}_2$ .

Question: What is the role of carbon brushes in an alternating current dynamo?

Answer: Carbon brushes maintain contact with the rotating brushing rings, allowing current to flow to the external circuit without wearing out quickly.

Question: How does the weight of an object influence frictional forces?

Answer: The weight of an object increases the normal reaction force, which in turn increases the limiting frictional force between the contact surfaces.

Question: Why is solubility an important property in chemistry?

Answer: Solubility is important for understanding how substances interact, predicting reactions, and designing separation processes in chemical engineering and pharmaceuticals.

Question: Describe the process of electrochemical deposition of metals.

Answer: Electrochemical deposition of metals involves the reduction of metal ions from an electrolyte onto a conductive substrate, forming a metal coating. This process is used for applications like electroplating, metal finishing, and fabrication of microelectronic devices.

Question: What organs are involved in excretion in humans?

Answer: The kidneys, skin, and lungs.

Question: What is bud grafting?

Answer: Bud grafting involves selecting a live bud, making a cut on the stock, inserting the bud into the cut, and wrapping the area with polythene strips. After a few days, the wrap is removed, and the bud is exposed.

Question: What is the function of mitochondria in energy metabolism?

Answer: Mitochondria produce ATP through oxidative phosphorylation, providing energy for various cellular processes, including muscle contraction, active transport, and biosynthesis.

Question: What are the characteristics of organisms in the Domain Bacteria?

Answer: Organisms in the Domain Bacteria are prokaryotes, sensitive to antibiotics, can be pathogenic, and are found everywhere in the environment.

Question: What is the reaction of sodium with cold water?

Answer: Sodium reacts vigorously with cold water to form sodium hydroxide and hydrogen gas.

Question: How do geneticists use probability to study inheritance patterns?

Answer: Geneticists use probability to study inheritance patterns by calculating the likelihood of certain traits appearing in offspring, based on the known genotypes of the parents and the rules of inheritance.

Question: Calculate the molar mass of magnesium oxide (MgO).

Answer: The molar mass of magnesium oxide is 40 grams per mole, calculated as 24 for magnesium plus 16 for oxygen.

Question: How are the shapes of bacteria described in the document?

Answer: Bacteria can be spherical (coccus), rod-shaped (bacillus), spiral (spirillum), or comma-shaped (vibrio).

Question: How does the use of traditional agricultural methods contribute to sustainability?

Answer: Traditional agricultural methods promote biodiversity, reduce dependency on chemical inputs, and enhance soil health. They are more resilient to environmental changes and support long-term sustainability.

Question: What are the main factors affecting photosynthesis?

Answer: The main factors affecting photosynthesis are chlorophyll, light energy, water, and carbon dioxide.

Question: What are the benefits of using electrolysis for industrial metal refining?

Answer: Electrolysis for metal refining produces high-purity metals, removes impurities, and allows for the recovery of valuable by-products.

Question: What are the potential health risks associated with exposure to heavy metals?

Answer: Exposure to heavy metals such as lead, mercury, and cadmium can cause neurological damage, kidney disease, reproductive issues, and cancer. They pose significant health risks to humans and wildlife.

Question: What is the relative atomic mass?

Answer: The relative atomic mass is the mass of a selected atom taken as a unit, and the masses of other atoms are given relative to it. It is not the true mass of an atom of an element.

Question: What is the role of the diaphragm in the Downs cell?

Answer: The diaphragm in the Downs cell prevents the reaction between sodium and chlorine, ensuring the separation of sodium metal and chlorine gas during electrolysis.

Question: Explain the concept of a double displacement reaction with the reaction between barium chloride and sodium sulfate.

Answer: In a double displacement reaction, the cations and anions of two compounds exchange places, forming new compounds. For example, barium chloride and sodium sulfate react to form barium sulfate and sodium chloride:  $\text{BaCl}_2 + \text{Na}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + 2\text{NaCl}$ .

Question: How do different musical instruments produce unique sounds?

Answer: Unique sounds are produced by varying the waveforms, frequencies, and harmonics generated by each instrument.

Question: What is the role of a base terminal in a transistor?

Answer: The base terminal in a transistor controls the flow of carriers from the emitter to the collector.

Question: What is the role of the penis in the male reproductive system?

Answer: The penis is responsible for ejecting semen into the female reproductive system. It becomes rigid due to increased blood supply during



erection.

Question: How do you determine the direction of displacement from a velocity-time graph?

Answer: The direction of displacement is indicated by the sign of the velocity values on the graph.

Question: What is the effect of gravitational acceleration on the weight of an object at different altitudes?

Answer: Gravitational acceleration decreases with altitude, so the weight of an object decreases as it moves to higher altitudes, while its mass remains constant.

Question: How do ribosomes contribute to protein synthesis?

Answer: Ribosomes translate mRNA into polypeptides, assembling amino acids into proteins based on the genetic code, essential for cellular functions.

Question: What are the features of invertebrates in the phylum Annelida?

Answer: Invertebrates in the phylum Annelida are triploblastic, have segmented bodies, bilateral symmetry, a coelom, and reproduce both asexually and sexually.

Question: What is the principle behind the operation of a bicycle dynamo?

Answer: The principle behind a bicycle dynamo is electromagnetic induction, where mechanical rotation induces an electromotive force in the coil.

Question: How does the induced current direction change during coil rotation in a dynamo?

Answer: The induced current direction changes periodically, resulting in an alternating current as the coil rotates within the magnetic field.

Question: What is the function of the commutator in a DC motor?

Answer: The commutator alternates the current direction in the coil, ensuring continuous rotation and improving motor efficiency.

Question: What are the safety precautions necessary when performing electrolysis?

Answer: Safety precautions for electrolysis include using appropriate personal protective equipment (PPE), ensuring proper ventilation, handling chemicals with care, avoiding short circuits, and following correct procedures to prevent hazards like gas explosions or chemical spills.

Question: How do you apply a couple of forces to rotate a steering wheel?

Answer: Apply a couple of forces by using both hands to exert equal and opposite forces on opposite sides of the steering wheel, creating a moment that rotates the wheel.

Question: How is static electricity generated?

Answer: Static electricity is generated by rubbing materials together, which transfers electrons between the surfaces, creating an imbalance of charges.

Question: Describe the process of electrolysis.

Answer: Electrolysis is a process where an electric current is passed through a solution or molten liquid containing ions, causing chemical reactions at the electrodes and resulting in the decomposition of the substance.

Question: How are fatty acids and glycerol absorbed in the small intestine?

Answer: Fatty acids and glycerol are absorbed into lacteals within the villi and transported to the lymphatic system before entering the bloodstream.

Question: What is the greenhouse effect?

Answer: The greenhouse effect is the process by which greenhouse gases absorb radiation given out by the Earth and re-radiate some of it back to the Earth's surface, helping to warm the planet and maintain a climate that supports life.

Question: How do you calculate the moment of a force applied to a stick pivoted at one end?

Answer: Calculate the moment by multiplying the applied force by the perpendicular distance from the pivot point to the line of action of the force (Moment = Force  $\times$  Perpendicular distance).

Question: What are the advantages of using solid-state electrolytes in batteries?

Answer: Solid-state electrolytes in batteries offer advantages like improved safety, higher energy density, longer cycle life, and the potential for flexible and lightweight designs, making them suitable for advanced energy storage applications.

Question: What are bisexual flowers?

Answer: Bisexual flowers have both male and female reproductive parts, enabling self-pollination or cross-pollination within the same flower.

Question: How do bacteria contribute to nutrient cycling in ecosystems?

Answer: Bacteria contribute to nutrient cycling by decomposing organic matter, fixing nitrogen, and participating in various biochemical processes that recycle nutrients within ecosystems.

Question: What is the significance of the electromagnetic spectrum in telecommunications?

Answer: The electromagnetic spectrum provides various frequency bands for transmitting signals, enabling efficient and reliable telecommunications.

Question: What are linked genes?

Answer: Linked genes are genes located close together on the same chromosome that tend to be inherited together because they do not segregate independently during meiosis.

Question: What is the relationship between the speed of coil rotation and the output voltage of a dynamo?

Answer: The output voltage of a dynamo increases with the speed of coil rotation, as a higher speed induces a greater electromotive force.

Question: What is the effect of particle size on the rate of reaction?

Answer: Smaller particles have a larger surface area-to-volume ratio, leading to more collision sites and a higher rate of reaction.

Question: What is the significance of boiling points in separating components by distillation?

Answer: Components with different boiling points vaporize at different temperatures, allowing for their separation.

Question: How does the reactivity of metals with dilute hydrochloric acid vary?

Answer: The reactivity of metals with dilute hydrochloric acid varies, with metals like magnesium, aluminum, and zinc reacting vigorously, producing hydrogen gas. Iron reacts slowly, and copper does not react.

Question: What are homozygous and heterozygous genotypes?

Answer: Homozygous genotypes have identical alleles for a trait (e.g., TT or tt), while heterozygous genotypes have different alleles for a trait (e.g., Tt).

Question: What is the significance of understanding work, energy, and power in physics?

Answer: Understanding these concepts helps in analyzing and calculating the efficiency of various physical and mechanical processes.

Question: How does the power factor of an electric appliance affect its efficiency?

Answer: The power factor measures the efficiency of power usage. A higher power factor indicates more efficient use of electricity, reducing energy losses and improving system performance.

Question: What are the four main types of bio molecules?

Answer: The four main types of bio molecules are carbohydrates, proteins, lipids, and nucleic acids.

Question: Describe the equilibrium of a plank of wood suspended by four strings in terms of forces.

Answer: The plank of wood is in equilibrium because the forces of tension in the four strings balance the weight of the plank. The tensions act vertically upwards and are equal in magnitude to the weight, resulting in no net force.

Question: How does a transformer transfer electrical energy between circuits?

Answer: A transformer uses electromagnetic induction to transfer electrical energy between its primary and secondary windings, allowing voltage step-up or step-down in power distribution.

Question: What is the concentration of a solution containing 1 mol of NaOH in 500 cm<sup>3</sup> of solution?

Answer: The concentration is 2 mol/dm<sup>3</sup>.

Question: What is the composition of sodium chloride in Jeewani solution if 1 dm<sup>3</sup> contains 5g of NaCl?

Answer: The composition is 5 g/dm<sup>3</sup>.

Question: What is the role of genes in inheritance?

Answer: Genes are specific segments of DNA that determine particular characteristics of an organism and transmit them from generation to generation.

Question: What is the significance of the turning effect of a force in practical applications?

Answer: The turning effect of a force is significant in practical applications such as opening doors, using wrenches, and rotating objects, where the ease of rotation depends on the applied moment.

Question: What is the principle behind the operation of a hydraulic press?

Answer: The principle behind a hydraulic press is that pressure applied to a confined fluid is transmitted undiminished in all directions, allowing a small force applied to a small piston to generate a larger force on a larger piston.

Question: What is the role of ultrasound waves in lithotripsy?

Answer: Ultrasound waves are used to break down bladder stones into smaller fragments, which can then be passed out of the body naturally.

Question: What is the formula for calculating displacement?

Answer: Displacement = Velocity \* Time

Question: How does the number of coil turns affect the dynamo's performance?

Answer: More coil turns increase the induced electromotive force, enhancing the dynamo's efficiency and electricity generation.

Question: Under what circumstances does dynamic friction act?

Answer: Dynamic friction acts when there is relative motion between the contact surfaces of two objects.

Question: What does the speedometer of a vehicle indicate?

Answer: The speedometer indicates the speed of the vehicle at a particular instant.

Question: Describe the motion of an object with uniform speed.

Answer: An object with uniform speed travels equal distances in equal time intervals.

Question: What is dichogamy?

Answer: Dichogamy is an adaptation where stamens mature earlier than the pistil (proterandry) or the pistil matures earlier than the stamens (protogyny). Examples include corn and tridax.

Question: How does concentration affect the number of collisions in a reaction?

Answer: Higher concentration increases the number of reactant particles in a given volume, leading to more collisions and a faster reaction rate.

Question: What are the main features of the Kingdom Plantae?

Answer: The Kingdom Plantae includes multicellular organisms known as plants, which have cell walls with cellulose, appear green due to chlorophyll, and reproduce sexually and asexually.

Question: What is the relationship between the potential difference and current in a nichrome wire coil?

Answer: The potential difference and current in a nichrome wire coil are directly proportional, as described by Ohm's Law, provided the temperature remains constant.

Question: At which point on the door is the force required to rotate it the minimum?

Answer: The force required to rotate the door is minimum at the point farthest from the axis of rotation (hinges).

Question: What does the area under a velocity-time graph represent?

Answer: The area under a velocity-time graph represents the displacement of the object.

Question: How does a smart thermostat improve energy efficiency in households?

Answer: A smart thermostat adjusts heating and cooling settings based on occupancy and user preferences, optimizing energy usage and reducing utility bills.

Question: What happens when a passenger in a bus at rest is suddenly moved?

Answer: When a bus at rest suddenly moves, the passenger tends to fall backward because the bus exerts a force on the feet, giving the lower body velocity, while the upper body remains at rest.

Question: What is the difference between DNA and RNA in terms of function?

Answer: DNA stores genetic information and transfers it from generation to generation, while RNA is involved in protein synthesis.

Question: What is the role of water in transporting nutrients?

Answer: Water helps transport nutrients, vitamins, and hormones to relevant locations in the body.

Question: What is the formula to calculate the pressure exerted by a liquid column?

Answer: The formula to calculate the pressure exerted by a liquid column is  $P = h\rho g$ , where  $h$  is the height of the column,  $\rho$  is the density of the liquid, and  $g$  is gravitational acceleration.

Question: How should a voltmeter be connected in a circuit?

Answer: A voltmeter should be connected in parallel with the component or points across which the potential difference is to be measured.

Question: What are the benefits of using renewable energy sources?

Answer: Renewable energy sources reduce greenhouse gas emissions, decrease dependency on fossil fuels, and promote environmental sustainability. They support energy security and help mitigate climate change.

Question: What is the relationship between relative atomic mass and molar mass?

Answer: The relative atomic mass is a dimensionless quantity, while the molar mass is the mass of one mole of the element, expressed in grams per mole. They are numerically equal but have different units.

Question: How do catalysts benefit industrial chemical reactions?

Answer: Catalysts enhance reaction rates, reduce energy costs, and improve product yield in industrial chemical reactions.

Question: How do geneticists study the genetic basis of diseases?

Answer: Geneticists study the genetic basis of diseases by identifying genetic variants associated with disease risk, analyzing family pedigrees, conducting functional studies on disease-related genes, and using model organisms to understand disease mechanisms.

Question: What components are involved in an alternating current dynamo?

Answer: Components of an alternating current dynamo include the coil, magnetic poles, axle, brushing rings, and carbon brushes.

Question: What is the significance of Mendel's work in the field of genetics?

Answer: Mendel's work established the foundational principles of inheritance, leading to the development of the field of genetics and our understanding of how traits are passed down through generations.

Question: What adaptations do fruits dispersed by wind have?

Answer: Fruits dispersed by wind have thread-like structures, wing-like structures, light seeds, and are produced in large numbers.

Question: How do you calculate the total distance traveled by an object with varying speeds?

Answer: The total distance is calculated by summing the distances traveled in each time interval, considering the varying speeds.

Question: How does the specific heat capacity of lead affect its use in shielding?

Answer: The low specific heat capacity of lead allows it to absorb and dissipate large amounts of heat, making it effective for use in radiation shielding and other high-temperature applications.

Question: How can you study inherited characteristics within your family?

Answer: By preparing a table of inherited characteristics observed in your mother's and father's relatives and noting any new characteristics that appear in the current generation.

Question: Describe the process of corrosion and how electrochemical principles are involved.

Answer: Corrosion is the deterioration of metals due to electrochemical reactions with their environment. It involves the oxidation of metal at the anode and reduction of oxygen or other species at the cathode, leading to metal degradation and loss.

Question: How does friction affect a passenger standing on a moving bus?

Answer: When the bus suddenly stops, friction between the passenger's feet and the bus floor brings the feet to rest, while the upper body continues moving forward, causing the passenger to fall forward.

Question: What are the environmental concerns associated with electrochemical processes?

Answer: Environmental concerns associated with electrochemical processes include the disposal of hazardous waste, release of toxic gases, and high energy consumption. Proper waste management and energy-efficient methods are needed to mitigate these issues.

Question: Describe the different forms of carbon.

Answer: Carbon occurs in crystalline forms such as diamond, graphite, and fullerene, and in amorphous forms such as charcoal, lamp soot, and coal.

Question: What are the two main types of magnets?

Answer: The two main types of magnets are electromagnets, where magnetism exists only while a current is passing through the coil, and permanent magnets, where magnetism is a characteristic of the material and remains permanently.

Question: What is the principle behind using ultrasound waves to detect air gaps in solid materials?

Answer: Ultrasound waves do not penetrate air gaps, indicating potential structural issues in materials like airplane components.

Question: What is the focal point of a convex lens?

Answer: The focal point is the point where light rays traveling parallel to the principal axis converge after refracting through the lens.

Question: How does deforestation affect the water cycle?

Answer: Deforestation affects the water cycle by reducing transpiration, altering precipitation patterns, increasing runoff and soil erosion, and reducing the ability of forests to regulate water flow.

Question: What is the significance of using ice in the final step of recrystallization?

Answer: Cooling the filtrate in ice promotes the formation of pure crystals by reducing the solubility of the solute.

Question: What is the primary function of a magnetron in microwave ovens?

Answer: The magnetron produces microwaves needed for the operation of microwave ovens and radar systems.

Question: What is the electronic configuration of an oxygen atom?

Answer: The electronic configuration of an oxygen atom is 2, 6.

Question: How does the diaphragm movement in a microphone relate to sound waves?

Answer: The diaphragm moves in response to sound waves, causing the attached coil to move within a magnetic field and generate an alternating current corresponding to the sound.

Question: How does the RCCB enhance safety in domestic electric circuits?

Answer: The RCCB enhances safety by detecting current leaks and automatically disconnecting the power supply, preventing electric shocks and potential injuries.

Question: What is the importance of solubility in the synthesis of new materials?

Answer: Solubility is important in the synthesis of new materials for controlling reaction conditions, ensuring uniformity, and achieving desired properties in the final product.

Question: What are anemophilous flowers?

Answer: Anemophilous flowers are pollinated by wind and produce large amounts of small, light pollen with branched stigmas to facilitate wind pollination.

Question: What is the significance of Charles's Law in understanding gas behavior?

Answer: Charles's Law states that the volume of a gas is directly proportional to its temperature at constant pressure, explaining how gases expand when heated.

Question: What is the role of Pascal's principle in hydraulic systems?

Answer: Pascal's principle states that pressure applied to a confined fluid is transmitted undiminished in all directions. This principle is fundamental in hydraulic systems, allowing small forces to generate larger forces.

Question: What are the two forms of electricity?

Answer: The two forms of electricity are static electricity and current electricity.

Question: How does the electrolysis of water demonstrate the decomposition of water molecules?

Answer: The electrolysis of water decomposes water molecules into hydrogen and oxygen gases, illustrating the breakdown of water into its constituent elements through an electrochemical process.

Question: How does the electronic configuration of sulfur influence its bonding behavior?

Answer: The electronic configuration of sulfur (2, 8, 6) allows it to form covalent bonds by sharing its valence electrons with other atoms to achieve a stable configuration.

Question: What is infrared radiation, and why is it often referred to as heat rays?



Answer: Infrared radiation is a range of frequencies below visible red light, emitted by heated bodies, and felt as warmth on the skin.

Question: What is specific heat capacity?

Answer: Specific heat capacity is the amount of heat required to increase the temperature of a unit mass of a given substance by one degree.

Question: How do convex mirrors enhance visibility and safety in various applications?

Answer: By providing a wider field of view, convex mirrors help drivers and security personnel see a larger area, reducing blind spots and improving situational awareness

Question: What is the relationship between force and acceleration for a given mass?

Answer: For a given mass, force and acceleration are directly proportional. An increase in force results in an increase in acceleration, and a decrease in force results in a decrease in acceleration.

Question: What is the relationship between force and mass for a given acceleration?

Answer: For a given acceleration, force is directly proportional to mass. An increase in mass results in an increase in force required to achieve the same acceleration.

Question: What is the refracted ray in light refraction?

Answer: The refracted ray is the ray that bends and travels through the second medium.

Question: What are exothermic reactions, and give an example from the document?

Answer: Exothermic reactions release heat to the surroundings. An example is the reaction between magnesium and hydrochloric acid.

Question: What are some uses of convex mirrors?

Answer: Convex mirrors are used in vehicles to provide a wide view of the road behind and in shops for security to observe large areas.

Question: How does surface area affect the rate of reaction in heterogeneous systems?

Answer: In heterogeneous systems, a larger surface area of reactants increases the interaction sites, thus accelerating the rate of reaction.

Question: What observations indicate that chlorine gas is produced during the electrolysis of sodium chloride solution?

Answer: The production of chlorine gas is indicated by the formation of gas bubbles at the anode and the characteristic greenish-yellow color and strong odor of chlorine.

Question: How does an alternating current dynamo work?

Answer: An alternating current dynamo works by rotating a coil in a magnetic field, inducing an electromotive force and generating alternating current.

Question: How does the induced current direction change during coil rotation in a dynamo?

Answer: The induced current direction changes periodically, resulting in an alternating current as the coil rotates within the magnetic field.

Question: What is soil pollution?

Answer: Soil pollution is the contamination of soil with harmful substances, affecting its quality and the health of organisms living in it.

Question: What is electronics and how has it impacted our daily lives?

Answer: Electronics is the branch of physics and technology concerned with the design and application of devices, circuits, and systems that use electricity to perform tasks. It has significantly impacted our daily lives through devices like mobile phones, computers, televisions, and radios, which facilitate communication, information access, and entertainment.

Question: How does a solar inverter convert DC to AC?

Answer: A solar inverter converts the DC electricity generated by solar panels into AC electricity, making it compatible with the power grid and household appliances.

Question: What is the distance if path R is used from A to B?

Answer: The distance is 240 m.

Question: What are some common laboratory bases?

Answer: Sodium hydroxide (NaOH), potassium hydroxide (KOH), and ammonia solution (NH<sub>4</sub>OH) are common laboratory bases.

Question: What is particulate matter?

Answer: Particulate matter is a mixture of tiny particles and droplets in the air that can harm respiratory health.

Question: What are the features of vertebrates in the class Pisces?

Answer: Vertebrates in the class Pisces have a bony or cartilaginous endoskeleton, streamlined bodies, scales, fins for swimming, a lateral line system for detecting vibrations, a two-chambered heart, gills for respiration, and are cold-blooded.

Question: What is the resultant force when two forces of 8 N and 16 N act on a trolley?

Answer: The resultant force is 24 N.

Question: How does the speed of rotation affect the output of a bicycle dynamo?

Answer: The output of the dynamo increases with the speed of rotation, as a higher speed induces a greater electromotive force.

Question: How do you determine if a potential difference exists across a bulb in a circuit?

Answer: Use a voltmeter to measure the potential difference across the terminals of the bulb in the circuit.

Question: How does atmospheric pressure affect the boiling point of water?

Answer: Atmospheric pressure affects the boiling point of water; higher pressure raises the boiling point, while lower pressure lowers it.

Question: Explain the process of electroforming.

Answer: Electroforming is a manufacturing process where a metal object is created by electrodepositing metal onto a mold or mandrel, which is later removed, leaving a precise and detailed metal structure used in jewelry, electronics, and aerospace.

Question: How does Newton's third law apply to the motion of a boat?

Answer: When rowing a boat, the oars push water backward (action), and the water pushes the boat forward (reaction), causing the boat to move forward.

Question: What is a population in ecological terms?

Answer: A population is a group of organisms belonging to the same species in a particular geographical location during a specific time period.

Question: What are some applications of gamma rays?

Answer: Gamma rays are used to destroy cancer cells and sterilize food utensils and surgical instruments.

Question: What is the significance of using a polystyrene cup in heat change experiments?

Answer: It acts as a thermal insulator, minimizing heat loss to the surroundings.

Question: How does the specific heat capacity of water influence its role in the human body's temperature regulation?

Answer: Water's high specific heat capacity allows it to absorb and store large amounts of heat, helping to regulate body temperature by distributing heat throughout the body and through processes like sweating.

Question: What is the role of the umbilical cord in fetal development?

Answer: The umbilical cord connects the fetus to the placenta, allowing the exchange of nutrients, oxygen, and waste products between the mother and fetus.

Question: What is the difference between simple and complex permanent tissues?

Answer: Simple permanent tissues consist of similar cells, while complex permanent tissues are composed of different types of cells working together.

Question: What is the valency of phosphorus?

Answer: The valency of phosphorus is 5 and 3.

Question: How do arteries, veins, and capillaries differ in structure and function?

Answer: Arteries carry oxygenated blood away from the heart, veins return deoxygenated blood to the heart, and capillaries facilitate exchange of gases, nutrients, and waste products between blood and tissues.

Question: What are the effects of concentrated acids on various materials?  
Answer: Concentrated acids can corrode substances like wood, metals, and cloth, and cause severe burns on skin contact.

Question: What are monoecious plants?  
Answer: Monoecious plants bear both staminate (male) and pistillate (female) flowers on the same plant. Examples include pumpkin, corn, and coconut.

Question: What is the concentration of a solution containing 0.5 mol of NaOH in 250 cm<sup>3</sup> of solution?  
Answer: The concentration is 2 mol/dm<sup>3</sup>.

Question: How can sexually transmitted diseases be prevented?  
Answer: Sexually transmitted diseases can be prevented by avoiding risky sexual activities, using protection during intercourse, and avoiding blood transmission from infected individuals.

Question: Calculate the energy consumption of a 1500W water heater used for 30 minutes daily over a month.  
Answer: The energy consumption is  $(1500\text{W} \times 0.5 \text{ hours} \times 30 \text{ days}) / 1000 = 22.5 \text{ kWh}$ .

Question: How do plano-convex lenses affect light rays?  
Answer: Plano-convex lenses converge parallel light rays to a focal point on the convex side.

Question: What are the advantages of natural flavorings in food?  
Answer: Natural flavorings improve the color, taste, odor, and appetite of food, contain bactericidal properties, and minimize harmful effects caused by food. They offer unique tastes and qualities that artificial flavorings cannot replicate.

Question: What is the significance of electron sharing in the formation of covalent bonds?  
Answer: Electron sharing allows atoms to achieve stable electronic configurations, forming strong and stable covalent bonds that hold the atoms together in molecules.

Question: What is the first ionisation energy of sulfur?  
Answer: The first ionisation energy of sulfur is 999 kJ/mol.

Question: What would be the weight of a 1 kg object on the moon?  
Answer: The weight of a 1 kg object on the moon would be about 1/6th of 9.8 N, which is approximately 1.63 N.

Question: How do you calculate the potential difference across each resistor in a parallel circuit with a known total voltage?  
Answer: The potential difference across each resistor in a parallel circuit is equal to the total voltage of the circuit.

Question: How do plants perform gas exchange?

Answer: Plants perform gas exchange through stomata on their leaves, allowing carbon dioxide to enter for photosynthesis and oxygen to exit as a byproduct.

Question: What is the pressure exerted by a 1-meter-high column of mercury with a density of  $13,600 \text{ kg/m}^3$ ?

Answer: The pressure exerted is calculated using  $P = h\rho g$ . For a height of 1 m, the pressure is  $P = 1 \text{ m} * 13,600 \text{ kg/m}^3 * 10 \text{ m/s}^2 = 136,000 \text{ Pa}$ .

Question: What happens when two forces of equal magnitude act on an object in opposite directions?

Answer: The object remains in equilibrium and does not move.

Question: What happens when the ends of a metallic conductor are connected to a dry cell?

Answer: When the ends of a metallic conductor are connected to a dry cell, electrons flow from the negative terminal to the positive terminal, creating an electric current.

Question: How do sieve plates facilitate nutrient transport in phloem tissue?

Answer: Sieve plates, with their porous structure, allow for the efficient flow of nutrient solutions through sieve tubes, enabling the distribution of food throughout the plant.

Question: What are the two types of reproduction in living organisms?

Answer: The two types of reproduction in living organisms are sexual reproduction, involving the fusion of gametes, and asexual reproduction, where a single organism produces offspring without the involvement of another organism.

Question: What is the effect of pressure on the solubility of gases in water?

Answer: Higher pressure increases the solubility of gases in water.

Question: How much heat is required to increase the temperature of 2 kg of iron from  $25^\circ\text{C}$  to  $65^\circ\text{C}$ ?

Answer: The heat required is 36,800 J, calculated using the formula  $Q = mc\Delta T = 2 \times 460 \times (65 - 25)$ .

Question: How does recombinant DNA technology work?

Answer: Recombinant DNA technology involves combining DNA from different sources to create new genetic combinations. This technology is used to produce genetically modified organisms with desirable traits.

Question: How is carbon dioxide produced in the laboratory using hydrochloric acid?

Answer: Carbon dioxide is produced by adding dilute hydrochloric acid to calcium carbonate ( $\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$ ).

Question: What is the role of the cytoskeleton in vesicle transport?

Answer: The cytoskeleton provides tracks for motor proteins to transport vesicles within the cell, ensuring the proper distribution of proteins, lipids, and other molecules.

Question: How does the speed of motion affect electromagnetic induction?  
Answer: Faster motion of the magnet or coil increases the rate of change of the magnetic field, inducing a larger electromotive force.

Question: What causes the rigidity of an unopened soda bottle?  
Answer: The rigidity is due to carbon dioxide gas under high pressure above the liquid. When the cap is opened, CO<sub>2</sub> escapes, and the bottle's rigidity is lost.

Question: How does thermal expansion affect the design of metallic bottle lids?  
Answer: Thermal expansion allows metallic bottle lids to expand when heated, making them easier to open, and contract when cooled, ensuring a secure fit.

Question: Describe the process of electrochemical hydrogenation and its applications.  
Answer: Electrochemical hydrogenation involves the reduction of unsaturated organic compounds using hydrogen gas produced electrochemically. It is used in the synthesis of pharmaceuticals, agrochemicals, and fine chemicals, offering a cleaner alternative to traditional hydrogenation methods.

Question: What is the resultant force of two parallel forces acting along the same direction?  
Answer: The resultant force is the sum of the two forces.

Question: What are the benefits of using fuel cells for stationary power generation?  
Answer: Fuel cells for stationary power generation offer high efficiency, low emissions, reliable operation, and the ability to use various fuels like hydrogen and natural gas, providing a clean and sustainable energy solution for buildings and industries.

Question: What are metalloids?  
Answer: Metalloids are elements that have properties in between those of metals and non-metals.

Question: How are radio waves used in communication?  
Answer: Radio waves are used in communication by transmitting and receiving signals through antennas, allowing for the transmission of radio programs and other data.

Question: What are the factors that affect the rate of chemical reactions?  
Answer: Factors include surface area of reactants, concentration of reactants, pressure of gaseous reactants, temperature, and the presence of catalysts or inhibitors.

Question: What is binomial nomenclature?  
Answer: Binomial nomenclature is a system of naming organisms using two epithets (a generic name and a specific epithet) introduced by Carolus Linnaeus in 1753. It is regulated by the International Commission on

Botanical Nomenclature (ICBN) and the International Commission on Zoological Nomenclature (ICZN).

Question: How is the chemical formula of calcium chloride written?

Answer: The chemical formula of calcium chloride is  $\text{CaCl}_2$ , indicating one calcium ion and two chloride ions.

Question: What is implantation?

Answer: Implantation is the process by which the fertilized ovum (zygote) attaches to and sinks into the uterine wall, becoming a morula and then a blastula.

Question: What is heredity?

Answer: Heredity is the transmission of inherited characteristics from one generation to the next. The process by which these characters are transmitted is known as inheritance.

Question: How does electromagnetic induction enable the operation of a moving coil microphone?

Answer: Electromagnetic induction enables the microphone to convert sound waves into electrical signals by inducing a current in the vibrating coil.

Question: What factors should be considered when selecting a fuse for an electric circuit?

Answer: Factors to consider include the current rating, voltage rating, and the type of load being protected.

Question: How does potassium hydroxide (KOH) affect the  $\text{CO}_2$  experiment?

Answer: KOH absorbs  $\text{CO}_2$ , preventing it from being available for photosynthesis and demonstrating the necessity of  $\text{CO}_2$  for the process.

Question: How does atmospheric pressure influence the functioning of a barometer?

Answer: Atmospheric pressure determines the height of the liquid column in a barometer, with higher atmospheric pressure supporting a taller column and lower pressure resulting in a shorter column.

Question: How is hydrogen gas prepared in the laboratory?

Answer: Hydrogen gas is prepared in the laboratory by reacting a metal such as zinc or magnesium with an acid like dilute hydrochloric acid or dilute sulfuric acid, collecting the gas by downward displacement of water or air.

Question: Describe the energy conversion process in a fluorescent light.

Answer: In a fluorescent light, electric energy is first converted into ultraviolet radiation, which is then converted into visible light.

Question: What is the principle behind the operation of a bicycle dynamo?

Answer: The principle behind a bicycle dynamo is electromagnetic induction, where mechanical rotation induces an electromotive force in the coil.

Question: What is the chemical formula for potassium carbonate?

Answer: The chemical formula for potassium carbonate is  $K_2CO_3$ , indicating two potassium ions and one carbonate ion.

Question: What are the challenges associated with scaling up electrochemical processes for industrial applications?

Answer: Challenges associated with scaling up electrochemical processes include maintaining efficiency and selectivity, managing heat and mass transfer, ensuring material durability, optimizing reactor design, and reducing costs to achieve commercial viability.

Question: What is the resultant force if two forces of 10 N and 6 N act in the same direction?

Answer: The resultant force is 16 N in the same direction.

Question: What is the purpose of the axle in an alternating current dynamo?

Answer: The axle rotates the coil within the magnetic field, enabling continuous induction of electromotive force and generation of alternating current.

Question: How does a compressed gas exert pressure?

Answer: A compressed gas exerts pressure due to the force of the gas molecules colliding with the walls of the container. The more the gas is compressed, the higher the pressure.

Question: What is the difference between artificial and natural classification?

Answer: Artificial classification groups organisms based on observable features without considering evolutionary relationships, while natural classification considers evolutionary relationships and various biological features.

Question: What is the potential energy of a 3 kg object at a height of 6 m?

Answer: The potential energy is 180 Joules (J).

Question: Explain the relationship between voltage, current, and power in an electric circuit.

Answer: Power (P) in an electric circuit is the product of voltage (V) and current (I), expressed as  $P = VI$ . Higher voltage or current results in higher power output.

Question: What causes energy crises, and what are the impacts?

Answer: Energy crises are caused by the drastic growth of the human population, increased industrial activity, overconsumption, and wastage of energy. They lead to higher energy prices and limited supply of natural resources.

Question: How does lactic acid fermentation occur in human cells?

Answer: During anaerobic respiration, glucose is broken down into lactic acid, releasing energy, which can accumulate in muscles causing pain and cramps.



Question: How does a bicycle dynamo convert mechanical energy into electrical energy?

Answer: A bicycle dynamo converts mechanical energy from the rotating tire into electrical energy by inducing a current in the rotating coil within a magnetic field.

Question: How are ultraviolet rays used in sterilization?

Answer: Ultraviolet rays have germicidal properties and are used to sterilize water, air, and surfaces by killing bacteria and viruses.

Question: What is the function of a voltage regulator in electronic devices?

Answer: A voltage regulator maintains a constant output voltage despite variations in input voltage or load conditions, ensuring stable and reliable power supply for electronic devices.

Question: How do plants adapt to different environments?

Answer: Plants adapt to different environments through structural, physiological, and behavioral changes, such as developing drought-resistant leaves, varying root structures, and adjusting growth patterns.

Question: How do you achieve equilibrium in an object under the action of two equal and opposite forces?

Answer: Achieve equilibrium by ensuring that the forces have equal magnitudes, act in opposite directions, and lie along the same line of action, resulting in no net force.

Question: What is seed germination?

Answer: Seed germination is the activation of the embryo in a seed and its development into a seedling, requiring viability, air (oxygen), water (moisture), and optimum temperature.

Question: How do vibrations of vocal cords produce different sounds?

Answer: Different sounds are produced by varying the tension and length of the vocal cords, changing the frequency and pitch of the sound.

Question: How is a methane ( $\text{CH}_4$ ) molecule formed?

Answer: A methane ( $\text{CH}_4$ ) molecule is formed when a carbon atom shares four pairs of electrons with four hydrogen atoms, forming four single bonds.

Question: What is the importance of the nervous system in animals?

Answer: The nervous system is essential for coordinating responses to stimuli, controlling movements, and regulating physiological processes, enabling animals to interact with their environment.

Question: What is the impact of plastic and polythene waste on the environment?

Answer: The impact of plastic and polythene waste on the environment includes pollution of land and water, harm to wildlife, and the release of toxic substances during decomposition.

Question: What is the significance of the observation when a bottle of soda water is opened?

Answer: The observation that gas bubbles evolve when a bottle of soda water is opened demonstrates that gases are dissolved in the liquid under pressure and are released when the pressure is reduced.

Question: How do you calculate the sum of moments of forces about a point?

Answer: The sum of moments of forces about a point is calculated by adding the moments of all forces acting on the object, considering their directions (clockwise or anti-clockwise).

Question: What is the equation for the combustion of methane, an exothermic reaction?

Answer:  $\text{CH}_4 (\text{g}) + 2\text{O}_2 (\text{g}) \rightarrow \text{CO}_2 (\text{g}) + 2\text{H}_2\text{O} (\text{g}) + \text{Heat}.$

Question: What is the reaction between zinc and sulfuric acid?

Answer: Zinc reacts with sulfuric acid to form zinc sulfate and hydrogen gas:  $\text{Zn} + \text{H}_2\text{SO}_4 \rightarrow \text{ZnSO}_4 + \text{H}_2.$

Question: How does the magnetic field direction affect the force on a current-carrying conductor?

Answer: The force direction is perpendicular to both the magnetic field and current direction, following the right-hand rule.

Question: Explain the process of DNA replication during the S phase.

Answer: During the S phase, the cell's DNA is replicated, resulting in two identical copies of each chromosome, ensuring that each daughter cell receives a complete set of genetic information.

Question: How does sex determination occur in humans?

Answer: Sex determination in humans occurs based on the combination of sex chromosomes. An XX combination results in a female, while an XY combination results in a male.

Question: What is the role of combustion of fuels in meeting energy requirements?

Answer: Combustion of fuels like coal, bio gas, and petrol releases energy used for running vehicles and machinery.

Question: What are the applications of electrochemical cells in medical devices?

Answer: Electrochemical cells are used in medical devices for applications like powering pacemakers, drug delivery systems, biosensors for glucose monitoring, and diagnostic equipment, providing reliable and efficient energy solutions for healthcare.

Question: How does the kidney's ability to reabsorb water affect overall hydration?

Answer: The kidneys adjust water reabsorption based on the body's hydration status, concentrating or diluting urine to maintain proper fluid balance.

Question: How are glucose and other monosaccharides absorbed in the small intestine?

Answer: Glucose, galactose, and fructose are absorbed into the blood capillaries of the villi and transported to the liver and other body parts.

Question: What are the advantages of vegetative propagation?

Answer: Vegetative propagation enables the propagation of plants that do not produce seeds, produces offspring identical to the mother plant, and allows the propagation of disease-resistant and early-fruiting plants.

Question: How did Mendel use probability to explain inheritance patterns?

Answer: Mendel used probability to predict the likelihood of certain traits appearing in offspring, showing that genetic inheritance follows predictable ratios.

Question: Explain the process of balancing the chemical equation for the reaction between hydrogen and oxygen.

Answer: The chemical equation for hydrogen reacting with oxygen to form water is balanced by ensuring equal numbers of hydrogen and oxygen atoms on both sides:  $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$ .

Question: What changes occur in the fetus during the seventh month of development?

Answer: During the seventh month, the eyelids open and the skin becomes wrinkled.

Question: What is the role of calcium in plants?

Answer: Calcium is a component of the cell wall, helps maintain the structure and functions of the plasma membrane, and is important for enzyme activity.

Question: What is the weight of a 5 kg object on Earth?

Answer: The weight of a 5 kg object on Earth is 49 N ( $5 \times 9.8 = 49$  N).

Question: What is the unit of pressure and who is it named after?

Answer: The unit of pressure is Newtons per square meter ( $\text{Nm}^{-2}$ ), also known as Pascal (Pa), named after the French scientist Blaise Pascal.

Question: What is the atomic number and mass number of tritium?

Answer: The atomic number is 1 and the mass number is 3 for tritium.

Question: What is the role of ATP in cellular respiration?

Answer: ATP stores and releases energy needed for various biological processes, including muscle contraction, active transport, and synthesis of complex molecules.

Question: What is the role of ultrasound waves in treating diseases like bladder stones?

Answer: Ultrasound waves are used to break down bladder stones into smaller fragments, which can then be passed out of the body naturally.

Question: What is the main cause of Chronic Kidney Disease (CKD) in agricultural areas of Sri Lanka?

Answer: The main cause of Chronic Kidney Disease (CKD) in agricultural areas of Sri Lanka is the gradual loss of kidney functions due to factors such as the use of agrochemicals, high blood pressure, diabetes, constant urine infections, and intoxication from snake venom, wasp, hornet venom, and agrochemicals.

Question: How do epithelial tissues protect the body from external harm?

Answer: Epithelial tissues form a protective barrier on the skin and internal surfaces, preventing microbial invasion, physical damage, and dehydration.

Question: What is the condition for a system of forces to remain in equilibrium under the action of more than three forces?

Answer: For a system to remain in equilibrium under the action of more than three forces, the forces must be applied such that their resultant is zero, meaning the sum of the forces and moments must balance out.

Question: How do microtubules support intracellular transport?

Answer: Microtubules serve as tracks for motor proteins like kinesin and dynein, facilitating the transport of vesicles, organelles, and other cargo within the cell.

Question: What is a tissue in the context of multicellular organisms?

Answer: A tissue is a group of cells with a common origin that have been modified to perform particular functions in the body.

Question: How does Newton's third law apply to the motion of a skater?

Answer: In skating, the skater pushes against the ground with their foot (action), and the ground pushes the skater forward with an equal and opposite force (reaction), propelling the skater forward.

Question: How does habitat fragmentation affect biodiversity?

Answer: Habitat fragmentation affects biodiversity by isolating populations, reducing genetic diversity, limiting species' ability to move and find resources, and increasing vulnerability to environmental changes and human activities.

Question: What are the features of invertebrates in the phylum Echinodermata?

Answer: Invertebrates in the phylum Echinodermata are marine, triploblastic, coelomic organisms with bodies separated into 5 radial arms, a sharp spiny body covering, a water vascular system, tube feet for locomotion and respiration, and penta-radial symmetry.

Question: What are the benefits of regular exercise for kidney health?

Answer: Regular exercise helps maintain a healthy weight, reduces blood pressure, improves cardiovascular health, and supports overall kidney function.

Question: How is a nitrogen ( $N_2$ ) molecule formed?

Answer: A nitrogen ( $N_2$ ) molecule is formed when two nitrogen atoms share three pairs of electrons, forming a triple bond.

Question: How does gas exchange occur in the alveoli?

Answer: Oxygen diffuses from the alveoli into blood capillaries, while carbon dioxide and water vapor diffuse from the blood into the alveoli to be exhaled.

Question: Describe the function of an isolator in a domestic electric circuit.

Answer: An isolator disconnects the household circuit from the power mains for safety and maintenance, acting as a high-current circuit breaker.

Question: What is a chemical combination reaction, and provide an example?

Answer: A chemical combination reaction is when two or more substances combine to form a new compound. An example is magnesium reacting with oxygen to form magnesium oxide:  $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$ .

Question: What does a horizontal line on a velocity-time graph represent?

Answer: It represents uniform velocity.

Question: What is the result of the reaction between nitric acid and magnesium hydroxide?

Answer: Nitric acid reacts with magnesium hydroxide to form magnesium nitrate and water ( $\text{Mg}(\text{OH})_2 + 2\text{HNO}_3 \rightarrow \text{Mg}(\text{NO}_3)_2 + 2\text{H}_2\text{O}$ ).

Question: What is the standard voltage drop across a silicon p-n junction?

Answer: The standard voltage drop across a silicon p-n junction is about 0.7 V.

Question: How does the use of sustainable transportation methods reduce environmental impact?

Answer: Sustainable transportation methods, such as public transit, cycling, and electric vehicles, reduce greenhouse gas emissions, lower air pollution, and decrease dependency on fossil fuels. They support environmental sustainability.

Question: Describe the process of electrochemical deposition of metals.

Answer: Electrochemical deposition of metals involves the reduction of metal ions from an electrolyte onto a conductive substrate, forming a metal coating. This process is used for applications like electroplating, metal finishing, and fabrication of microelectronic devices.

Question: What is the role of the electrolyte in an electrolytic cell?

Answer: The electrolyte in an electrolytic cell conducts electricity by allowing ions to move between electrodes, enabling the chemical reactions necessary for electrolysis.

Question: What is the resultant force of two parallel forces acting along the same direction?

Answer: The resultant force is the sum of the two forces.

Question: How does concentration affect the number of collisions in a reaction?

Answer: Higher concentration increases the number of reactant particles in a given volume, leading to more collisions and a faster reaction rate.

Question: What is the pressure exerted by a 1-meter-high column of mercury with a density of  $13,600 \text{ kg/m}^3$ ?

Answer: The pressure exerted is calculated using  $P = h\rho g$ . For a height of 1 m, the pressure is  $P = 1 \text{ m} * 13,600 \text{ kg/m}^3 * 10 \text{ m/s}^2 = 136,000 \text{ Pa}$ .

Question: What is the operation of a triac in AC power control?

Answer: A triac is a bidirectional semiconductor switch that controls AC power by allowing current to flow in both directions when triggered, used in light dimmers and motor speed controls.

Question: What happens to the temperature of a substance during a change of state?

Answer: During a change of state, the temperature of a substance remains constant as the heat supplied is used to break the bonds between the molecules.

Question: What does the velocity-time graph represent in the context of uniform acceleration?

Answer: The velocity-time graph represents a straight line when the velocity increases uniformly over equal time intervals, indicating motion with uniform (constant) acceleration.

Question: What is the specific heat capacity of mercury?

Answer: The specific heat capacity of mercury is  $140 \text{ J kg}^{-1} \text{ K}^{-1}$ .

Question: How does pressure affect the solubility of gases in liquids?

Answer: Increased pressure increases the solubility of gases in liquids, as demonstrated by the high pressure used to dissolve carbon dioxide in soda water.

Question: How do convex mirrors reflect light rays coming parallel to the principal axis?

Answer: These rays reflect as if they are diverging from the focal point.

Question: What are the four types of chemical reactions?

Answer: The four types of chemical reactions are combination, decomposition, single displacement, and double displacement.

Question: How does the structure of ionic compounds affect their solubility in water?

Answer: The structure of ionic compounds, with positive and negative ions, makes them soluble in water because water molecules can surround and separate the ions, dissolving the compound.

Question: How do sodium and chlorine atoms achieve a stable electronic configuration in sodium chloride?

Answer: Sodium atoms lose electrons to form  $\text{Na}^+$  ions, and chlorine atoms gain electrons to form  $\text{Cl}^-$  ions. The electrostatic attraction between these ions forms sodium chloride ( $\text{NaCl}$ ).

Question: What is the significance of the valence band in semiconductor physics?

Answer: The valence band in semiconductor physics is the energy band where electrons are bound to atoms and are not free to move. It is crucial in determining the material's electrical properties.

Question: What are the functions of the gastrointestinal tract?

Answer: The gastrointestinal tract digests food, absorbs nutrients, and eliminates waste, involving organs like the stomach, intestines, and colon.

Question: What is the final velocity of an object that starts from rest and accelerates at  $6 \text{ m/s}^2$  for 3 seconds?

Answer: Final velocity =  $6 \text{ m/s}^2 \times 3 \text{ s} = 18 \text{ m/s}$ .

Question: What is the relationship between the force required to initiate the turning effect and the tightening of the screw in a stick?

Answer: The force required to initiate the turning effect increases as the screw is tightened, indicating that the moment depends on the magnitude of the force.

Question: What are the main endocrine glands in the human body?

Answer: The pituitary gland, thyroid gland, pancreas, adrenal glands, testes, and ovaries.

Question: What are some uses of nitrogen gas?

Answer: Nitrogen gas is used to produce ammonia in industrial scale, chemical fertilizers, and other nitrogen compounds. It is also used to fill electric bulbs and thermometers, create an inert environment for making electronic devices, store substances, package milk powder, as a coolant (liquid nitrogen), and to fill vehicle tires.

Question: How does the electronic configuration of noble gases contribute to their stability?

Answer: Noble gases have a complete outer shell of electrons, which makes them chemically stable and unreactive.

Question: What is potential difference?

Answer: Potential difference is the electric pressure difference between two points in a circuit, which causes electrons to flow.

Question: What are the features of invertebrates in the phylum Arthropoda?

Answer: Invertebrates in the phylum Arthropoda are triploblastic, coelomic, have jointed limbs, segmented bodies forming functional segments called Tagma, a chitinous cuticle acting as an exoskeleton, bilateral symmetry, and show sexual dimorphism.

Question: What is the impact of stress on kidney health?

Answer: Chronic stress can contribute to hypertension, increased cortisol levels, and potential kidney damage over time.

Question: How does the mass of an object affect its acceleration for a given force?

Answer: For a given force, the acceleration of an object is inversely proportional to its mass. A larger mass results in a smaller acceleration.

Question: How does the electron configuration of an element determine its chemical reactivity?

Answer: The electron configuration of an element determines its chemical reactivity by indicating the number of valence electrons, which influence how the element will interact with others.

Question: Calculate the power of a 12V electric bulb drawing a current of 1.5A.

Answer: The power (P) of the bulb is  $P = VI = 12V \times 1.5A = 18W$ .

Question: How is zinc used to demonstrate a single displacement reaction with hydrochloric acid?

Answer: Zinc displaces hydrogen from hydrochloric acid, forming zinc chloride and hydrogen gas:  $Zn + 2HCl \rightarrow ZnCl_2 + H_2$ .

Question: Explain the reaction of aluminum with copper sulfate solution.

Answer: Aluminum displaces copper from copper sulfate, forming aluminum sulfate and copper:  $2Al + 3CuSO_4 \rightarrow Al_2(SO_4)_3 + 3Cu$ .

Question: Describe the working principle of a light-emitting diode (LED).

Answer: A light-emitting diode (LED) produces light through electroluminescence, where electrons recombine with holes in the semiconductor material, releasing energy as photons.

Question: Calculate the energy consumption of a 100W bulb used for 5 hours daily over a week.

Answer: The energy consumption is  $(100W \times 5 \text{ hours} \times 7 \text{ days}) / 1000 = 3.5 \text{ kWh}$ .

Question: How does a concave mirror form an image when the object is placed very far from the mirror?

Answer: The image is real, inverted, and smaller than the object, formed at the focal point.

Question: Explain the reaction between iron and steam.

Answer: Iron reacts with steam to form iron oxide and hydrogen gas:  $3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$ . This reaction is reversible, indicated by the sign.

Question: How is the pressure due to gases similar to the pressure due to liquids?

Answer: Both gases and liquids exert pressure due to their weight and when they are compressed. The pressure in a gas increases with the height of the gas column and when the gas is confined.

Question: What is the function of the urinary bladder?

Answer: The urinary bladder stores urine temporarily before it is expelled from the body through the urethra.

Question: How does a transformer transfer electrical energy between circuits?

Answer: A transformer uses electromagnetic induction to transfer electrical energy between its primary and secondary windings, allowing voltage



step-up or step-down in power distribution.

Question: How do halogens react with alkali metals?

Answer: Halogens react with alkali metals to form ionic salts, such as sodium chloride.

Question: What is the role of vacuoles in plant cells?

Answer: Vacuoles store nutrients, waste products, and water, helping to maintain turgor pressure, support cell structure, and regulate intracellular conditions.

Question: How do geneticists use symbols to represent alleles?

Answer: Geneticists use capital letters for dominant alleles and lowercase letters for recessive alleles, simplifying the notation of genotypes and inheritance patterns.

Question: What is the relative molecular mass of water (H<sub>2</sub>O)?

Answer: The relative molecular mass of water (H<sub>2</sub>O) is 18, calculated as 2 x 1 for hydrogen plus 16 for oxygen.

Question: What are some ethical considerations in genetic testing?

Answer: Ethical considerations in genetic testing include issues of privacy, the potential for discrimination based on genetic information, informed consent, and the implications of knowing one's genetic risks for certain diseases.

Question: Where can parenchyma tissues be found in plants?

Answer: Parenchyma tissues can be found in the cortex and pith of plant stems, the pith and cortex of roots, fleshy parts of fruits, seeds (endosperm), and leaves (mesophylls).

Question: What is the fallopian tube?

Answer: The fallopian tube is a muscular tube that transports ova from the ovaries to the uterus. It has finger-like projections called fimbria that help transfer the ovum into the tube.

Question: What role does phloem parenchyma play in phloem tissue?

Answer: Phloem parenchyma are living cells that assist in the transport and storage of nutrients within the phloem tissue.

Question: What is the relationship between force magnitude and the moment of force in rotational motion?

Answer: The moment of force in rotational motion is directly proportional to the magnitude of the applied force. An increase in force results in a larger moment, making it easier to rotate the object.

Question: Explain the concept of coulombic efficiency in batteries and its significance.

Answer: Coulombic efficiency in batteries is the ratio of the charge extracted during discharge to the charge input during charging. It indicates the efficiency of charge storage and retrieval, with higher values representing better battery performance and lower losses.

Question: What is the role of a fractionating column in fractional distillation?

Answer: The fractionating column allows for the separation of components with closer boiling points by providing multiple condensation and vaporization stages.

Question: What is the function of the kidney in excretion?

Answer: The kidney is primarily responsible for nitrogenous excretion in humans, filtering out urea and other waste products from the blood.

Question: What is the acceleration of a 5 kg object when a force of 15 N is applied?

Answer: The acceleration is  $a = F/m = 3 \text{ m/s}^2$ .

Question: What are the molecular formulae of propane and butane?

Answer: The molecular formula of propane is  $\text{C}_3\text{H}_8$ , and the molecular formula of butane is  $\text{C}_4\text{H}_{10}$ .

Question: Explain the decomposition reaction of hydrogen peroxide.

Answer: Hydrogen peroxide decomposes to form water and oxygen gas:  
 $2\text{H}_2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{O}_2$ .

Question: How does a solid oxide fuel cell (SOFC) differ from other fuel cells?

Answer: A solid oxide fuel cell (SOFC) operates at high temperatures (800-1000°C) using a solid ceramic electrolyte. It offers high efficiency, fuel flexibility, and durability, making it suitable for stationary power generation.

Question: What is the purpose of a voltmeter in a circuit?

Answer: A voltmeter is used to measure the potential difference (voltage) between two points in a circuit.

Question: How does a silicon-controlled rectifier (SCR) work?

Answer: A silicon-controlled rectifier (SCR) is a semiconductor device that conducts current when triggered by a gate signal, used for controlling high power in applications like motor drives and light dimmers.

Question: What is a polar covalent bond?

Answer: A polar covalent bond is a covalent bond in which the electron distribution between two atoms of different electronegativities is asymmetric, causing a partial positive and negative charge.

Question: How does a Liebig condenser work in distillation?

Answer: The Liebig condenser cools the vapor produced during distillation by circulating cold water around the vapor, causing it to condense back into liquid.

Question: How do catalysts benefit industrial chemical reactions?

Answer: Catalysts enhance reaction rates, reduce energy costs, and improve product yield in industrial chemical reactions.

Question: What does the gradient of a velocity-time graph represent?

Answer: The gradient of a velocity-time graph represents acceleration.

Question: How do you prepare a  $1 \text{ mol/dm}^3$  solution of ammonium chloride?

Answer: Weigh the required mass of  $\text{NH}_4\text{Cl}$ , dissolve it in water, and adjust the final volume in a volumetric flask.

Question: How is the chemical formula of hydrochloric acid represented?

Answer: The chemical formula of hydrochloric acid is  $\text{HCl}$ , indicating one hydrogen atom and one chlorine atom.

Question: What does a straight line with a negative slope on a velocity-time graph represent?

Answer: It represents uniform deceleration.

Question: How do inhibitors affect the rate of chemical reactions?

Answer: Inhibitors slow down reactions by decreasing the frequency of effective collisions between reactant particles.

Question: How do multicellular organisms achieve growth and development?

Answer: Multicellular organisms achieve growth and development through cell division, differentiation, and the formation of specialized tissues and organs.

Question: What is the role of a supporting metal frame in a loudspeaker?

Answer: The supporting metal frame holds the cone and magnet in place, ensuring proper alignment and function of the loudspeaker.

Question: How does habitat destruction impact pollinator populations?

Answer: Habitat destruction reduces available resources, nesting sites, and foraging areas for pollinators. It leads to declines in pollinator populations and affects ecosystem health and agricultural productivity.

Question: What is the molar mass of magnesium oxide ( $\text{MgO}$ )?

Answer: The molar mass of magnesium oxide is 40 grams per mole, calculated as 24 for magnesium plus 16 for oxygen.

Question: What observations can be made when varying the concentration of hydrochloric acid in reactions with magnesium ribbon?

Answer: Higher concentrations of hydrochloric acid lead to faster gas evolution, indicating an increased reaction rate.

Question: Describe the purpose of a power amplifier in audio systems.

Answer: A power amplifier increases the power of audio signals, driving speakers to produce sound at higher volumes and with better clarity.

Question: How does friction affect the motion of a carom disc on a smooth surface?

Answer: Friction opposes the motion of the carom disc, causing it to slow down and eventually stop. A smoother surface reduces friction, allowing the disc to move further before stopping.

Question: What is the principle of thermal equilibrium?

Answer: Thermal equilibrium is the state when two objects in contact reach the same temperature, resulting in no net heat transfer between them.

Question: What are hydrophilous flowers?

Answer: Hydrophilous flowers are pollinated by water. Staminate flowers float in water and contact pistillate flowers for pollination. An example is vallisneria.

Question: How do you determine the equilibrium of an object under the action of two forces using a ring and spring balances?

Answer: Attach the spring balances to the ring and pull in opposite directions with varying forces. The object remains in equilibrium when the forces are equal in magnitude and opposite in direction, resulting in no net movement.

Question: What happens to the induced current when the coil in a dynamo is parallel to the magnetic field?

Answer: When the coil is parallel to the magnetic field, the induced current becomes zero as there is no intersection of field lines.

Question: How are components with close boiling points separated by fractional distillation?

Answer: By using a fractionating column to provide multiple stages of condensation and vaporization, enhancing separation.

Question: How do magnesium and sulfur atoms achieve a stable electronic configuration in magnesium sulfide?

Answer: Magnesium atoms lose electrons to form  $Mg^{2+}$  ions, and sulfur atoms gain electrons to form  $S^{2-}$  ions. The electrostatic attraction between these ions forms magnesium sulfide ( $MgS$ ).

Question: What is the role of a fractionating column in fractional distillation?

Answer: To separate components with close boiling points by providing multiple condensation and vaporization stages

Question: What are some common colors emitted by LEDs?

Answer: Common colors emitted by LEDs include red, yellow, green, blue, as well as infrared (IR) and ultraviolet (UV).

Question: What is the significance of the umbilical cord?

Answer: The umbilical cord connects the fetus to the placenta, allowing for the exchange of nutrients, oxygen, and waste products between the mother and fetus.

Question: How does electromagnetic induction enable the operation of a moving coil microphone?

Answer: Electromagnetic induction enables the microphone to convert sound waves into electrical signals by inducing a current in the vibrating coil.

Question: What is the momentum of a 10 kg object moving at 6 m/s?

Answer: The momentum is  $p = m \times v = 10 \times 6 = 60$  kg m/s.

Question: How do polyatomic ions form ionic compounds?

Answer: Polyatomic ions form ionic compounds by combining with oppositely charged ions through electrostatic attraction, resulting in compounds like ammonium nitrate ( $\text{NH}_4\text{NO}_3$ ) and calcium carbonate ( $\text{CaCO}_3$ ).

Question: What is the velocity of an object with a displacement of 30 meters in 5 seconds?

Answer: Velocity =  $30 \text{ m} / 5 \text{ s} = 6 \text{ m/s}$ .

Question: What happens to the induced current when the coil in a dynamo is parallel to the magnetic field?

Answer: When the coil is parallel to the magnetic field, the induced current becomes zero as there is no intersection of field lines.

Question: What is the reaction between potassium and water?

Answer: Potassium reacts vigorously with water to form potassium hydroxide and hydrogen gas:  $2\text{K} + 2\text{H}_2\text{O} \rightarrow 2\text{KOH} + \text{H}_2$ .

Question: Explain the concept of environmental management and its importance in sustainable development.

Answer: Environmental management involves the responsible use and protection of natural resources through sustainable practices. It aims to balance human needs with the preservation of the environment to ensure that natural resources are available for future generations. Key aspects of environmental management include:

- Sustainable Development:** Sustainable development is the use of resources in a way that meets present needs without compromising the ability of future generations to meet theirs. It involves reforestation, using traditional knowledge and technologies, and minimizing carbon footprints.
- Traditional Knowledge and Technology:** Traditional agricultural practices, such as using local seeds and crop varieties, can enhance sustainability. Historical irrigation systems, like those used in ancient Sri Lanka, demonstrate effective water management techniques.
- Benefits:** Preserves cultural heritage, promotes biodiversity, and ensures resource efficiency.
- Waste Management:** Effective waste management involves reducing, reusing, and recycling waste materials. The 4R technique (Reuse, Reduce, Replace, Recycle) helps manage waste sustainably. Benefits: Reduces pollution, conserves natural resources, and minimizes environmental impact.
- Energy Management:** Energy management includes planning and monitoring energy production and consumption to ensure sustainable use. It involves using renewable energy sources and improving energy efficiency. Benefits: Reduces dependency on fossil fuels, lowers greenhouse gas emissions, and promotes sustainable energy use.

Question: What is biomagnification?

Answer: Biomagnification is the accumulation of toxic chemical pollutants along food chains from one trophic level to the next, resulting in higher concentrations in top predators.

Question: What is the molar mass of calcium carbonate ( $\text{CaCO}_3$ )?

Answer: The molar mass of calcium carbonate is 100 grams per mole, calculated as 40 for calcium, 12 for carbon, and  $3 \times 16$  for oxygen.

Question: How do you calculate the total current passing through a circuit with three bulbs connected in parallel to a 12 V power supply?

Answer: Calculate the current through each bulb using  $I = V/R$ , then sum the currents to get the total current.

Question: What are the characteristics of organisms in the Domain Archaea?

Answer: Organisms in the Domain Archaea are prokaryotes that can live in extreme environments like volcanoes, deserts, and polar ice caps. They are not sensitive to most antibiotics.

Question: How does the use of nanomaterials enhance the performance of electrochemical sensors?

Answer: The use of nanomaterials enhances the performance of electrochemical sensors by providing a high surface area, improved conductivity, and increased sensitivity, enabling the detection of low concentrations of analytes and rapid response times.

Question: How do geneticists use probability to study inheritance patterns?

Answer: Geneticists use probability to study inheritance patterns by calculating the likelihood of certain traits appearing in offspring, based on the known genotypes of the parents and the rules of inheritance.

Question: What are the signs and symptoms of chronic kidney disease (CKD)?

Answer: Symptoms of CKD include fatigue, swelling in legs and ankles, frequent urination, blood in urine, high blood pressure, and nausea.

Question: What is the relative molecular mass of glucose ( $C_6H_{12}O_6$ )?

Answer: The relative molecular mass of glucose is 180, calculated as  $6 \times 12$  for carbon,  $12 \times 1$  for hydrogen, and  $6 \times 16$  for oxygen.

Question: What is the function of vitamin E?

Answer: Vitamin E is important for the growth of tissues and cells.

Question: What are the signs and symptoms of urinary retention?

Answer: Symptoms of urinary retention include difficulty starting urination, weak urine flow, frequent urination, and a feeling of incomplete bladder emptying.

Question: What is the valency of carbon?

Answer: The valency of carbon is 4.

Question: What is the chemical formula for sodium chloride?

Answer: The chemical formula for sodium chloride is NaCl.

Question: What are common respiratory diseases?

Answer: Common respiratory diseases include asthma, bronchitis, pneumonia, and chronic obstructive pulmonary disease (COPD).

Question: What is the significance of grafting in plant propagation?

Answer: Grafting allows the propagation of plants with desirable traits, including disease resistance and strong root systems, by fusing the stock and scion.

Question: How does the accumulation of heavy metals in soil affect plant growth?

Answer: The accumulation of heavy metals in soil affects plant growth by interfering with nutrient uptake, causing toxicity, and reducing crop yields.

Question: How does an aneroid barometer measure atmospheric pressure?

Answer: An aneroid barometer measures atmospheric pressure using a sealed, air-evacuated cavity with flexible walls. Changes in pressure cause the walls to flex, moving an indicator to show the pressure on a scale.

Question: How does the expansion of liquids demonstrate thermal expansion principles?

Answer: The expansion of liquids demonstrates thermal expansion principles by showing how liquid volume increases with temperature, as seen in experiments with colored water and test tubes.

Question: What are common kidney diseases?

Answer: Common kidney diseases include chronic kidney disease, kidney stones, and nephritis.

Question: What is the importance of homeostasis?

Answer: Homeostasis maintains a constant internal environment, essential for stable cellular activities and overall health.

Question: What are the practical applications of understanding heat changes in chemical reactions?

Answer: Applications include industrial process optimization, energy production, environmental management, and scientific research.

Question: What is the function of the androecium?

Answer: The androecium, the male reproductive structure, produces pollen in the anther, which contains the male gamete cells of the plant.

Question: What happens to the induced current when the coil in a dynamo is parallel to the magnetic field?

Answer: When the coil is parallel to the magnetic field, the induced current becomes zero as there is no intersection of field lines.

Question: How does atmospheric pressure vary with weather conditions?

Answer: Atmospheric pressure varies with weather conditions; low pressure is often associated with storms and precipitation, while high pressure generally brings clear and calm weather.

Question: What is the difference between concave and convex mirrors in terms of image formation?

Answer: Concave mirrors can form both real and virtual images, while convex mirrors always form virtual images that are smaller and upright.

Question: What is the purpose of a watchdog timer in microcontroller systems?

Answer: A watchdog timer monitors the operation of a microcontroller and resets it if the system becomes unresponsive, enhancing reliability and preventing system crashes.

Question: How is the amount of substance deposited during electrolysis calculated?

Answer: The amount of substance deposited during electrolysis is calculated using Faraday's law:  $\text{mass} = (\text{current} \times \text{time} \times \text{molar mass}) / (n \times \text{Faraday's constant})$ , where  $n$  is the number of electrons involved in the reaction.

Question: How do geneticists use probability to study inheritance patterns?

Answer: Geneticists use probability to study inheritance patterns by calculating the likelihood of certain traits appearing in offspring, based on the known genotypes of the parents and the rules of inheritance.

Question: How does a digital oscilloscope display electrical signals?

Answer: A digital oscilloscope samples electrical signals, converts them to digital data, and displays the waveform on a screen, allowing analysis of signal characteristics.

Question: What is the role of genetic counseling in managing inherited cancer risk?

Answer: Genetic counseling provides individuals with information about their genetic risk for inherited cancers, helping them understand their options for surveillance, prevention, and treatment, and guiding them in making informed decisions about their health.

Question: How is power related to work and time?

Answer: Power is the rate at which work is done, calculated as the work done divided by the time taken.

Question: How do microwaves heat food in a microwave oven?

Answer: Microwaves cause water and fat molecules in food to vibrate, converting microwave energy into heat.

Question: How does the solubility of a gas in water change with temperature?

Answer: The solubility of a gas in water decreases with an increase in temperature.

Question: What are the signs and symptoms of polycystic kidney disease (PKD)?

Answer: Symptoms of PKD include high blood pressure, back or side pain, blood in urine, frequent urination, and kidney stones.

Question: How do you prepare a 1 mol/dm<sup>3</sup> solution of potassium hydroxide?

Answer: Weigh the required mass of KOH, dissolve it in water, and adjust the final volume in a volumetric flask.



Question: What are the features of non-flowering seedless plants?

Answer: Non-flowering seedless plants can have a thalloid body or small fern type, are autotrophic and photosynthetic, and reproduce asexually by spores and vegetative fragmentation.

Question: What is the importance of accurate weighing in preparing solutions?

Answer: Accurate weighing ensures the correct concentration and effectiveness of the solution.

Question: What is the role of epithelial tissue in the thyroid gland?

Answer: Epithelial tissue in the thyroid gland produces and secretes hormones that regulate metabolism, growth, and development

Question: What is the effect of a convex lens on parallel light rays?

Answer: A convex lens converges parallel light rays to a focal point on the opposite side of the lens.

Question: How does friction influence the motion of a car on a road?

Answer: Friction between the car's tires and the road surface provides the necessary grip for acceleration, deceleration, and turning. It opposes the motion of the car and can cause the car to slow down.

Question: What is the specific heat capacity of a substance, and how is it measured?

Answer: The specific heat capacity of a substance is the amount of heat required to raise the temperature of a unit mass of the substance by one degree Celsius or Kelvin. It is measured by supplying a known amount of heat to a known mass and measuring the resulting temperature change.

Question: What is the first ionisation energy of phosphorus?

Answer: The first ionisation energy of phosphorus is 1012 kJ/mol.

Question: How does the ionisation energy of noble gases compare to other elements in the same period?

Answer: The ionisation energy of noble gases is generally higher than other elements in the same period.

Question: How does the speed of a rotating coil influence the dynamo's output?

Answer: A faster rotating coil increases the rate of change of the magnetic field, generating higher voltage and more electrical power.

Question: What is the chemical formula for monosaccharides?

Answer: The chemical formula for monosaccharides is  $C_6H_{12}O_6$ .

Question: What is reproduction?

Answer: Reproduction is the life process that gives rise to a new generation from an existing generation. It is essential to maintain the continuity of life and is a characteristic feature of organisms.

Question: How does the diaphragm movement in a microphone relate to sound waves?

Answer: The diaphragm moves in response to sound waves, causing the attached coil to move within a magnetic field and generate an alternating current corresponding to the sound.

Question: What happens when two forces of 10 N and 6 N act in opposite directions?

Answer: The resultant force is 4 N in the direction of the larger force.

Question: What is the electronic configuration of potassium?

Answer: The electronic configuration of potassium is 2, 8, 8, 1.

Question: How does the body's acid-base balance relate to kidney function?

Answer: The kidneys help maintain acid-base balance by excreting hydrogen ions and reabsorbing bicarbonate, regulating blood pH levels.

Question: What is a sledge hammer used for?

Answer: A sledge hammer is used for breaking stones and cutting firewood by converting its potential energy into kinetic energy upon impact.

Question: How is work calculated when a force is applied to move an object?

Answer: Work is calculated by multiplying the magnitude of the force by the distance moved in the direction of the force.

Question: How is gravitational potential energy calculated?

Answer: Gravitational potential energy ( $E_p$ ) =  $mgh$ , where  $m$  is mass,  $g$  is gravitational acceleration, and  $h$  is height.

Question: What role does the axle play in an alternating current dynamo?

Answer: The axle rotates the coil within the magnetic field, enabling continuous induction of electromotive force and generation of alternating current.

Question: What is the difference between evaporation and boiling in terms of heat transfer?

Answer: Evaporation is the gradual conversion of a liquid to gas at temperatures below the boiling point, while boiling is the rapid conversion of a liquid to gas at its boiling point. Both processes involve heat transfer but occur under different conditions.

Question: What components are involved in the operation of a DC motor?

Answer: Components involved in a DC motor's operation include the coil, split rings, brushes, armature, and magnetic poles.

Question: What are the five main phyla of invertebrates mentioned in the document?

Answer: The five main phyla of invertebrates are Cnidaria/Coelenterata, Annelida, Mollusca, Arthropoda, and Echinodermata.

Question: How does the diaphragm movement in a microphone relate to sound waves?

Answer: The diaphragm moves in response to sound waves, causing the attached coil to move within a magnetic field and generate an alternating

current corresponding to the sound.

Question: What is denitrification?

Answer: Denitrification is the process by which denitrifying bacteria, such as *Pseudomonas* and *Thiobacillus*, convert nitrates back into atmospheric nitrogen.

Question: What is the difference between real and virtual images?

Answer: Real images can be projected on a screen as they are formed by actual converging rays, while virtual images cannot be projected as they are formed by rays that only appear to converge.

Question: How is the chemical formula of phosphorus pentoxide written?

Answer: The chemical formula of phosphorus pentoxide is  $P_2O_5$ , indicating two phosphorus atoms and five oxygen atoms.

Question: How do geneticists use symbols to represent alleles?

Answer: Geneticists use capital letters for dominant alleles and lowercase letters for recessive alleles, simplifying the notation of genotypes and inheritance patterns.

Question: What hormone does the pituitary gland secrete, and what is its function?

Answer: The pituitary gland secretes growth hormone, which increases protein synthesis, and promotes the growth of body tissues and long bones.

Question: What is the resultant force when two forces of 8 N and 6 N act in opposite directions?

Answer: The resultant force is 2 N in the direction of the larger force (8 N).

Question: What is the atomic number of phosphorus?

Answer: The atomic number of phosphorus is 15.

Question: What are the potential benefits of CRISPR technology in agriculture?

Answer: CRISPR technology can be used to create crops with improved traits such as disease resistance, enhanced nutritional content, and increased yield, contributing to food security and sustainable agriculture.

Question: What is an example of a non-polar inorganic solute and solvent pair?

Answer: An example is carbon disulfide (non-polar inorganic solute) dissolving in liquid carbon dioxide (non-polar solvent).

Question: What is rectification in electronics?

Answer: Rectification is the process of converting alternating current (AC) to direct current (DC) using devices like diodes that allow current to flow in only one direction.

Question: How is the chemical formula of water written?

Answer: The chemical formula of water is  $H_2O$ , indicating two hydrogen atoms and one oxygen atom.

Question: What is the significance of the boiling point in phase transitions?  
Answer: The boiling point is the temperature at which a liquid changes to a gas, important for understanding phase transitions and the behavior of substances under different conditions.

Question: How does a membrane electrode assembly (MEA) function in a fuel cell?

Answer: A membrane electrode assembly (MEA) in a fuel cell consists of a proton-conducting membrane sandwiched between two electrodes (anode and cathode). It facilitates the electrochemical reactions, allowing protons to pass through the membrane while electrons flow through an external circuit, generating electricity.

Question: What is a food chain?

Answer: A food chain is the sequence of energy and material flow from producers to consumers, such as primary consumers to secondary consumers.

Question: What is the effect of doubling the force on the acceleration of an object?

Answer: Doubling the force on an object doubles its acceleration, as acceleration is directly proportional to the applied force.

Question: How is zinc used to demonstrate a single displacement reaction with hydrochloric acid?

Answer: Zinc displaces hydrogen from hydrochloric acid, forming zinc chloride and hydrogen gas:  $\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$ .

Question: What is the specific heat capacity of copper?

Answer: The specific heat capacity of copper is  $400 \text{ J kg}^{-1} \text{ K}^{-1}$ .

Question: What is the significance of the noble gas configuration in chemical bonding?

Answer: The noble gas configuration is significant in chemical bonding because elements tend to gain, lose, or share electrons to achieve a stable electron arrangement similar to that of noble gases.

Question: How do you investigate the equilibrium of a meter ruler under the action of three coplanar parallel forces?

Answer: Suspend the meter ruler horizontally using two rubber bands and spring balances at either end. Measure the forces exerted by the balances and compare them to the weight of the ruler to ensure they balance and maintain equilibrium.

Question: What happens when sulphur is burned in air?

Answer: Sulphur burns with a blue flame in air, forming sulphur dioxide gas.

Question: How do protists contribute to aquatic ecosystems?

Answer: Algae, a type of protist, act as primary producers in aquatic food chains.

Question: What is the role of carbon electrodes in electrolysis?

Answer: Carbon electrodes are inert and do not participate in the reactions, ensuring only the desired electrolytic reactions occur.

Question: What is the role of the cathode in electroplating?

Answer: The cathode is the object to be plated, where metal ions are reduced and deposited as a thin metallic layer, providing the desired coating.

Question: What lifestyle changes can reduce the risk of kidney disease?

Answer: Reducing salt and protein intake, maintaining a healthy weight, staying hydrated, managing blood pressure and diabetes, and avoiding smoking can reduce the risk of kidney disease.

Question: Calculate the energy consumption of a 100W bulb used for 5 hours daily over a week.

Answer: The energy consumption is  $(100\text{W} \times 5 \text{ hours} \times 7 \text{ days}) / 1000 = 3.5 \text{ kWh}$ .

Question: How are flowering plants classified?

Answer: Flowering plants are classified into monocotyledonae (monocots) and dicotyledonae (dicots) based on the number of cotyledons in the seed.

Question: How does the specific heat capacity of a substance affect its temperature change?

Answer: Substances with higher specific heat capacities experience smaller temperature changes when the same amount of heat is supplied compared to substances with lower specific heat capacities.

Question: What is the reaction between potassium and water?

Answer: Potassium reacts vigorously with water to form potassium hydroxide and hydrogen gas:  $2\text{K} + 2\text{H}_2\text{O} \rightarrow 2\text{KOH} + \text{H}_2$ .

Question: What is the role of the culture medium in tissue culture?

Answer: The culture medium provides essential nutrients, including sucrose, mineral salts, vitamins, and growth substances, and is solidified with agar.

Question: How do scientists study the genetic basis of inherited traits?

Answer: Scientists study the genetic basis of inherited traits through experiments, genetic crosses, and analysis of DNA sequences to understand how traits are passed down from one generation to the next.

Question: What is the mass number of sodium if it has 11 protons and 12 neutrons?

Answer: The mass number of sodium is 23 (11 protons + 12 neutrons).

Question: How are polysaccharides formed?

Answer: Polysaccharides are formed by the polymerization of a large number of monosaccharides.

Question: What are the two processes involved in food digestion?

Answer: The two processes are mechanical digestion, which alters the physical nature of the food, and chemical digestion, which breaks down

complex compounds into simple molecules using enzymes.

Question: How do you calculate the potential difference across a bulb with a current of 1.5 A and a resistance of  $6\ \Omega$ ?

Answer: Using Ohm's Law,  $V = IR$ , the potential difference is  $V = 1.5\text{ A} \times 6\ \Omega = 9\text{ V}$ .

Question: Describe the working principle of an ultrasonic sensor.

Answer: An ultrasonic sensor emits high-frequency sound waves and measures the time it takes for the waves to reflect back from an object, determining the object's distance.

Question: How is the chemical formula of sodium hydroxide represented?

Answer: The chemical formula of sodium hydroxide is NaOH, indicating one sodium ion and one hydroxide ion.

Question: What causes gonorrhea, and what are its symptoms?

Answer: Gonorrhea is caused by the bacterium *Neisseria gonorrhoeae* and is characterized by secretions from sex organs, pain, and blockage of the fallopian tube.

Question: What is the impact of industrialization on the environment?

Answer: The impact of industrialization on the environment includes increased pollution, habitat destruction, and depletion of natural resources.

Question: What did Robert Hooke observe in the cork?

Answer: Robert Hooke observed structures like chambers in a beehive, which he named cells.

Question: What is the function of red blood cells (RBCs) in blood?

Answer: RBCs transport oxygen from the lungs to body tissues and carry carbon dioxide from tissues to the lungs, using hemoglobin to bind oxygen.

Question: What are the common examples of exothermic reactions in daily life?

Answer: Combustion of fuels, cellular respiration, and neutralization reactions between acids and bases.

Question: What is multiple cropping, and what are its benefits?

Answer: Multiple cropping is the cultivation of different crops in one land area instead of mono-cropping on a large scale. It avoids the risk of crop destruction from disease and reduces pests with high resistance.

Question: How do plant cells maintain their rigidity?

Answer: Plant cells maintain their rigidity through the cell wall, which provides structural support and protection, and the central vacuole, which maintains turgor pressure.

Question: What is the function of skeletal muscle tissue?

Answer: Skeletal muscle tissue is involved in locomotion and movements, is voluntarily controlled, and fatigues easily.

Question: What is the vas deferens?

Answer: The vas deferens is a tube that transports sperms from the epididymis to the urethra, joining the tube coming from the seminal vesicles.

Question: Describe the process of respiration in humans.

Answer: Respiration involves three stages: gas exchange between the external environment and lungs, gas exchange in alveoli, and cellular respiration, where oxygen is used to produce energy.

Question: What are the main symptoms of gastritis?

Answer: The main symptoms of gastritis include inflammation and swelling in the stomach lining due to increased acidity. This condition is often caused by not taking meals on time, frequent consumption of oily and acidic foods, and mental stress from a competitive lifestyle.

Question: What role does the magnetic field play in the operation of a bicycle dynamo?

Answer: The magnetic field interacts with the rotating coil, inducing an electromotive force that generates electrical power for the bicycle's lights.

Question: What are the advantages of using electrochemical methods for carbon capture and utilization?

Answer: Electrochemical methods for carbon capture and utilization offer advantages like high efficiency, selective conversion of CO<sub>2</sub> to valuable products, integration with renewable energy sources, and reduced environmental impact compared to traditional methods.

Question: How does the structure of water contribute to its high surface tension?

Answer: The structure of water, with hydrogen bonds between molecules, creates a cohesive force at the surface that results in high surface tension, allowing water to form droplets and support small objects.

Question: How does the reactivity of halogens change down Group VII?

Answer: The reactivity of halogens decreases down Group VII.

Question: How does a transformer change the voltage?

Answer: A transformer changes the voltage by inducing a higher or lower voltage in the secondary coil based on the ratio of turns between the primary and secondary coils.

Question: How do geneticists use bioinformatics in genetic research?

Answer: Bioinformatics combines biology, computer science, and statistics to analyze and interpret large-scale genetic data, helping to identify genes associated with diseases, understand genetic variation, and predict the effects of genetic mutations.

Question: What is the valency of oxygen?

Answer: The valency of oxygen is 2.

Question: How is the chemical formula of aluminium oxide written?

Answer: The chemical formula of aluminium oxide is Al<sub>2</sub>O<sub>3</sub>, indicating two aluminium ions and three oxide ions.

Question: What is the significance of the nucleolus in ribosome assembly?

Answer: The nucleolus assembles ribosomal RNA and proteins into ribosomal subunits, which are then transported to the cytoplasm for protein synthesis.

Question: What is the significance of the latent heat of fusion in phase change processes?

Answer: The latent heat of fusion is significant in phase change processes because it quantifies the energy required to convert a solid into a liquid at its melting point, providing insight into the energy dynamics of phase transitions.

Question: What are the standards of binomial nomenclature?

Answer: The standards include using Latin or Greek for names, capitalizing the first letter of the generic name, underlining handwritten names, and italicizing printed names.

Question: How do potassium and fluorine atoms achieve a stable electronic configuration in potassium fluoride?

Answer: Potassium atoms lose electrons to form  $K^+$  ions, and fluorine atoms gain electrons to form  $F^-$  ions. The electrostatic attraction between these ions forms potassium fluoride (KF).

Question: Explain the reaction of potassium with hydrochloric acid.

Answer: Potassium reacts violently with hydrochloric acid, forming potassium chloride and hydrogen gas:  $2K + 2HCl \rightarrow 2KCl + H_2$ .

Question: How is the resultant force of two parallel forces acting along the same direction demonstrated?

Answer: It is demonstrated by using Newton balances and a strip of wood to show that the sum of the forces from two balances is equal to the force measured by a third balance.

Question: What is the relationship between sound wave amplitude and energy?

Answer: Higher amplitude sound waves carry more energy, resulting in louder sounds.

Question: How do you calculate the potential difference across each resistor in a series circuit with a 12 V power supply?

Answer: Use Ohm's Law to calculate the voltage drop across each resistor:  $V = IR$ , where  $I$  is the total current and  $R$  is the resistance of each resistor.

Question: How many electrons can the fourth energy level hold?

Answer: The fourth energy level can hold a maximum of 32 electrons.

Question: How do inhibitors influence chemical reactions?

Answer: Inhibitors decrease the rate of chemical reactions by interfering with the reactant collisions, making reactions slower.



Question: How does the nature of the solute affect solubility in a given solvent?

Answer: Different solutes have varying solubility levels in the same solvent due to their chemical nature.

Question: Why is binomial nomenclature important?

Answer: Binomial nomenclature provides a standardized way to name organisms, avoiding confusion caused by different common names in various languages and regions, and helps in identifying evolutionary relationships.

Question: How does the coil in a DC motor rotate?

Answer: When current flows through the coil in a magnetic field, forces act on the coil due to Fleming's left-hand rule, causing it to rotate clockwise.

Question: What is the role of a photodiode in electronics?

Answer: A photodiode converts light into electrical current by generating electron-hole pairs when exposed to light, making it useful in light detection and solar energy applications.

Question: How does habitat destruction contribute to the decline in biodiversity?

Answer: Habitat destruction contributes to the decline in biodiversity by eliminating the natural environments where species live, leading to the loss of species and genetic diversity.

Question: How do plants respond to water availability?

Answer: Plants respond to water availability by adjusting their root growth, opening or closing stomata, and producing hormones like abscisic acid to regulate water loss and uptake.

Question: How does the release of methane (CH<sub>4</sub>) contribute to climate change?

Answer: Methane is a potent greenhouse gas that traps heat in the atmosphere, contributing to global warming. It is released from agricultural activities, landfills, and fossil fuel extraction.

Question: What is the difference between genotype and phenotype?

Answer: Genotype is the genetic makeup of an organism, while phenotype is the observable expression of traits determined by the genotype.

Question: How does the electrolysis of water produce oxygen gas?

Answer: Oxygen gas is produced at the anode by the oxidation of OH<sup>-</sup> ions:  $4\text{OH}^- (\text{aq}) \rightarrow \text{O}_2 (\text{g}) + 2\text{H}_2\text{O} (\text{l}) + 4\text{e}^-$ .

Question: What is the role of an isolation transformer in electrical safety?

Answer: An isolation transformer provides electrical isolation between the input and output, protecting users and equipment from electrical shocks and reducing ground loop interference.

Question: Explain the process of electroplating with a specific example.

Answer: Electroplating involves depositing a thin layer of metal onto an object's surface using electrolysis. For example, in nickel electroplating, the

object to be plated is the cathode, and a nickel anode is used. Nickel ions from the electrolyte are reduced and deposited onto the object's surface.

Question: How is a light ray represented in diagrams?

Answer: A light ray is represented by a straight line with an arrowhead indicating the direction of the light's travel.

Question: How are flowering plants adapted to life on land?

Answer: Flowering plants have various adaptations to conserve water and can produce flowers for sexual reproduction.

Question: How does cardiac muscle tissue differ from other muscle tissues?

Answer: Cardiac muscle tissue consists of short, uninucleate, striated cells with intercalated discs that allow synchronized contractions, and it does not fatigue.

Question: What is the molar mass of sodium chloride (NaCl)?

Answer: The molar mass of sodium chloride is 58.5 grams per mole, calculated as 23 for sodium plus 35.5 for chlorine.

Question: How does a membrane electrode assembly (MEA) function in a fuel cell?

Answer: A membrane electrode assembly (MEA) in a fuel cell consists of a proton-conducting membrane sandwiched between two electrodes (anode and cathode). It facilitates the electrochemical reactions, allowing protons to pass through the membrane while electrons flow through an external circuit, generating electricity.

Question: What is the primary function of water in the cells of organisms?

Answer: Water provides a medium for bio-chemical reactions in the cells of organisms.

Question: What are some useful effects of fungi to humans?

Answer: Useful effects of fungi include serving as a supplementary protein source (e.g., mushrooms), aiding in bread and alcohol fermentation (e.g., yeast), and producing antibiotics (e.g., Penicillium).

Question: What is the purpose of the axle in an alternating current dynamo?

Answer: The axle rotates the coil within the magnetic field, enabling continuous induction of electromotive force and generation of alternating current.

Question: What is the heat capacity of an object?

Answer: The heat capacity of an object is the amount of heat required to increase the object's temperature by one unit.

Question: How does the electronic configuration of hydrogen influence the formation of hydrogen chloride?

Answer: The electronic configuration of hydrogen (1 electron) allows it to share its electron with a chlorine atom, forming hydrogen chloride (HCl) with a stable electronic configuration.

Question: How do you determine the volume fraction of a component in a liquid mixture?

Answer:  $\text{Volume fraction} = \frac{\text{Volume of component}}{\text{Total volume of the mixture}}$ .

Question: What is the concentration of a solution prepared by dissolving 12g of urea in 1 dm<sup>3</sup> of water?

Answer: The concentration is 0.2 mol/dm<sup>3</sup>.

Question: How is the principal axis related to the curvature of spherical mirrors?

Answer: The principal axis is perpendicular to the mirror's surface at the pole and passes through the center of curvature.

Question: What is the role of carbon monoxide in the blast furnace?

Answer: Carbon monoxide acts as a reducing agent, reducing iron ore to liquid iron by reacting with iron(III) oxide to form carbon dioxide.

Question: What is the principle behind the operation of a bicycle dynamo?

Answer: The principle behind a bicycle dynamo is electromagnetic induction, where mechanical rotation induces an electromotive force in the coil.

Question: What is the purpose of the galvanometer in demonstrating electromagnetic induction?

Answer: The galvanometer measures the induced current, indicating the presence and magnitude of electromagnetic induction in a circuit.

Question: How does a photovoltaic cell generate electricity from sunlight?

Answer: A photovoltaic cell generates electricity by absorbing sunlight, which excites electrons in the semiconductor material, creating a flow of electric current.

Question: What is the direction of current flow in a pnp transistor?

Answer: In a pnp transistor, the current flows from the emitter to the collector.

Question: What is the function of motor neurons?

Answer: Motor neurons transmit impulses from the central nervous system to effectors (muscles).

Question: Describe the function of the Golgi apparatus in protein modification.

Answer: The Golgi apparatus adds carbohydrates and lipids to proteins, sorts them, and packages them into vesicles for transport to their final destinations.

Question: How is an oxygen (O<sub>2</sub>) molecule formed?

Answer: An oxygen (O<sub>2</sub>) molecule is formed when two oxygen atoms share two pairs of electrons, forming a double bond.

Question: How do bacteria form biofilms?

Answer: Bacteria form biofilms by adhering to surfaces and producing extracellular polymeric substances (EPS) that create a protective matrix, allowing them to survive in harsh environments and resist antibiotics.

Question: How does the rough endoplasmic reticulum contribute to protein synthesis?

Answer: The rough endoplasmic reticulum has ribosomes attached to its surface, facilitating the translation of mRNA into proteins, which are then modified and transported within the cell.

Question: What are the charge carriers in a metallic conductor?

Answer: The charge carriers in a metallic conductor are negatively charged electrons.

Question: Explain the concept of galvanic corrosion and how it can be prevented.

Answer: Galvanic corrosion occurs when two dissimilar metals are in electrical contact in the presence of an electrolyte, causing the more reactive metal (anode) to corrode. It can be prevented by using compatible metals, insulating the metals, or applying protective coatings.

Question: How does the body respond to allergens?

Answer: The body responds to allergens by releasing histamines and other chemicals, causing symptoms like itching, swelling, and sneezing.

Question: How do environmental stress factors such as drought and high salinity impact photosynthesis?

Answer: Environmental stress factors can reduce water availability, inhibit stomatal opening, and damage photosynthetic machinery, decreasing photosynthesis rates.

Question: What is the resultant force if two forces of 10 N and 6 N act in the same direction?

Answer: The resultant force is 16 N in the same direction.

Question: How does Newton's first law apply to a passenger standing in a moving bus when it starts moving?

Answer: When a bus at rest suddenly starts moving, the passenger tends to fall backward due to inertia. The lower part of the body starts moving with the bus, but the upper part remains at rest, demonstrating Newton's first law.

Question: How does the electrolysis of acidulated water differ from that of pure water?

Answer: The electrolysis of acidulated water involves additional  $H^+$  ions from sulfuric acid, increasing conductivity and efficiency, while pure water has limited ionization and slower electrolysis.

Question: What are the potential complications of untreated kidney infections?

Answer: Untreated kidney infections can lead to sepsis, chronic kidney disease, and permanent kidney damage.

Question: How does galvanizing protect iron from rusting?

Answer: Galvanizing coats iron with a layer of zinc, which acts as a sacrificial anode, corroding in place of the iron.

Question: What is the residue in filtration?

Answer: The residue is the substance left in the filter after the filtration process.

Question: What is the proliferation phase in the uterus?

Answer: The proliferation phase is when the uterine lining rebuilds under the influence of estrogen, forming a new cell layer and blood capillaries, typically lasting about ten days.

Question: Calculate the energy consumption of a 100W bulb used for 5 hours daily over a week.

Answer: The energy consumption is  $(100\text{W} \times 5 \text{ hours} \times 7 \text{ days}) / 1000 = 3.5 \text{ kWh}$ .

Question: Why do objects weigh less on the top of a mountain than at sea level?

Answer: Objects weigh less on the top of a mountain because the gravitational acceleration decreases with altitude.

Question: Materials required: - A small beaker, a piece of magnesium strip, dilute hydrochloric acid, a thermometer Method: - Add about 10 cm<sup>3</sup> of dilute hydrochloric acid to a small beaker and measure its temperature. Add a piece of magnesium ribbon about 2 cm long into it. Measure the temperature at the end of the reaction again. Record your observations. What is observed when magnesium reacts with hydrochloric acid in the Activity ?

Answer: The temperature increases, indicating an exothermic reaction.

Question: What is parturition?

Answer: Parturition, or childbirth, is the process of delivering the fetus from the uterus through the vagina, facilitated by the contraction of uterine muscles.

Question: How does cellular respiration in living organisms qualify as an exothermic reaction?

Answer: It releases energy in the form of heat as glucose is broken down to produce ATP.

Question: What is the significance of Avogadro's constant in determining the number of particles in a mole?

Answer: Avogadro's constant provides the exact number of particles (atoms, molecules, or ions) in one mole of a substance, which is  $6.022 \times 10^{23}$ , allowing for precise calculations in chemical reactions.

Question: How do you use a screw driver to unscrew a nail?

Answer: To unscrew a nail with a screw driver, apply a couple of forces on the handle of the screw driver by rotating it with both hands, creating a moment that unscrews the nail.

Question: What are the advantages of using electroplating for coating metal objects?

Answer: Electroplating provides a durable and attractive finish, enhances corrosion resistance, improves wear resistance, and offers cost-effective surface treatment for various metal objects.

Question: What is the difference between homozygous and heterozygous genotypes?

Answer: Homozygous genotypes have identical alleles for a trait, while heterozygous genotypes have different alleles for a trait.

Question: How does a bicycle dynamo generate electricity?

Answer: A bicycle dynamo generates electricity by rotating a magnet near a coil, inducing an electromotive force that produces a current.

Question: What are dioecious plants?

Answer: Dioecious plants have staminate and pistillate flowers on separate plants, requiring cross-pollination between different plants.

Question: What is the specific heat capacity of iron?

Answer: The specific heat capacity of iron is  $460 \text{ J kg}^{-1} \text{ K}^{-1}$ .

Question: What are the benefits of conventional food patterns?

Answer: Conventional food patterns improve the quality of life by providing nutrition, cultural significance, and health benefits. They help prevent non-contagious diseases like high blood pressure and diabetes by promoting healthier eating habits.

Question: How does air pollution affect human health?

Answer: Air pollution causes respiratory problems, cardiovascular diseases, lung cancer, and increased mortality rates. Pollutants such as particulate matter, nitrogen oxides, and volatile organic compounds are harmful to human health.

Question: Describe the structure and function of xylem tracheids.

Answer: Xylem tracheids are elongated, spindle-shaped cells that transport water and provide structural support to the plant.

Question: Describe the function of a stepper motor in automation.

Answer: A stepper motor moves in discrete steps, controlled by digital pulses, providing precise positioning and speed control in automation and robotics applications.

Question: What is a covalent bond?

Answer: A covalent bond is a type of chemical bond formed by the sharing of electron pairs between atoms, allowing them to achieve a stable electronic configuration.

Question: What is the balanced chemical equation for the reaction between sodium and chlorine?

Answer: The balanced chemical equation for sodium reacting with chlorine is:  $2\text{Na} + \text{Cl}_2 \rightarrow 2\text{NaCl}$ .

Question: What are the potential impacts of climate change on water availability?

Answer: Climate change affects water availability by altering precipitation patterns, increasing evaporation rates, and reducing snowpack and glacier melt. It leads to water scarcity and impacts water supply.

Question: What is the definition of solubility?

Answer: Solubility is defined as the maximum amount of a solute that can dissolve in a given amount of solvent at a specific temperature.

Question: What is the significance of genetic linkage maps?

Answer: Genetic linkage maps show the relative positions of genes on a chromosome, helping geneticists understand how traits are inherited and identify genes associated with specific disorders.

Question: What is the role of the flower in plant reproduction?

Answer: The flower bears the sexual parts of a plant, arranged in whorls on the receptacle, which is located at the tip of the flower stalk.

Question: How does the decomposition reaction of silver oxide occur?

Answer: Silver oxide decomposes upon heating to form silver and oxygen gas:  $2\text{Ag}_2\text{O} \rightarrow 4\text{Ag} + \text{O}_2$ .

Question: How does gas exchange occur in the alveoli?

Answer: Oxygen diffuses from the alveoli into blood capillaries, while carbon dioxide and water vapor diffuse from the blood into the alveoli to be exhaled.

Question: What are the benefits of using energy-efficient technologies?

Answer: Energy-efficient technologies reduce energy consumption, lower greenhouse gas emissions, and decrease energy costs. They support sustainable energy use and environmental protection.

Question: How do you calculate the distance traveled by an object moving at a constant speed?

Answer:  $\text{Distance} = \text{Speed} \times \text{Time}$ .

Question: What is loudness, and what does it depend on?

Answer: Loudness is the perception of the sound wave's energy, depending on the amplitude of the wave.

Question: What is the potential energy of a 4 kg object at a height of 8 m?

Answer: The potential energy is 320 Joules (J).

Question: How does the orientation of the coil affect the induced voltage in a dynamo?

Answer: The orientation of the coil affects the induced voltage, with maximum values generated when the coil is perpendicular to the magnetic field lines.

Question: What experiment can demonstrate the magnetic effect of a current?

Answer: An experiment involving a compass and a current-carrying conductor can demonstrate the magnetic effect by showing compass needle deflection.

Question: What is an endothermic reaction, and give an example from daily life?

Answer: An endothermic reaction absorbs heat from the surroundings. An example is photosynthesis in green plants.

Question: Describe an experiment to demonstrate the working of a simple transformer, including the setup, procedure, and observations.

Answer: To demonstrate the working of a simple transformer, an experiment can be conducted using copper wire, soft iron wires, dry cells, and a center-zero galvanometer. Setup: Wrap about 100 turns of insulated copper wire around a bundle of soft iron wires to form a primary coil. Form another similar coil (secondary coil) on the same soft iron core, about one centimeter away from the primary coil. Connect a switch and two 1.5V dry cells in series to the primary coil. Connect the secondary coil to a center-zero galvanometer. Procedure: Turn on the switch and observe the deflection of the galvanometer. Keep the switch on continuously and observe any changes in the galvanometer. Turn off the switch and observe the galvanometer again. Repeat the experiment with an alternating voltage source connected to the primary coil. Observations: When the switch is turned on, the galvanometer deflects, indicating a current induced in the secondary coil. When the switch remains on continuously, the galvanometer shows no deflection, indicating no induced current. When the switch is turned off, the galvanometer deflects in the opposite direction, showing an induced current in the reverse direction. Using an alternating voltage source results in continuous deflection of the galvanometer, corresponding to the alternating current induced in the secondary coil. Conclusion: The experiment demonstrates that an emf is induced in the secondary coil whenever there is a change in the magnetic field through it, consistent with the principles of electromagnetic induction. Transformers work by transferring energy between coils through a changing magnetic field, efficiently transforming voltage levels in AC circuits.

Question: What is the fundamental property of any material object that describes its temperature?

Answer: Temperature is the fundamental property of any material object that describes its measure of the mean kinetic energy possessed by the particles that form the object.

Question: What does a curved line on a displacement-time graph indicate?

Answer: A curved line indicates non-uniform velocity or acceleration.

Question: How does water help in the transportation of nutrients?

Answer: Water helps transport nutrients, vitamins, and hormones to relevant locations in the body.

Question: What is pollination?

Answer: Pollination is the process of transferring pollen from the anther to the stigma of a flower, enabling fertilization and the production of seeds.



Question: How do metals and non-metals differ in their chemical behavior?  
Answer: Metals tend to lose electrons and form cations, while non-metals tend to gain electrons and form anions in chemical reactions.

Question: What is the function of the stomach in digestion?  
Answer: The stomach secretes enzymes and acids to break down food, starting the digestion of proteins.

Question: How does the amplitude of a wave affect its energy?  
Answer: The amplitude of a wave is directly related to its energy; higher amplitude waves carry more energy.

Question: How does friction affect the motion of a sliding object on an inclined plane?  
Answer: Friction opposes the motion of a sliding object on an inclined plane, causing it to slow down and eventually stop unless an external force is applied to maintain motion.

Question: What is the role of carbon brushes in an alternating current dynamo?  
Answer: Carbon brushes maintain contact with the rotating brushing rings, allowing current to flow to the external circuit without wearing out quickly.

Question: What is convection and how does it occur in fluids?  
Answer: Convection is the transfer of heat by the movement of fluids (liquids or gases). Heated fluid becomes less dense and rises, while cooler fluid sinks, creating a circulation pattern known as convection currents.

Question: How does the direction of the applied force affect the motion of an object?  
Answer: The direction of the applied force determines the direction of the object's motion. A force applied in the direction of motion increases speed, while a force applied opposite to the direction of motion decreases speed.

Question: What are the features of invertebrates in the phylum Mollusca?  
Answer: Invertebrates in the phylum Mollusca are triploblastic, soft-bodied animals with a body divided into head, visceral mass, and muscular foot, and some have internal and external shells made of  $\text{CaCO}_3$ .

Question: Explain the role of a logic analyzer in digital circuit debugging.  
Answer: A logic analyzer captures and displays multiple digital signals, allowing engineers to analyze and debug the behavior of digital circuits by observing timing and logic states.

Question: What is the role of the smooth endoplasmic reticulum in cells?  
Answer: The smooth endoplasmic reticulum (SER) is involved in lipid synthesis, detoxification of harmful substances, and storage of calcium ions, contributing to various metabolic processes.

Question: What are alkenes, and how do they differ from alkanes?  
Answer: Alkenes are hydrocarbons containing at least one double bond between carbon atoms, making them more reactive than alkanes, which have only single bonds.

Question: What is the purpose of the axle in an alternating current dynamo?

Answer: The axle rotates the coil within the magnetic field, enabling continuous induction of electromotive force and generation of alternating current.

Question: How does paper chromatography separate components?

Answer: By utilizing differences in the attraction of the components to the stationary phase (paper) and their movement with the mobile phase (solvent).

Question: How much heat is required to increase the temperature of 0.8 kg of aluminium from 30°C to 50°C?

Answer: The heat required is 14,400 J, calculated using the formula  $Q = mc\Delta T = 0.8 \times 900 \times (50 - 30)$ .

Question: How does the principle of pressure transmission apply to a hydraulic jack?

Answer: A hydraulic jack operates on the principle of pressure transmission, where a small force applied to a small piston generates pressure in the oil, which is transmitted to a larger piston, lifting the vehicle.

Question: What changes occur in the fetus during the fourth month of development?

Answer: During the fourth month, the fetus starts developing a skeleton and hair begins to grow.

Question: How do you achieve equilibrium in a system of forces acting on an object suspended by multiple strings?

Answer: Achieve equilibrium by ensuring that the forces exerted by the strings balance the weight of the object. The tensions in the strings must be equal and opposite to the weight, and their lines of action must intersect at a common point.

Question: What is the role of ATP in cellular respiration?

Answer: ATP stores and releases energy needed for various biological processes, including muscle contraction, active transport, and synthesis of complex molecules.

Question: What is the significance of cellulose in the human diet?

Answer: Cellulose is not digested in the human digestive system, but it helps to avoid constipation by adding bulk to the stool.

Question: Explain the operation of a thermocouple in temperature measurement.

Answer: A thermocouple generates a voltage proportional to the temperature difference between its two junctions, providing accurate temperature measurement for various applications.

Question: What are exothermic reactions, and give an example from the document?

Answer: Exothermic reactions release heat to the surroundings. An example is the reaction between magnesium and hydrochloric acid.

Question: How do animals perform digestion?

Answer: Animals perform digestion by breaking down food into smaller molecules through mechanical and chemical processes, allowing nutrients to be absorbed and utilized by the body.

Question: How is the chemical formula of sodium chloride written?

Answer: The chemical formula of sodium chloride is NaCl, indicating one sodium ion and one chloride ion.

Question: How is the electronic configuration of nitrogen related to the formation of an ammonia molecule?

Answer: The electronic configuration of nitrogen (2, 5) allows it to share three pairs of electrons with three hydrogen atoms, forming an ammonia molecule (NH<sub>3</sub>) with a stable configuration.

Question: How does the reaction between sodium hydroxide and hydrochloric acid illustrate an exothermic reaction?

Answer: The reaction releases heat, increasing the temperature of the solution.

Question: How much heat is required to increase the temperature of 0.8 kg of aluminium from 30°C to 50°C?

Answer: The heat required is 14,400 J, calculated using the formula  $Q = mc\Delta T = 0.8 \times 900 \times (50 - 30)$ .

Question: What is the function of brushing rings in an alternating current dynamo?

Answer: Brushing rings connect the rotating coil to the external circuit, allowing current to flow continuously despite the coil's rotation.

Question: What is the formula to calculate the pressure exerted by a liquid column?

Answer: The formula to calculate the pressure exerted by a liquid column is  $P = h\rho g$ , where  $h$  is the height of the column,  $\rho$  is the density of the liquid, and  $g$  is gravitational acceleration.

Question: How are dominant and recessive alleles represented in genetics?

Answer: Dominant alleles are represented by capital letters (e.g.,  $T$  for tall), and recessive alleles are represented by lowercase letters (e.g.,  $t$  for short).

Question: What is chromatography used for?

Answer: Chromatography is used to separate and identify the components in a mixture containing non-volatile substances.

Question: What is the purpose of using a U-magnet in electromagnetic experiments?

Answer: A U-magnet provides a strong, uniform field, allowing accurate observation and study of electromagnetic effects.

Question: How can the experimental determination of heat change be applied in real-world scenarios?

Answer: It can be used in industrial processes, environmental monitoring, and developing energy-efficient systems.

Question: What are the distinguishing features of sclerenchyma sclereids?

Answer: Sclereids are short, irregularly shaped sclerenchyma cells with thick, lignified cell walls that provide mechanical strength and support to plant tissues.

Question: Items required: a nichrome wire coil, a voltmeter, an ammeter, a rheostat, two dry cells, connecting wires, a switch 1. The voltmeter is used to measure the voltage affecting the conductor (nichrome coil). 2. The ammeter is used to measure the current passing through the conductor (nichrome coil). Figure 19.15 - Rheostat 3. The rheostat (Figure 19.15) is used to vary the current and the potential difference across the nichrome coil. The circuit symbol used for the rheostat is 4. Connect the circuit using the items above. 5. Close the switch (s) and quickly obtain the readings of the voltmeter and the ammeter and turn off the switch. The reason for quickly turning off the switch is to prevent the temperature of the nichrome coil from rising. It is essential to maintain a constant temperature throughout the activity. 6. After sometime adjust the rheostat, close the switch and take another set of readings. 7. Repeat the above steps to take at least five sets of readings. How do you calculate the resistance of a conductor using measurements from above Activity?

Answer: Measure the potential difference and current for the conductor, then use Ohm's Law to calculate resistance by dividing the potential difference by the current.

Question: Describe the benefits of using energy-efficient cookers.

Answer: Energy-efficient cookers reduce energy consumption, cook food faster, and generate less heat waste, leading to cost savings and a reduced environmental impact.

Question: How do Molluscs reproduce?

Answer: Molluscs show sexual reproduction and most of them are unisexual (produce one type of gamete).

Question: What is the molar mass of carbon dioxide (CO<sub>2</sub>)?

Answer: The molar mass of carbon dioxide is 44 grams per mole, calculated as 12 for carbon plus 2 x 16 for oxygen.

Question: How does smoking affect the respiratory system?

Answer: Smoking can cause lung cancer, bronchitis, and other respiratory diseases, potentially leading to severe health consequences or death.

Question: How does Newton's third law apply to the motion of a skater?

Answer: In skating, the skater pushes against the ground with their foot (action), and the ground pushes the skater forward with an equal and opposite force (reaction), propelling the skater forward.

Question: Describe the physical properties of sulphur.

Answer: Sulphur is a poor conductor of electricity, insoluble in water, slightly soluble in organic solvents, and highly soluble in carbon disulphide. It exists in crystalline form as a yellow brittle solid and in amorphous form as a white powder.

Question: What are the effects of ground-level ozone on human health?

Answer: Ground-level ozone causes respiratory problems, aggravated asthma, reduced lung function, and increased risk of respiratory infections. It is a significant public health concern, particularly for vulnerable populations.

Question: How do you calculate the moment of a couple of forces in a given scenario?

Answer: The moment of a couple of forces is calculated as the product of the magnitude of one force and the perpendicular distance between the lines of action of the two forces (Moment = Force  $\times$  Perpendicular distance).

Question: What is the role of oscillations in the generation of waves?

Answer: Oscillations create periodic disturbances that propagate as waves, transferring energy without transporting matter

Question: Calculate the molar mass of potassium sulfate ( $K_2SO_4$ ).

Answer: The molar mass of potassium sulfate is 174 grams per mole, calculated as  $2 \times 39$  for potassium, 32 for sulfur, and  $4 \times 16$  for oxygen.

Question: How does genetic engineering address environmental challenges?

Answer: Genetic engineering addresses environmental challenges by developing crops that require fewer chemical inputs, creating organisms that can clean up pollution, and engineering plants to sequester carbon and mitigate climate change.

Question: What is the deceleration of a car that slows down from 60 km/h to 20 km/h in 5 seconds?

Answer: Deceleration =  $(20 \text{ km/h} - 60 \text{ km/h}) / 5 \text{ s} = -8 \text{ km/h/s}$ .

Question: What is the melting point and boiling point of sodium chloride ( $NaCl$ )?

Answer: The melting point of sodium chloride ( $NaCl$ ) is  $801^\circ\text{C}$ , and its boiling point is  $1413^\circ\text{C}$ .

Question: What are some examples of organisms in the phylum Annelida?

Answer: Examples of organisms in the phylum Annelida include Earthworm, Leech, and Nereis.

Question: What are sclerenchyma tissues, and what are their features?

Answer: Sclerenchyma tissues consist of dead cells with lignified cell walls, tightly packed cells with no intercellular spaces, and evenly thickened cell walls forming a central lumen.

Question: What is the principle behind the functioning of a siphon?

Answer: A siphon works on the principle of atmospheric pressure and gravity, transferring liquid from a higher to a lower level through a tube by creating a continuous flow.

Question: What is the importance of the number of turns in a coil for electromagnetic devices?

Answer: More turns in a coil increase the induced electromotive force, enhancing the performance of electromagnetic devices like generators and transformers.

Question: How does the cell membrane maintain homeostasis?

Answer: The cell membrane maintains homeostasis by controlling the movement of substances in and out of the cell, allowing the cell to maintain a stable internal environment.

Question: Explain the process of electrochemical polymerization and its applications.

Answer: Electrochemical polymerization involves the formation of conductive polymers on an electrode surface through the electrochemical oxidation or reduction of monomers. Applications include sensors, batteries, supercapacitors, and corrosion-resistant coatings.

Question: What is the total surface area of a single small marble cube with sides of 1 cm?

Answer: The total surface area of a single small marble cube is  $6 \text{ cm}^2$  ( $1 \text{ cm}^2 \times 6$ ).

Question: How does Newton's third law apply to the motion of a jet plane?

Answer: In a jet plane, the expulsion of exhaust gases (action) generates a force that propels the plane forward (reaction) due to the equal and opposite force exerted by the gases.

Question: What is the role of the liver in detoxification?

Answer: The liver detoxifies harmful substances by metabolizing and excreting them, converting ammonia to urea, and breaking down drugs and toxins.

Question: How does genetic engineering improve the quality of livestock?

Answer: Genetic engineering improves the quality of livestock by creating animals with desirable traits such as faster growth rates, disease resistance, and improved meat or milk quality, enhancing agricultural productivity and efficiency.

Question: What is the equivalent resistance of three resistors with values  $20 \Omega$ ,  $6 \Omega$ , and  $12 \Omega$  connected in series?

Answer: The equivalent resistance is  $R = 20 \Omega + 6 \Omega + 12 \Omega = 38 \Omega$ .

Question: How does the speed of sound in steel compare to that in air?

Answer: The speed of sound in steel is much higher, about  $5000 \text{ m/s}$ , compared to  $330 \text{ m/s}$  in air.

Question: Why is the solubility of different solutes compared in the same solvent?

Answer: Comparing the solubility of different solutes in the same solvent helps understand how solute properties affect dissolution and solubility behavior.

Question: How do atoms achieve a stable electronic configuration through chemical bonding?

Answer: Atoms achieve a stable electronic configuration through chemical bonding by either gaining, losing, or sharing electrons to fill their valence shells, similar to the electron configuration of noble gases.

Question: How is the resultant of two collinear forces acting along the same direction calculated?

Answer: The resultant of two collinear forces acting along the same direction is the sum of the two forces.

Question: How is a fluorine (F<sub>2</sub>) molecule formed?

Answer: A fluorine (F<sub>2</sub>) molecule is formed when two fluorine atoms share a pair of electrons, each achieving a stable electronic configuration of 2, 8.

Question: What is the chemical formula for potassium fluoride?

Answer: The chemical formula for potassium fluoride is KF.

Question: What is thermal equilibrium?

Answer: Thermal equilibrium is the state when two objects in contact no longer transfer heat between them, having reached the same temperature.

Question: What is the relationship between voltage (V) and current (I) for a conductor according to Ohm's Law?

Answer: According to Ohm's Law, the relationship between voltage (V) and current (I) for a conductor is linear, with the slope of the graph representing the resistance (R).

Question: Discuss the industrial applications of electrolysis, providing examples of metal extraction, refining, and electroplating.

Answer: Electrolysis has several industrial applications, including metal extraction, refining, and electroplating. Each application utilizes the principles of electrolysis to achieve specific goals.

1. Metal Extraction: Example: Extraction of sodium metal from fused sodium chloride. In the Downs cell, sodium chloride is melted, and an electric current is passed through it. At the cathode:  $\text{Na}^+(\text{l}) + \text{e}^- \rightarrow \text{Na}(\text{l})$  At the anode:  $2\text{Cl}^-(\text{l}) \rightarrow \text{Cl}_2(\text{g}) + 2\text{e}^-$  Sodium metal is collected at the cathode, and chlorine gas is released at the anode.

2. Metal Refining: Example: Refining of copper. Impure copper is used as the anode, and a pure copper sheet is used as the cathode in an electrolytic cell with copper sulfate solution as the electrolyte. At the anode:  $\text{Cu}(\text{s}) \rightarrow \text{Cu}^{2+}(\text{aq}) + 2\text{e}^-$  At the cathode:  $\text{Cu}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Cu}(\text{s})$  Impurities fall off the anode, and pure copper is deposited at the cathode.

3. Electroplating: Example: Electroplating an iron spoon with copper. The iron spoon (cathode) and a copper plate (anode) are immersed in a copper sulfate solution. At the anode:  $\text{Cu}(\text{s}) \rightarrow \text{Cu}^{2+}(\text{aq}) + 2\text{e}^-$  At the cathode:  $\text{Cu}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Cu}(\text{s})$  Copper is deposited on the iron spoon, giving it a copper coating.

Applications and Benefits: Metal Extraction: Produces pure metals for industrial use. Metal Refining: Improves the quality and purity of metals, making them suitable for electrical and

structural applications. Electroplating: Enhances the appearance, corrosion resistance, and durability of objects by coating them with a thin layer of a different metal.

Question: What is the significance of water in living organisms?

Answer: Water provides a medium for bio-chemical reactions, transportation of nutrients, removal of waste, and maintaining body temperature.

Question: What is a secondary consumer?

Answer: A secondary consumer is a carnivore that feeds on primary consumers and can also be an omnivore.

Question: How do you calculate the equivalent resistance of a circuit with resistors connected in both series and parallel?

Answer: Calculate the equivalent resistance of series and parallel combinations separately, then combine the results to find the total equivalent resistance.

Question: How does increasing the height of an object affect its potential energy?

Answer: Increasing the height of an object increases its potential energy proportionally.

Question: What does a straight line with a negative slope on a velocity-time graph represent?

Answer: It represents uniform deceleration.

Question: How does the induced current direction change during coil rotation in a dynamo?

Answer: The induced current direction changes periodically, resulting in an alternating current as the coil rotates within the magnetic field.

Question: What are the features of invertebrates in the phylum Mollusca?

Answer: Invertebrates in the phylum Mollusca are triploblastic, soft-bodied animals with a body divided into head, visceral mass, and muscular foot, and some have internal and external shells made of  $\text{CaCO}_3$ .

Question: What are the two main factors affecting the solubility of gases in water?

Answer: The two main factors are temperature and pressure.

Question: How do inhibitors affect the rate of chemical reactions?

Answer: Inhibitors slow down reactions by decreasing the frequency of effective collisions between reactant particles.

Question: What is the significance of the cell wall in plant cells?

Answer: The cell wall provides structural support, protection, and rigidity to plant cells, allowing them to withstand turgor pressure and maintain their shape.

Question: How do vacuoles maintain cell turgor in plants?



Answer: Vacuoles maintain cell turgor by storing water, which exerts pressure against the cell wall, providing structural support and keeping the plant upright.

Question: What is the principle behind ultrasound scanning in medical diagnostics?

Answer: Ultrasound scanning uses high-frequency sound waves to create images of internal body structures based on the reflection of sound waves from tissues.

Question: How is the chemical formula of calcium oxide written?

Answer: The chemical formula of calcium oxide is CaO, indicating one calcium ion and one oxide ion.

Question: What is the role of the epiglottis during swallowing?

Answer: The epiglottis covers the trachea during swallowing, preventing food from entering the respiratory tract and directing it into the esophagus.

Question: What is the reaction between sodium and water?

Answer: Sodium reacts vigorously with water to form sodium hydroxide and hydrogen gas:  $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$ .

Question: Describe the equilibrium of a sphere suspended by a string in terms of forces.

Answer: The sphere is in equilibrium because the tension in the string balances the weight of the sphere. The forces are equal in magnitude, opposite in direction, and their lines of action are along the same line, resulting in no net force.

Question: How does reducing friction affect the motion of an object?

Answer: Reducing friction allows an object to move more easily and with less applied force. It increases the distance an object can travel before coming to rest.

Question: How does the diaphragm in a moving coil microphone respond to sound?

Answer: The diaphragm vibrates in response to sound waves, moving the attached coil within a magnetic field and generating an alternating current.

Question: How does a commutator ensure continuous rotation in a DC motor?

Answer: The commutator switches the current direction in the coil every half-cycle, preventing reverse motion and maintaining continuous rotation.

Question: How does the accumulation of plastic waste in oceans affect marine life?

Answer: The accumulation of plastic waste in oceans affects marine life by causing ingestion and entanglement, leading to injury, starvation, and death, and by introducing toxic substances into the marine food web.

Question: What are the changes that occur in the male reproductive system during puberty?

Answer: Changes in the male reproductive system during puberty include the growth of pubertal hair, widened shoulders, deepened voice, accelerated growth of bones and muscles, production of sperms, and growth of genitals.

Question: What is the role of sulfuric acid in acidulated water for electrolysis?

Answer: Sulfuric acid provides additional  $H^+$  ions, increasing the conductivity of the water and facilitating the electrolysis process.

Question: How is the deceleration of an object calculated if its velocity decreases from 12 m/s to 0 m/s in 4 seconds?

Answer: Deceleration =  $(0 \text{ m/s} - 12 \text{ m/s}) / 4 \text{ s} = -3 \text{ m/s}^2$ .

Question: How do we perceive the loudness of sound?

Answer: Loudness is perceived based on the energy carried by the sound waves and the sensitivity of our ears to different frequencies.

Question: How is blood glucose regulated during high and low levels?

Answer: High blood glucose triggers insulin secretion to convert glucose into glycogen, while low levels trigger glucagon secretion to convert glycogen into glucose.

Question: What is the efficiency of a transformer?

Answer: The efficiency of a transformer is the ratio of the power output to the power input, ideally 100% but less in practical scenarios due to energy losses.

Question: What is the role of anhydrous calcium chloride in the rusting experiment?

Answer: Anhydrous calcium chloride absorbs water vapor from the air, helping to create a controlled environment to test the necessity of water for rusting.

Question: How is the octet rule applied in the formation of covalent bonds?

Answer: In covalent bonds, atoms share electrons to complete their valence shell with eight electrons, achieving stability according to the octet rule.

Question: What is the simplest alkane, and what is its formula?

Answer: The simplest alkane is methane, with the formula  $CH_4$ .

Question: How does a battery management system (BMS) enhance the performance and safety of batteries?

Answer: A battery management system (BMS) monitors and manages the state of charge, temperature, and voltage of individual cells in a battery pack, ensuring optimal performance, preventing overcharging and deep discharging, and enhancing safety and lifespan.

Question: What causes the pencil to appear bent in the water?

Answer: The bending of light rays as they enter from water to air with different optical properties causes the pencil to appear bent.

Question: What are the deficiency symptoms of potassium?

Answer: Deficiency symptoms of potassium include muscle weakening and psychological disorders.

Question: What are the two main categories of things in our environment?

Answer: The two main categories of things in our environment are matter and energy.

Question: How does the kinetic energy of an object change with velocity?

Answer: The kinetic energy of an object changes with the square of its velocity; increasing the velocity results in a quadratic increase in kinetic energy.

Question: What are the features of vertebrates in the class Amphibia?

Answer: Vertebrates in the class Amphibia have eyes without eyelids, require water to complete their life cycle, undergo metamorphosis, have thin mucous skin with glands, pentadactyle limbs, a three-chambered heart, and respire through lungs, moist skin, and buccal cavity.

Question: What is the molar mass of glucose (C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>)?

Answer: The molar mass of glucose is 180 grams per mole, calculated as 6 x 12 for carbon, 12 x 1 for hydrogen, and 6 x 16 for oxygen.

Question: What occurs during the reaction between potassium bromide and chlorine?

Answer: When potassium bromide reacts with chlorine, potassium chloride and bromine are formed:  $2\text{KBr} + \text{Cl}_2 \rightarrow 2\text{KCl} + \text{Br}_2$ .

Question: How does the sharing of electrons lead to the formation of a covalent bond in a hydrogen molecule?

Answer: The sharing of electrons between two hydrogen atoms allows each atom to achieve the stable configuration of helium, forming a covalent bond and resulting in a hydrogen molecule (H<sub>2</sub>).

Question: What is the significance of the valence shell in an atom?

Answer: The valence shell is the outermost shell carrying electrons in an atom, determining the atom's chemical reactivity and bonding behavior.

Question: Explain the role of microfilaments in cellular activities.

Answer: Microfilaments, composed of actin, are involved in cell movement, muscle contraction, and maintaining cell shape by providing tensile strength.

Question: What are the symptoms and complications of diabetes?

Answer: Symptoms include frequent urination, excessive thirst, and fatigue. Complications can include heart disease, kidney failure, and nerve damage.

Question: How does the nature of the solute affect its solubility in a solvent?

Answer: The chemical and physical properties of the solute, such as polarity and molecular structure, determine its solubility in a particular solvent.

Question: How does the writing on an ambulance appear in a rearview mirror?

Answer: The writing appears inverted so that it can be read correctly in a rearview mirror, displaying as "AMBULANCE" when viewed from the front.

Question: How are the surfaces of a convex lens described?

Answer: The surfaces of a convex lens are parts of two imaginary spherical surfaces, with centers denoted as C1 and C2, and the line joining these centers is the principal axis.

Question: How does a commutator ensure continuous rotation in a DC motor?

Answer: The commutator switches the current direction every half-cycle, preventing reverse motion and maintaining continuous rotation.

Question: What is the importance of the kidney's role in regulating blood pressure?

Answer: The kidneys regulate blood pressure by adjusting the volume of blood (via urine production) and releasing renin, which activates the renin-angiotensin-aldosterone system (RAAS) to control blood pressure.

Question: How do light rays behave when incident on a convex mirror at an angle to the principal axis?

Answer: The rays diverge after reflection, appearing to come from the focal point behind the mirror.

Question: What are some common inherited traits observed in plants?

Answer: Common inherited traits in plants include flower color, seed shape, pod shape, and plant height, which can vary among different varieties of the same species.

Question: What is the principle behind the operation of a bicycle dynamo?

Answer: The principle behind a bicycle dynamo is electromagnetic induction, where mechanical rotation induces an electromotive force in the coil.

Question: What factors determine the magnitude of induced voltage in a coil?

Answer: Factors determining the magnitude of induced voltage include the number of coil turns, magnetic field strength, and speed of motion.

Question: How does the reaction between an acid and a base lead to neutralization?

Answer: The  $H^+$  ions from the acid combine with the  $OH^-$  ions from the base to form water, neutralizing both the acid and base properties.

Question: What is the difference between fixed value resistors and variable resistors?

Answer: Fixed value resistors have a constant resistance value that cannot be changed, while variable resistors allow the resistance value to be adjusted manually.

Question: A person suffering from colour blindness (1) can see only distant objects clearly. (2) can see only near objects clearly. (3) cannot distinguish colours in dim light. (4) cannot distinguish red and green colours.

Answer: (4) cannot distinguish red and green colours.

Question: Explain the function of a load cell in weighing systems.

Answer: A load cell measures force or weight by converting mechanical stress into an electrical signal, providing accurate weight measurement in scales and industrial applications.

Question: What is fractional distillation used for?

Answer: Fractional distillation is used to separate mixtures containing multiple volatile components with different boiling points.

Question: What are the common examples of endothermic reactions in daily life?

Answer: Photosynthesis in plants and the thermal decomposition of compounds like limestone.

Question: How does increasing the mass of an object affect its acceleration for a constant force?

Answer: Increasing the mass of an object decreases its acceleration for a constant force, as acceleration is inversely proportional to mass.

Question: What is the principle method of asexual reproduction in plants?

Answer: The principle method of asexual reproduction in plants is vegetative propagation by aerial or underground parts.

Question: How do you achieve equilibrium in a system of three non-parallel coplanar forces?

Answer: To achieve equilibrium, the three forces must be coplanar, their lines of action must intersect at a common point, and the resultant of any two forces must equal the third force in magnitude and be opposite in direction.

Question: Describe the mechanical process of digestion.

Answer: Mechanical digestion involves physically breaking down food into smaller pieces, such as chewing by teeth, to facilitate chemical digestion.

Question: What are the main parts of a flower involved in sexual reproduction?

Answer: The main parts of a flower involved in sexual reproduction are the calyx, corolla, androecium, and gynoecium.

Question: What are the main components of a loudspeaker?

Answer: The main components include a light-weight cardboard cone, a conducting coil, and a ring magnet.

Question: What are the main types of muscle tissue in the human body?

Answer: The main types of muscle tissue are smooth muscle tissue, skeletal muscle tissue, and cardiac muscle tissue.

Question: What is the molar mass of sodium chloride (NaCl)?

Answer: The molar mass of sodium chloride is 58.5 grams per mole, calculated as 23 for sodium plus 35.5 for chlorine.

Question: How does the electron configuration of alkali metals affect their chemical properties?

Answer: The electron configuration of alkali metals, with one valence electron, makes them highly reactive and prone to losing that electron in chemical reactions.

Question: How is radiation different from conduction and convection in heat transfer?

Answer: Radiation is the transfer of heat in the form of electromagnetic waves, allowing heat to transfer through a vacuum without the need for a material medium, unlike conduction and convection which require a medium.

Question: How is genetic engineering used in the industrial field?

Answer: Genetic engineering is used in the industrial field to produce enzymes, amino acids, and vitamins. Genetically modified bacteria and fungi are employed in various industrial processes to enhance production efficiency.

Question: What is the chemical formula for sodium chloride?

Answer: The chemical formula for sodium chloride is NaCl.

Question: How do you find the total displacement of a body with multiple displacements in opposite directions?

Answer: The total displacement is the sum of all displacements, considering their directions.

Question: How does the coil's position affect the electromotive force in an alternating current dynamo?

Answer: The electromotive force varies with the coil's position, reaching maximum values when the coil intersects the magnetic field lines perpendicularly.

Question: What is an example of a scientific name given in the document?

Answer: An example of a scientific name is *Mangifera indica*.

Question: What is the balanced chemical equation for the reaction between potassium and water?

Answer: The balanced chemical equation for potassium reacting with water is:  $2K + 2H_2O \rightarrow 2KOH + H_2$ .

Question: How do you balance a uniform rod with different weights using the principle of moments?

Answer: Balance the rod by adjusting the positions and magnitudes of the weights such that the moments on either side of the pivot are equal, resulting in equilibrium.

Question: What is the emergent ray in light refraction?

Answer: The emergent ray is the ray that exits the second medium and re-enters the first medium.

Question: What is the chemical formula for ammonium chloride?

Answer: The chemical formula for ammonium chloride is  $\text{NH}_4\text{Cl}$ .

Question: How did Mendel's experiments demonstrate the concept of dominant and recessive traits?

Answer: Mendel's experiments demonstrated that dominant traits mask recessive traits in the F1 generation, but recessive traits reappear in the F2 generation, showing the principles of dominance and recessiveness.

Question: How are cyanobacteria classified in terms of their nutritional mode?

Answer: Cyanobacteria are classified as autotrophic because they perform photosynthesis to produce their food.

Question: What happens to light rays parallel to the principal axis when reflected by a concave mirror?

Answer: These rays pass through the focal point after reflection.

Question: What role does the axle play in an alternating current dynamo?

Answer: The axle rotates the coil within the magnetic field, enabling continuous induction of electromotive force and generation of alternating current.

Question: How does the pressure inside a gas cylinder change with temperature?

Answer: The pressure inside a gas cylinder increases with temperature due to the increased kinetic energy of gas molecules, causing more frequent and forceful collisions with the cylinder walls.

Question: What are the principal changes in fetal development with time?

Answer: Principal changes in fetal development include the formation of human features, development of nails, skeleton, hair, and sex organs, as well as the ability to move and develop vital organs.

Question: Explain the significance of the nucleolus.

Answer: The nucleolus is a structure within the nucleus responsible for producing ribosomal RNA and assembling ribosomes, essential for protein synthesis.

Question: Why is the concept of power important in physics?

Answer: The concept of power is important to understand the efficiency and capability of machines and systems in performing work over time.

Question: What are the advantages of grafting?

Answer: Grafting produces offspring with characteristics of the scion, obtains disease-resistant plants with strong root systems, and propagates plants that do not produce seeds.

Question: How does the combustion of fuels illustrate exothermic reactions?

Answer: The combustion process releases heat, providing energy for various activities like running vehicles and machinery.

Question: How is pure water obtained through simple distillation?

Answer: By heating the water to produce vapor, which is then condensed and collected as distilled water.

Question: What is the role of a voltage stabilizer in power supply systems?

Answer: A voltage stabilizer maintains a constant output voltage despite fluctuations in the input voltage, protecting sensitive electronic devices from damage.

Question: What is the specific heat capacity of copper?

Answer: The specific heat capacity of copper is  $400 \text{ J kg}^{-1}$ .

Question: What is the result of sharing electrons between atoms in a covalent bond?

Answer: Sharing electrons between atoms in a covalent bond allows the atoms to achieve a stable electronic configuration, similar to that of noble gases.

Question: What is the importance of friction in walking?

Answer: Friction is essential in walking as it prevents slipping by providing the necessary grip between the feet and the ground.

Question: How is atmospheric nitrogen fixed biologically?

Answer: Atmospheric nitrogen is fixed biologically by free-living bacteria in soil, such as *Azotobacter*, and symbiotic bacteria in root nodules of leguminous plants, such as *Rhizobium*.

Question: What is the result of the reaction between hydrochloric acid and sodium hydroxide?

Answer: Hydrochloric acid reacts with sodium hydroxide to form sodium chloride and water ( $\text{HCl} + \text{NaOH} \rightarrow \text{NaCl} + \text{H}_2\text{O}$ ).

Question: What is the role of the urinary system?

Answer: The urinary system produces and removes urine from the body.

Question: What is the unit for measuring speed?

Answer: The unit for measuring speed is meters per second (m/s).

Question: How do microtubules assist in cell division?

Answer: Microtubules form the mitotic spindle during cell division, which helps segregate chromosomes into daughter cells, ensuring accurate distribution of genetic material.

Question: What is the period of a wave?

Answer: The period is the time taken for one complete oscillation of a particle in the wave.

Question: How is the large intestine involved in digestion?

Answer: The large intestine absorbs water and electrolytes from undigested food, forming solid waste for excretion.



Question: How do you calculate the moment of force for a couple of forces acting on an object?

Answer: The moment of force for a couple of forces is calculated as the product of one of the forces and the perpendicular distance between the lines of action of the two forces.

Question: What is the effect of solubility on the formation of scale in water systems?

Answer: Solubility affects the formation of scale in water systems, with low solubility salts precipitating and forming deposits on surfaces.

Question: How do you maintain equilibrium in an object under the action of more than three forces?

Answer: Maintain equilibrium by applying the forces in such a way that their resultant is zero, meaning the sum of the forces and moments balance out, resulting in no net force or moment acting on the object.

Question: How does a water barometer differ from a mercury barometer?

Answer: A water barometer uses water instead of mercury to measure atmospheric pressure. Due to water's lower density, the column height must be much taller to balance atmospheric pressure.

Question: What is the potential energy of a 7 kg object at a height of 3 m?

Answer: The potential energy is 210 Joules (J).

Question: How does the diaphragm movement in a microphone relate to sound waves?

Answer: The diaphragm moves in response to sound waves, causing the attached coil to move within a magnetic field and generate an alternating current corresponding to the sound.

Question: What is the role of friction in Newton's first law?

Answer: Friction is the resistive force that must be overcome to change the state of motion of an object. It is the reason why objects come to rest without continuous external force.

Question: How do you determine the direction of the resultant force for two collinear forces acting in opposite directions?

Answer: The direction of the resultant force is in the direction of the larger force.

Question: What occurs when aluminum reacts with hydrochloric acid?

Answer: Aluminum reacts with hydrochloric acid, producing aluminum chloride and hydrogen gas:  $2\text{Al} + 6\text{HCl} \rightarrow 2\text{AlCl}_3 + 3\text{H}_2$ .

Question: Describe the Daniell cell and its components.

Answer: The Daniell cell is an electrochemical cell consisting of a zinc electrode in zinc sulfate solution (anode) and a copper electrode in copper sulfate solution (cathode), connected by a salt bridge that allows ion flow to maintain electrical neutrality.

Question: How do you rotate a steering wheel more easily?

Answer: Rotate a steering wheel more easily by applying a couple of forces with both hands, exerting equal and opposite forces on opposite sides of the wheel.

Question: How does tightening a screw affect the moment of force required to rotate a stick?

Answer: Tightening the screw increases the moment of force required to rotate the stick, confirming that the moment depends on the magnitude of the force.

Question: How do noble gases achieve a stable electronic configuration?

Answer: Noble gases achieve a stable electronic configuration by having a full valence shell, typically with eight electrons, making them chemically inert.

Question: What happens when a drinking straw is rubbed with a piece of cotton cloth?

Answer: When a drinking straw is rubbed with a piece of cotton cloth, it can attract tiny bits of paper due to static electricity.

Question: What is the principal focus of a concave mirror?

Answer: The principal focus is the point on the principal axis where parallel rays converge after reflecting off the concave mirror.

Question: How do geneticists use symbols to represent genotypes?

Answer: Geneticists use capital letters for dominant alleles and lowercase letters for recessive alleles, allowing for a simplified notation of genotypes and inheritance patterns.

Question: How does the momentum of a body change with velocity?

Answer: Momentum is directly proportional to velocity. If the velocity of a body increases, its momentum increases, and if the velocity decreases, its momentum decreases.

Question: Explain the relationship between voltage, current, and power in an electric circuit.

Answer: Power ( $P$ ) in an electric circuit is the product of voltage ( $V$ ) and current ( $I$ ), expressed as  $P = VI$ . Higher voltage or current results in higher power output.

Question: How do ultrasound waves assist in detecting underwater objects?

Answer: SONAR technology uses ultrasound pulses that reflect back from underwater objects, helping to locate and identify them.

Question: Describe the process of secondary growth in plants.

Answer: Secondary growth in plants involves the activity of lateral meristems (cambium), producing new xylem and phloem cells, increasing the diameter of stems and roots.

Question: What are the main components of the central nervous system?

Answer: The brain and spinal cord.

Question: What is the importance of catalysts in everyday life?

Answer: Catalysts play a crucial role in various processes, such as food digestion, pollution control, and manufacturing of chemicals.

Question: Describe the equilibrium of a plank of wood suspended by four strings.

Answer: The plank of wood is in equilibrium because the forces of tension in the four strings balance the weight of the plank, resulting in no net force acting on it.

Question: How does the electrolysis of fused sodium chloride produce sodium and chlorine?

Answer: In the electrolysis of fused sodium chloride, sodium ions ( $\text{Na}^+$ ) migrate to the cathode and gain electrons to form sodium metal, while chloride ions ( $\text{Cl}^-$ ) migrate to the anode and lose electrons to form chlorine gas.

Question: How is the chemical formula of sulphuric acid represented?

Answer: The chemical formula of sulphuric acid is  $\text{H}_2\text{SO}_4$ , indicating two hydrogen atoms, one sulphur atom, and four oxygen atoms.

Question: Which element has the highest electronegativity according to the Pauling scale?

Answer: Fluorine has the highest electronegativity according to the Pauling scale.

Question: What is the significance of electron sharing in the formation of covalent bonds?

Answer: Electron sharing allows atoms to achieve a stable electronic configuration, forming covalent bonds that hold the atoms together in molecules.

Question: How does the structure of a leaf facilitate efficient gas exchange and water transport?

Answer: Leaf structure, with its large surface area, thinness, and network of veins, facilitates efficient gas exchange and water transport for photosynthesis.

Question: Discuss the importance of using efficient electric appliances and the impact on energy conservation and cost savings.

Answer: Using efficient electric appliances plays a crucial role in energy conservation and cost savings. Efficient appliances convert more electrical energy into useful work, reducing energy wastage and operational costs.

Importance of Efficiency: Energy Conservation: Efficient appliances consume less energy for the same output, conserving natural resources and reducing environmental impact. Example: LED bulbs consume significantly less power than filament bulbs for the same brightness, leading to substantial energy savings. Cost Savings: Reduced energy consumption translates to lower electricity bills. Although efficient appliances like LEDs and CFLs may have a higher initial cost, their long lifespan and lower energy usage result in cost savings over time.

Environmental Benefits: Lower energy consumption reduces greenhouse gas emissions from power plants, mitigating climate change. Efficient appliances contribute to sustainable living by reducing the carbon

footprint. Examples of Efficient Appliances: Lighting: LED bulbs: High efficiency, long lifespan, low energy consumption. CFL bulbs: More efficient than traditional filament bulbs, with moderate energy savings. Cooking Appliances: Induction cookers: High efficiency, minimal heat loss, faster cooking times. Microwave ovens: Efficient for heating food by directly targeting water molecules, reducing overall energy use. Cooling Appliances: Energy-efficient air conditioners and refrigerators: Designed with advanced technologies to reduce energy consumption while maintaining performance. Impact on Energy Conservation: By choosing efficient appliances, households and businesses can significantly reduce their energy consumption. Widespread adoption of efficient appliances can lead to a decrease in national energy demand, reducing the need for additional power generation and supporting energy sustainability. In conclusion, the use of efficient electric appliances is essential for conserving energy, reducing costs, and protecting the environment. Making informed choices about appliances can lead to substantial long-term benefits for individuals and society as a whole.

Question: How does atmospheric pressure change with altitude?

Answer: Atmospheric pressure decreases with altitude because the height of the air column above a point decreases, reducing the weight of the air and thus the pressure.

Question: What are the changes that occur in the female reproductive system during puberty?

Answer: Changes in the female reproductive system during puberty include the growth of pubertal hair, widened pubic region, growth of mammary glands, increased body fat, and the start of the menstrual cycle.

Question: What is the current passing through a series circuit with a total resistance of  $20\ \Omega$  and a power supply voltage of  $10\text{ V}$ ?

Answer: The current is  $I = \frac{V}{R} = \frac{10\text{ V}}{20\ \Omega} = 0.5\text{ A}$ .

Question: What is the speed of light in air?

Answer:  $300,000\text{ km/s}$ .

Question: How is the chemical formula of nitrogen dioxide written?

Answer: The chemical formula of nitrogen dioxide is  $\text{NO}_2$ , indicating one nitrogen atom and two oxygen atoms.

Question: How does the strength of the magnetic field affect the performance of a dynamo?

Answer: A stronger magnetic field increases the induced electromotive force, improving the dynamo's performance and electricity generation.

Question: How is the electronic configuration of nitrogen related to the formation of an ammonia molecule?

Answer: The electronic configuration of nitrogen (2, 5) allows it to share three pairs of electrons with three hydrogen atoms, forming an ammonia molecule ( $\text{NH}_3$ ) with a stable configuration.

Question: What is the effect of a convex mirror on incident light rays parallel to the principal axis?

Answer: These rays reflect as if they are diverging from the focal point behind the mirror.

Question: What are mechanical waves?

Answer: Mechanical waves are waves that require a material medium for propagation, such as water waves, sound waves, and waves on a string.

Question: What is the principle behind the use of X-rays in imaging?

Answer: X-rays penetrate soft tissues but are absorbed by denser materials like bones, creating contrast images that reveal internal structures.

Question: What is the primary function of electric appliances in daily life?

Answer: The primary function of electric appliances in daily life is to convert electric energy into other forms of energy to suit our requirements, such as heat, light, sound, or kinetic energy.

Question: What is the potential energy of a 3 kg object at a height of 5 m?

Answer: The potential energy is 150 Joules (J).

Question: What are the principal changes in fetal development during the first three months?

Answer: During the first three months, the fetus takes human form, develops a large head, starts developing nails, and differentiates male and female sex organs.

Question: What is the purpose of limestone in the blast furnace?

Answer: Limestone decomposes to form calcium oxide, which reacts with impurities in the iron ore to form slag, a mixture of calcium silicate and calcium aluminate.

Question: What are the subatomic particles in an atom?

Answer: The subatomic particles in an atom are electrons, protons, and neutrons.

Question: Items required: a nichrome wire coil, a voltmeter, an ammeter, a rheostat, two dry cells, connecting wires, a switch

1. The voltmeter is used to measure the voltage affecting the conductor (nichrome coil).
2. The ammeter is used to measure the current passing through the conductor (nichrome coil).
3. The rheostat (Figure 19.15) is used to vary the current and the potential difference across the nichrome coil.
4. The circuit symbol used for the rheostat is
5. Connect the circuit using the items above.
6. Close the switch (s) and quickly obtain the readings of the voltmeter and the ammeter and turn off the switch. The reason for quickly turning off the switch is to prevent the temperature of the nichrome coil from rising. It is essential to maintain a constant temperature throughout the activity.
7. After sometime adjust the rheostat, close the switch and take another set of readings.
8. Repeat the above steps to take at least five sets of readings. How do you calculate the ratio of voltage to current for different measurements in the Activity?

Answer: Divide the voltage value by the current value for each measurement and observe if the ratio remains constant, indicating the resistance.

Question: How does carbon monoxide act as a reducing agent in the blast furnace?

Answer: Carbon monoxide reduces iron ore by donating electrons, converting iron(III) oxide to iron and forming carbon dioxide in the process.

Question: How is voltage measured in a circuit?

Answer: Voltage is measured using a voltmeter connected across the two points where the potential difference is to be measured.

Question: How is the resultant force of two parallel forces acting in the same direction found?

Answer: The resultant force is found by adding the magnitudes of the two forces.

Question: How does the power consumption of LED televisions compare to that of older CRT televisions?

Answer: LED televisions consume significantly less power than older CRT televisions, making them more energy-efficient and cost-effective.

Question: What agrochemicals were banned by the Sri Lankan government in December 2014?

Answer: The Sri Lankan government banned Glyphosate, Propanil, Carbaryl, Chlorpyrifos, and Carbofuran.

Question: What is the relative molecular mass of sulfuric acid ( $\text{H}_2\text{SO}_4$ )?

Answer: The relative molecular mass of sulfuric acid is 98, calculated as  $2 \times 1$  for hydrogen, 32 for sulfur, and  $4 \times 16$  for oxygen.

Question: What are the characteristics of organisms in the Domain Bacteria?

Answer: Organisms in the Domain Bacteria are prokaryotes, sensitive to antibiotics, can be pathogenic, and are found everywhere in the environment.

Question: Describe the process of calculating the energy consumption of an electric appliance.

Answer: Energy consumption is calculated by multiplying the power (in watts) by the duration of use (in hours), then converting to kilowatt hours (kWh) if necessary.

Question: What are the potential impacts of climate change on ecosystems?

Answer: Climate change affects ecosystems by altering species distribution, changing phenology (timing of biological events), increasing the frequency of extreme weather events, and disrupting ecosystem services.

Question: How do plants adapt to different light conditions?

Answer: Plants adapt to different light conditions by adjusting the size and orientation of their leaves, altering chlorophyll content, and changing growth patterns to optimize light capture.

Question: What is the shape of the water molecule, and why is it significant?

Answer: The water molecule has a bent or angular shape due to the two lone pairs of electrons on the oxygen atom, which repel the hydrogen atoms and create a dipole moment, making water a polar molecule.

Question: What is the significance of the Kyoto Protocol?

Answer: The Kyoto Protocol is an international treaty that commits participating countries to reduce greenhouse gas emissions to combat climate change.

Question: What is the relationship between pressure and temperature in gases according to the Ideal Gas Law?

Answer: According to the Ideal Gas Law ( $PV = nRT$ ), pressure is directly proportional to temperature when volume and the number of moles are constant.

Question: What is the significance of Mendel's laws of inheritance?

Answer: Mendel's laws of inheritance, including the law of segregation and the law of independent assortment, provide the foundational principles for understanding how traits are inherited and predict the outcomes of genetic crosses.

Question: How is the molar mass of sulfuric acid ( $H_2SO_4$ ) calculated?

Answer: The molar mass of sulfuric acid is calculated by summing the molar masses of its constituent atoms:  $2 \times 1$  for hydrogen, 32 for sulfur, and  $4 \times 16$  for oxygen, resulting in 98 grams per mole.

Question: How is the blast furnace operated in iron extraction?

Answer: The blast furnace is operated by feeding raw materials from the top, blowing hot air from the bottom, and maintaining high temperatures to facilitate the reduction reactions that produce liquid iron.

Question: What is the significance of magnetic field strength in a solenoid?

Answer: The field strength determines the solenoid's effectiveness in generating a magnetic force and performing work.

Question: Define a species.

Answer: A species is a group of similar organisms that can interbreed naturally to produce fertile offspring.

Question: What is the impact of solubility on the flavor and aroma of food and beverages?

Answer: Solubility affects the release and perception of flavor and aroma compounds in food and beverages, influencing their sensory properties and consumer acceptance.

Question: What is the formula for the moment of a couple of forces in a given scenario?

Answer: The formula for the moment of a couple of forces is  $\text{Moment} = \text{Force} \times \text{Perpendicular distance between the lines of action of the two forces}$ .

Question: How does the loop of Henle contribute to urine concentration?

Answer: The loop of Henle creates a concentration gradient in the medulla, allowing for the reabsorption of water and concentration of urine.

Question: How do meristematic tissues contribute to the overall growth and development of plants?

Answer: Meristematic tissues produce new cells through active division, enabling primary and secondary growth, organ formation, and tissue differentiation in plants.

Question: Explain the operation of a temperature-controlled fan in cooling systems.

Answer: A temperature-controlled fan adjusts its speed based on the temperature detected by a sensor, providing efficient cooling by increasing airflow when the temperature rises and reducing it when the temperature drops.

Question: What is the function of a fuse in an electrical circuit?

Answer: A fuse protects the circuit from excessive current by breaking the circuit when the current exceeds a specified value, preventing damage to components and reducing the risk of fire.

Question: What is the reactivity of calcium with water?

Answer: Calcium reacts with cold water to form calcium hydroxide and hydrogen gas:  $\text{Ca} + 2\text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2 + \text{H}_2$ .

Question: What defines non-luminous objects?

Answer: Non-luminous objects do not emit light but can be seen when they reflect light from an external source like the Sun or artificial light.

Question: What are the four kingdoms in the Domain Eukarya?

Answer: The four kingdoms in the Domain Eukarya are Protista, Fungi, Plantae, and Animalia.

Question: What is the role of fruits and seeds in plant reproduction?

Answer: Fruits and seeds play a crucial role in plant reproduction by facilitating the dispersal and germination of new plants.

Question: How do bi-convex lenses differ from plano-convex lenses?

Answer: Bi-convex lenses have two outward-curved surfaces, while plano-convex lenses have one flat and one outward-curved surface.

Question: How is an exothermic reaction represented in a simple equation?

Answer:  $\text{Reactants} \rightarrow \text{Products} + \text{Heat}$ .

Question: What is the role of a galvanometer in demonstrating electromagnetic induction?

Answer: A galvanometer measures the induced current in a circuit, indicating the presence and magnitude of electromagnetic induction.

Question: How does solubility influence the formulation of cosmetic products?



Answer: Solubility affects the stability, texture, and performance of cosmetic products, determining the compatibility and effectiveness of active ingredients.

Question: What is the phosphorus cycle?

Answer: The phosphorus cycle is the movement of phosphorus through the lithosphere, hydrosphere, and biosphere.

Question: What is the significance of the number of turns in a transformer's coils?

Answer: The number of turns determines the voltage ratio between the primary and secondary coils, allowing for voltage transformation.

Question: What are the effects of industrialization on environmental pollution?

Answer: Industrialization increases the release of pollutants such as greenhouse gases, heavy metals, and particulate matter into the environment. It contributes to air and water pollution, habitat destruction, and climate change.

Question: How is a methane molecule ( $\text{CH}_4$ ) formed through covalent bonding?

Answer: A methane molecule ( $\text{CH}_4$ ) is formed when a carbon atom shares four pairs of electrons with four hydrogen atoms, resulting in covalent bonds and a stable electronic configuration for each atom.

Question: Calculate the power output of a machine that does 300 J of work in 5 seconds.

Answer: The power output is 60 Watts (W).

Question: How do the properties of elements change down a group?

Answer: The properties of elements change in a systematic pattern from top to bottom down a group.

Question: What are the different notations used to indicate the composition of a mixture?

Answer: Mass fraction (m/m), volume fraction (V/V), mole fraction, mass-volume ratio (m/V), and mole-volume ratio (n/V).

Question: How does a plane mirror form an image?

Answer: A plane mirror forms an image by reflecting light rays in such a way that they appear to come from a point behind the mirror, creating a virtual image.

Question: What is the relationship between ionisation energy and reactivity for metals?

Answer: For metals, lower ionisation energy generally means higher reactivity because it is easier to remove an electron.

Question: What are the symptoms of renal failure?

Answer: Symptoms of renal failure include urinary urgency at night, little or no urine output, pain in the back, swelling of feet and ankles, weakness, pale skin, urine containing protein, and rashes on the palms and soles.

Question: How does solvent extraction help in the production of medicinal extracts?

Answer: It concentrates the medicinal components from plants by dissolving them in a suitable solvent.

Question: How does the reaction of zinc with copper sulfate solution demonstrate the reactivity series?

Answer: Zinc displaces copper from copper sulfate, forming zinc sulfate and copper, demonstrating that zinc is more reactive than copper:  $\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$ .

Question: How does genetic engineering contribute to sustainable agriculture?

Answer: Genetic engineering contributes to sustainable agriculture by creating crops that require fewer chemical inputs, such as pesticides and herbicides, and by developing plants that can withstand environmental stresses like drought and salinity.

Question: How do you construct a simple DC motor for demonstration?

Answer: By winding a coil, attaching it to a dry cell and a magnet, and observing its rotation when current flows through the coil.

Question: What are the potential impacts of climate change on agriculture?

Answer: Potential impacts of climate change on agriculture include altered growing seasons, reduced crop yields, increased pest and disease outbreaks, and water scarcity.

Question: How do animals regulate their internal environment?

Answer: Animals regulate their internal environment through homeostatic mechanisms such as thermoregulation, osmoregulation, and hormonal control to maintain stable conditions.

Question: What is the purpose of the galvanometer in demonstrating electromagnetic induction?

Answer: The galvanometer measures the induced current, indicating the presence and magnitude of electromagnetic induction in a circuit.

Question: How does a loudspeaker's cone amplify sound waves?

Answer: The cone vibrates in response to the coil's movement, amplifying the sound waves produced by the varying electric current.

Question: What is the formula to calculate the pressure exerted by a liquid column?

Answer: The formula to calculate the pressure exerted by a liquid column is  $P = h\rho g$ , where  $h$  is the height of the column,  $\rho$  is the density of the liquid, and  $g$  is gravitational acceleration.

Question: How does particle size influence the rate of reaction?

Answer: Smaller particle size increases the surface area, leading to more collision sites and a faster rate of reaction.

Question: What are the primary components of pancreatic juice, and what do they digest?

Answer: Pancreatic juice contains trypsin (digests proteins), amylase (digests starch), and lipase (digests lipids), aiding in the breakdown of food in the small intestine.

Question: What is the relationship between magnetic field strength and induced voltage?

Answer: The induced voltage is directly proportional to the magnetic field strength, with stronger fields generating higher voltage.

Question: How does the commutator in a DC motor work?

Answer: The commutator alternates the direction of current flow in the motor's coil, ensuring continuous rotation by switching the current direction every half-cycle.

Question: What is the electronic configuration of calcium?

Answer: The electronic configuration of calcium is 2, 8, 8, 2.

Question: How do protists contribute to aquatic ecosystems?

Answer: Algae, a type of protist, act as primary producers in aquatic food chains.

Question: What is the role of donor atoms in n-type semiconductors?

Answer: Donor atoms in n-type semiconductors provide extra free electrons that increase the material's conductivity. These atoms typically come from group V elements like phosphorus.

Question: What is the potential difference across a bulb connected to a 3 V power supply with a resistance of  $6\ \Omega$ ?

Answer: The potential difference is 3 V, assuming the power supply voltage is the same as the voltage across the bulb.

Question: Describe the process of corrosion and how electrochemical principles are involved.

Answer: Corrosion is the deterioration of metals due to electrochemical reactions with their environment. It involves the oxidation of metal at the anode and reduction of oxygen or other species at the cathode, leading to metal degradation and loss.

Question: How do induction cookers achieve high efficiency?

Answer: Induction cookers achieve high efficiency by generating heat directly at the bottom of the cooking utensil through a variable magnetic field, minimizing heat loss.

Question: What are ionic bonds?

Answer: Ionic bonds, also known as electrovalent bonds, are formed due to the strong electrostatic attractions between oppositely charged ions.

Question: What are the most common elements in the living body?

Answer: The most common elements in the living body are Carbon, Hydrogen, Oxygen, and Nitrogen.

Question: How do skeletal muscle fibers facilitate voluntary movement?

Answer: Skeletal muscle fibers contract in response to nerve signals, enabling precise and controlled voluntary movements.

Question: What is the significance of solubility in the pharmaceutical industry?

Answer: Solubility determines the bioavailability and efficacy of drugs, influencing their formulation, delivery, and therapeutic effectiveness.

Question: What is the total surface area of one small marble cube with all six sides exposed?

Answer: The total surface area is  $6 \text{ cm}^2$  ( $1 \text{ cm}^2 \times 6$ ).

Question: How does urbanization affect water quality?

Answer: Urbanization increases water pollution from runoff, industrial discharges, and sewage. It degrades water quality, affects aquatic ecosystems, and poses health risks to humans.

Question: How do you calculate the current flowing through a nichrome wire coil with a resistance of  $12 \Omega$  and a potential difference of  $6 \text{ V}$ ?

Answer: Using Ohm's Law,  $I = V/R$ , the current is  $I = 6 \text{ V} / 12 \Omega = 0.5 \text{ A}$ .

Question: How is the quantity of heat evolved during the reaction between sodium and chlorine represented in an energy level diagram?

Answer: The reactants ( $2\text{Na (s)} + \text{Cl}_2 \text{ (g)}$ ) are at a higher energy level than the products ( $2\text{NaCl (s)}$ ), with the difference in energy released as heat.

Question: What hormone is involved in water balance regulation, and how does it work?

Answer: ADH (antidiuretic hormone) increases water reabsorption in the kidneys when blood water levels are low, reducing water excretion.

Question: What are the primary components of pancreatic juice, and what do they digest?

Answer: Pancreatic juice contains trypsin (digests proteins), amylase (digests starch), and lipase (digests lipids), aiding in the breakdown of food in the small intestine.

Question: What is the significance of the latent heat of fusion in phase change processes?

Answer: The latent heat of fusion is significant in phase change processes because it quantifies the energy required to convert a solid into a liquid at its melting point, providing insight into the energy dynamics of phase transitions.

Question: How does the principle of pressure transmission apply to a hydraulic jack?

Answer: A hydraulic jack operates on the principle of pressure transmission, where a small force applied to a small piston generates pressure in the oil, which is transmitted to a larger piston, lifting the vehicle.

Question: How do you calculate the current flowing through a nichrome wire coil with a resistance of  $12\ \Omega$  and a potential difference of  $6\text{ V}$ ?

Answer: Using Ohm's Law,  $I = V/R$ , the current is  $I = 6\text{ V} / 12\ \Omega = 0.5\text{ A}$ .

Question: What is Archimedes' principle and its significance?

Answer: Archimedes' principle states that when an object is partially or completely submerged in a fluid, the upthrust acting on it is equal to the weight of the fluid displaced by the object. It explains why objects float or sink.

Question: How does a moving coil microphone generate alternating current?

Answer: A moving coil microphone generates alternating current by vibrating a coil in a magnetic field, inducing an electromotive force that varies with the sound waves.

Question: How does the body handle glucose in the glomerular filtrate?

Answer: In a healthy adult, 100% of glucose is reabsorbed. However, in diabetes patients, some glucose may remain and be excreted in the urine.

Question: Explain the role of the nuclear envelope in protecting genetic material.

Answer: The nuclear envelope separates the nucleus from the cytoplasm, protecting genetic material and regulating the exchange of materials, maintaining the integrity of DNA.

Question: How does the orientation of the coil affect the output of an alternating current dynamo?

Answer: The coil's orientation affects the output, with maximum voltage generated when the coil is perpendicular to the magnetic field lines.

Question: How do bacteria reproduce?

Answer: Bacteria mostly reproduce asexually through binary fission. Cyanobacteria can reproduce by fragmentation and budding.

Question: How does the release of chlorofluorocarbons (CFCs) affect the ozone layer?

Answer: The release of chlorofluorocarbons (CFCs) affects the ozone layer by breaking down ozone molecules, leading to ozone depletion and the formation of ozone holes, which allow harmful UV radiation to reach the Earth's surface.

Question: Explain the significance of a ground fault circuit interrupter (GFCI) in electrical safety.

Answer: A ground fault circuit interrupter (GFCI) detects ground faults and quickly disconnects the circuit, preventing electric shocks and reducing the risk of electrical fires.

Question: Describe an example of potential energy converting into kinetic energy.

Answer: When water stored in a high reservoir falls, its potential energy converts into kinetic energy, which can be used to generate electricity.

Question: How is the chemical formula of aluminium oxide written?

Answer: The chemical formula of aluminium oxide is  $\text{Al}_2\text{O}_3$ , indicating two aluminium ions and three oxide ions.

Question: What is the role of glucose in the plant's metabolic processes?

Answer: Glucose is used as an energy source for cellular respiration, growth, and development, and is also converted into other organic compounds.

Question: How do the electronic configurations of carbon and chlorine atoms lead to the formation of carbon tetrachloride?

Answer: The electronic configurations of carbon (2, 4) and chlorine (2, 8, 7) allow one carbon atom to share four pairs of electrons with four chlorine atoms, forming carbon tetrachloride ( $\text{CCl}_4$ ).

Question: What is the significance of genetic drift in small populations?

Answer: Genetic drift is a random process that can lead to significant changes in allele frequencies in small populations, potentially reducing genetic diversity and increasing the risk of inbreeding and genetic disorders.

Question: How does the specific heat capacity of a substance relate to its heat capacity?

Answer: The specific heat capacity of a substance is the heat capacity per unit mass. The heat capacity of an object can be obtained by multiplying its specific heat capacity by its mass.

Question: How does pressure affect the solubility of gases in liquids?

Answer: Increasing pressure increases the solubility of gases in liquids, as described by Henry's Law, which states that gas solubility is directly proportional to pressure.

Question: What are the industrial applications of electrolysis for producing chemicals?

Answer: Industrial applications include the production of chemicals like sodium hydroxide, chlorine, hydrogen, and oxygen through the electrolysis of various solutions.

Question: What are the adverse effects of acid rain?

Answer: The adverse effects of acid rain include the destruction of forests and crops, the destruction of aquatic organisms due to increased acidity in water, the dissolution of limestones and other rocks, and the destruction of metallic buildings and statues.

Question: Describe the equilibrium of a sphere suspended by a string in terms of forces.

Answer: The sphere is in equilibrium because the tension in the string balances the weight of the sphere. The forces are equal in magnitude, opposite in direction, and their lines of action are along the same line, resulting in no net force.

Question: What happens when sodium reacts with dilute acids?

Answer: Sodium reacts violently with dilute acids, forming salt and hydrogen gas. This reaction is extremely dangerous and should not be attempted.

Question: How do concave mirrors form real images?

Answer: Concave mirrors form real images when light rays converge after reflecting off the mirror's surface.

Question: Explain the working principle of an ultrasonic transducer in distance measurement.

Answer: An ultrasonic transducer emits high-frequency sound waves and measures the time it takes for the waves to reflect back from an object, determining the object's distance based on the time delay.

Question: What is the significance of Mendel's work in the field of genetics?

Answer: Mendel's work established the foundational principles of inheritance, leading to the development of the field of genetics and our understanding of how traits are passed down through generations.

Question: What test can be conducted to identify proteins?

Answer: The Biurete test involves grinding dhal or egg white into a solution, adding sodium hydroxide, and then adding copper sulfate to observe a purple color change.

Question: What are the potential impacts of global warming on polar regions?

Answer: Potential impacts of global warming on polar regions include the melting of ice caps and glaciers, rising sea levels, loss of habitat for polar species, and changes in ocean circulation patterns.

Question: How does a barometer help in weather forecasting?

Answer: A barometer helps in weather forecasting by measuring atmospheric pressure changes, indicating potential changes in weather patterns, such as incoming storms or clear skies.

Question: How do radio waves enable the transmission of sound and data?

Answer: Radio waves carry modulated signals that encode sound and data, which can be decoded by receivers for communication and broadcasting.

Question: What is the quality of sound and what does it depend on?

Answer: The quality of sound, or timbre, is the sensation that varies according to the waveform of the sound, allowing us to distinguish between different sounds.

Question: What is the significance of the latent heat of vaporization in everyday processes like sweating?

Answer: The latent heat of vaporization is significant in processes like sweating, where the evaporation of water from the skin absorbs a large amount of heat, helping to cool the body.

Question: What is the purpose of using a watch glass in chromatography?

Answer: To collect the extract and apply it to the paper strip accurately.

Question: Discuss the principles of direct current (DC) and alternating current (AC), including their differences and typical applications.

Answer: Direct current (DC) and alternating current (AC) are two types of electric current used in various applications. Direct Current (DC): Flows in a single direction with a constant magnitude. Produced by sources such as batteries and solar cells. The voltage remains constant over time. Commonly used in low-voltage applications like electronic devices, batteries, and automotive systems. Alternating Current (AC): Changes direction periodically and varies in magnitude over time. Produced by generators and supplied by the power grid. The voltage alternates sinusoidally, described by the equation  $V(t) = V_0 \sin(\omega t)$ , where  $V_0$  is the peak voltage and  $\omega$  is the angular frequency. Commonly used in high-voltage applications like power transmission, household appliances, and industrial equipment. Differences: Direction: DC flows in one direction, while AC alternates direction periodically. Voltage Stability: DC has a constant voltage, whereas AC voltage varies sinusoidally. Applications: DC is used for low-voltage and portable applications, while AC is used for power distribution and high-power applications. Both types of current are essential for different technological needs, with DC providing stable power for electronics and AC enabling efficient long-distance power transmission.

Question: Explain the concept of power in an electric circuit.

Answer: Power in an electric circuit is the rate at which electrical energy is consumed or converted into other forms of energy, measured in watts (W).

Question: Define a junction diode and its function.

Answer: A junction diode is an electronic component made from a p-n junction that allows current to flow in one direction (forward bias) while blocking it in the opposite direction (reverse bias).

Question: How do you rotate an object using a couple of forces?

Answer: To rotate an object using a couple of forces, apply two equal forces in opposite directions along lines of action that are spaced apart. The object will rotate around a point between the two forces.

Question: How does the length of a conductor affect its resistance?

Answer: The resistance of a conductor is directly proportional to its length; a longer conductor has higher resistance.

Question: What factors determine the magnitude of induced voltage in a coil?

Answer: Factors determining the magnitude of induced voltage include the number of coil turns, magnetic field strength, and speed of motion.

Question: How does thermal expansion affect the design of metallic bottle lids?

Answer: Thermal expansion affects the design of metallic bottle lids by allowing them to expand when heated, making it easier to open tight-fitting lids. Cooling the lid contracts it, ensuring a secure fit.

Question: How do ball bearings reduce friction?

Answer: Ball bearings reduce friction by allowing the two contact surfaces to roll over each other instead of sliding, minimizing the frictional force.



Question: Explain why speed is a scalar quantity.

Answer: Speed is a scalar quantity because it is defined only by its magnitude and does not consider direction.

Question: What does a velocity-time graph represent?

Answer: A velocity-time graph represents the variation of velocity with time.

Question: What occurs when calcium carbonate decomposes upon heating?

Answer: Calcium carbonate decomposes to form calcium oxide and carbon dioxide gas:  $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$ .

Question: What is the chemical formula for lithium oxide?

Answer: The chemical formula for lithium oxide is  $\text{Li}_2\text{O}$ .

Question: How does the electrolysis of copper sulfate solution demonstrate the reduction of  $\text{Cu}^{2+}$  ions?

Answer: The reduction of  $\text{Cu}^{2+}$  ions to copper metal at the cathode demonstrates the electrochemical reduction process, where  $\text{Cu}^{2+}$  ions gain electrons and are deposited as solid copper on the electrode.

Question: What are the key takeaways from the document regarding heat changes in chemical reactions?

Answer: Understanding exothermic and endothermic reactions, calculating heat changes, and recognizing the significance of temperature changes in reactions.

Question: What is the importance of energy level diagrams in understanding chemical reactions?

Answer: They visually represent the energy changes, helping to understand whether a reaction is exothermic or endothermic.

Question: How does a membrane electrode assembly (MEA) function in a fuel cell?

Answer: A membrane electrode assembly (MEA) in a fuel cell consists of a proton-conducting membrane sandwiched between two electrodes (anode and cathode). It facilitates the electrochemical reactions, allowing protons to pass through the membrane while electrons flow through an external circuit, generating electricity.

Question: How does the boiling point difference affect the efficiency of fractional distillation?

Answer: A larger boiling point difference makes it easier to separate the components, while a smaller difference requires more precise control.

Question: What are some common sexually transmitted diseases?

Answer: Common sexually transmitted diseases include gonorrhea, syphilis, herpes, and AIDS.

Question: What are the main greenhouse gases?

Answer: The main greenhouse gases include carbon dioxide, methane, nitrous oxide, and fluorinated gases.

Question: What is the process of energy dissipation?

Answer: Energy dissipation is the loss of energy during the transfer from one trophic level to the next.

Question: Define electrical insulators and give examples.

Answer: Electrical insulators are materials that do not conduct electricity because their electrons are tightly bound to the nucleus and cannot move freely. Examples include ebonite, polythene, plastic, dry wood, and glass.

Question: How much heat is required to boil 400 g of water starting from 25°C?

Answer: The heat required is 126,000 J, calculated using the formula  $Q = mc\Delta T = 0.4 \times 4200 \times (100 - 25)$ .

Question: Describe the function of a heat sink in electronic devices.

Answer: A heat sink dissipates heat generated by electronic components, such as power transistors and CPUs, preventing overheating and ensuring reliable operation.

Question: Why are seat belts important in a moving vehicle?

Answer: Seat belts exert a force on the upper body, keeping the entire body at the same velocity as the vehicle, preventing forward movement when brakes are applied.

Question: What adaptations do fruits dispersed by animals have?

Answer: Fruits dispersed by animals have succulent edible parts, attractive colors, hooks or hairs for attachment, and shapes that attract animals.

Question: Explain the concept of coulombic efficiency in batteries and its significance.

Answer: Coulombic efficiency in batteries is the ratio of the charge extracted during discharge to the charge input during charging. It indicates the efficiency of charge storage and retrieval, with higher values representing better battery performance and lower losses.

Question: What is the structure of a typical amino acid?

Answer: A typical amino acid consists of a central carbon atom bonded to an amino group (NH<sub>2</sub>), a carboxyl group (COOH), a hydrogen atom, and a variable R group.

Question: How does a temperature sensor measure temperature in electronic systems?

Answer: A temperature sensor measures temperature by producing a voltage or resistance change proportional to the temperature, allowing electronic systems to monitor and control thermal conditions.

Question: What is the composition of connective tissue?

Answer: Connective tissue is composed of various cell types and fibers embedded in a large extracellular matrix.

Question: What hormones are synthesized from lipids?

Answer: Some vertebrate hormones, such as oestrogen, testosterone, and cortisone, are lipid compounds.

Question: What are the similarities between animal and plant cells?

Answer: Both animal and plant cells possess different organelles that perform various functions.

Question: How do geneticists study the inheritance of traits in humans?

Answer: Geneticists study the inheritance of traits in humans by analyzing family pedigrees, conducting genetic tests, and studying the genotypes and phenotypes of individuals.

Question: How does the diaphragm movement in a microphone relate to sound waves?

Answer: The diaphragm moves in response to sound waves, causing the attached coil to move within a magnetic field and generate an alternating current corresponding to the sound.

Question: Activity: Requirement: Three pieces of cleaned magnesium ribbon of equal surface area, three test tubes, dilute hydrochloric acid, water  
Take three test tubes and add 15 ml of water to each tube. Mark the water level of each tube with a rubber band and empty the water. Add 2.5 ml, 5.0 ml, and 7.5 ml of dilute hydrochloric acid to the three test tubes, and fill water to the rubber band mark of each tube. Introduce to each test tube a piece of magnesium ribbon and observe the speed of fizzing. What is the purpose of carrying out activity 17.3 with different concentrations of hydrochloric acid?

Answer: To observe how varying concentrations of hydrochloric acid affect the rate of reaction with magnesium ribbon.

Question: What adaptations do fruits dispersed by wind have?

Answer: Fruits dispersed by wind have thread-like structures, wing-like structures, light seeds, and are produced in large numbers.

Question: What is simple distillation used for?

Answer: Simple distillation is used to separate a volatile component from non-volatile components in a mixture.

Question: What is the mass number of tritium?

Answer: The mass number of tritium is 3.

Question: How do you prepare 250 cm<sup>3</sup> of a 1 mol/dm<sup>3</sup> copper sulfate solution?

Answer: Weigh 62.5g of CuSO<sub>4</sub> and dissolve it in water to make the final volume 250 cm<sup>3</sup>.

Question: How does a power inverter function in an electric circuit?

Answer: A power inverter converts direct current (DC) to alternating current (AC), enabling the use of AC-powered devices from DC sources like batteries and solar panels.

Question: How is the Lewis dot and cross diagram used to represent the methane (CH<sub>4</sub>) molecule?

Answer: In the Lewis dot and cross diagram of methane (CH<sub>4</sub>), the carbon atom's valence electrons are represented by dots, while the hydrogen atoms' valence electrons are represented by crosses.

Question: What is the significance of coil windings in a solenoid's magnetic field strength?

Answer: More windings increase the field strength, enhancing the solenoid's magnetic effect and overall performance.

Question: How does the electrochemical reduction of CO<sub>2</sub> to hydrocarbons contribute to sustainable energy solutions?

Answer: The electrochemical reduction of CO<sub>2</sub> to hydrocarbons converts CO<sub>2</sub>, a greenhouse gas, into valuable fuels and chemicals using renewable electricity, contributing to sustainable energy solutions and reducing carbon emissions.

Question: What is the formula for calculating power in terms of work done and time?

Answer:  $\text{Power (P)} = \text{Work done (W)} / \text{Time (t)}$ .

Question: How does urbanization affect natural water cycles?

Answer: Urbanization increases impervious surfaces, alters natural water infiltration, and increases runoff and pollution. It disrupts natural water cycles and affects water availability and quality.

Question: What is the significance of the critical temperature in phase transitions?

Answer: The critical temperature is the highest temperature at which a substance can exist as a liquid and gas in equilibrium, beyond which it becomes a supercritical fluid with unique properties.

Question: What is the final displacement of an object that travels at a constant velocity of 6 m/s for 10 seconds?

Answer:  $\text{Displacement} = 6 \text{ m/s} \times 10 \text{ s} = 60 \text{ meters}$ .

Question: What is the historical importance of Oersted's discovery of the magnetic effect of current?

Answer: Oersted's discovery established the relationship between electricity and magnetism, leading to the development of electromagnetic theory and technology.

Question: What is the chemical equation for the neutralization reaction between hydrochloric acid and sodium hydroxide?

Answer:  $\text{HCl (aq)} + \text{NaOH (aq)} \rightarrow \text{NaCl (aq)} + \text{H}_2\text{O (l)}$ .

Question: What are the products when zinc reacts with steam?

Answer: When zinc reacts with steam, it forms zinc oxide and hydrogen gas:  $\text{Zn} + \text{H}_2\text{O} \rightarrow \text{ZnO} + \text{H}_2$ .

Question: How is epithelial tissue classified?

Answer: Epithelial tissue is classified based on the shape of the cells and the number of cell layers.

Question: What is the role of villi in the small intestine?

Answer: Villi increase the surface area for nutrient absorption, with each villus containing blood capillaries and lacteals to transport absorbed nutrients.

Question: How does an electrochemical gradient drive the production of ATP in chloroplasts?

Answer: In chloroplasts, an electrochemical gradient created by the transport of protons across the thylakoid membrane during photosynthesis drives the production of ATP through chemiosmosis, where protons flow back into the stroma through ATP synthase, generating ATP.

Question: How is kinetic energy related to mass and velocity?

Answer: Kinetic energy is directly proportional to the mass of the object and the square of its velocity.

Question: How does Newton's third law apply to walking?

Answer: When walking, the foot pushes backward on the ground (action), and the ground pushes the foot forward (reaction), propelling the person forward.

Question: What are the benefits of using electrolysis for industrial metal refining?

Answer: Electrolysis produces high-purity metals, removes impurities, and allows for the recovery of valuable by-products, enhancing overall efficiency and profitability.

Question: Describe the equilibrium of a plank of wood suspended by four strings in terms of forces.

Answer: The plank of wood is in equilibrium because the forces of tension in the four strings balance the weight of the plank. The tensions act vertically upwards and are equal in magnitude to the weight, resulting in no net force.

Question: How do dietary habits impact the formation of kidney stones?

Answer: Diets high in oxalates, calcium, and insufficient water intake can increase the risk of kidney stone formation by promoting crystallization in the kidneys.

Question: What is the significance of cell differentiation in development?

Answer: Cell differentiation is significant as it allows cells to specialize and perform specific functions, contributing to the overall growth and development of multicellular organisms.

Question: What is the formula for the moment of a couple of forces in a given scenario?

Answer: The formula for the moment of a couple of forces is  $\text{Moment} = \text{Force} \times \text{Perpendicular distance between the lines of action of the two forces}$ .

Question: How long will it take for an 800 g object to reach its maximum height when projected upwards at 20 m/s?

Answer: It will take 2 seconds.

Question: What is the function of bile in digestion?

Answer: Bile emulsifies fats, breaking them into small droplets to increase the surface area for enzyme action, aiding in lipid digestion.

Question: What is the potential energy of a 200 g fruit at a height of 4 m?

Answer: The potential energy is 8 Joules (J).

Question: What are hydrophilous flowers?

Answer: Hydrophilous flowers are pollinated by water, with staminate flowers floating to contact pistillate flowers for pollination. An example is *vallisneria*.

Question: What is the historical importance of Oersted's discovery of the magnetic effect of current?

Answer: Oersted's discovery established the relationship between electricity and magnetism, leading to the development of electromagnetic theory and technology.

Question: What is the principle behind using ultrasound waves for medical imaging?

Answer: Ultrasound waves are emitted and reflected back from internal structures, creating images used for diagnostic purposes.

Question: What happens during the process of peristalsis in the esophagus?

Answer: Peristalsis involves rhythmic contractions and relaxations of the esophageal muscles, propelling the food bolus forward to the stomach.

Question: What is the chemical formula for sodium nitrate?

Answer: The chemical formula for sodium nitrate is  $\text{NaNO}_3$ , indicating one sodium ion and one nitrate ion.

Question: How do you determine the direction of the moment of force in a given scenario?

Answer: Determine the direction of the moment of force by observing whether the applied force causes clockwise or anti-clockwise rotation and classifying the moment accordingly.

Question: Describe the physical properties of magnesium.

Answer: Magnesium is a light, reactive metal that tarnishes when exposed to air. It is a good conductor of heat and electricity and has a higher density than water ( $1.74 \text{ g/cm}^3$ ).

Question: What is the relationship between dominant and recessive alleles?

Answer: Dominant alleles determine the trait expressed when present, while recessive alleles are expressed only when both alleles are recessive.

Question: What is the relationship between force magnitude and the moment of force in rotational motion?

Answer: The moment of force in rotational motion is directly proportional to the magnitude of the applied force. An increase in force results in a larger moment, making it easier to rotate the object.

Question: How does the body repair skin injuries?

Answer: The body repairs skin injuries through inflammation, formation of a blood clot, tissue regeneration, and remodeling of the injured area.

Question: What materials are needed to investigate the effect of salt on rusting?

Answer: Cleaned iron nails, boiling tubes, solid sodium chloride, and water.

Question: How does temperature affect the resistance of a nichrome wire coil?

Answer: The resistance of a nichrome wire coil increases with temperature. It is essential to maintain a constant temperature to accurately measure resistance.

Question: What are the general properties of non-metals?

Answer: Non-metals generally do not have a metallic lustre, cannot be hammered into sheets or drawn into wires, are brittle, and are poor conductors of heat and electricity. They exist in various states: solid (e.g., carbon, sulphur), liquid (e.g., bromine), and gas (e.g., chlorine, nitrogen).

Question: How does the electrolysis of sodium chloride solution produce chlorine gas?

Answer: Chlorine gas is produced at the anode by the oxidation of  $\text{Cl}^-$  ions:  
 $2\text{Cl}^- (\text{aq}) \rightarrow \text{Cl}_2 (\text{g}) + 2\text{e}^-$ .

Question: What is the significance of earthing in electric circuits?

Answer: Earthing provides a safe path for leakage currents to flow to the ground, preventing electric shocks and protecting electrical appliances from damage.

Question: Calculate the power of a 12V electric bulb drawing a current of 1.5A.

Answer: The power (P) of the bulb is  $P = VI = 12\text{V} \times 1.5\text{A} = 18\text{W}$ .

Question: What is the general form of a chemical decomposition reaction?

Answer: The general form of a chemical decomposition reaction is:  $\text{AB} \rightarrow \text{A} + \text{B}$ , where a compound breaks down into simpler substances.

Question: What are the key components of an electroplating setup?

Answer: The key components include the object to be plated as the cathode, a solution of a metal salt as the electrolyte, and a metal plate or rod as the anode.

Question: How are algae classified based on their color?

Answer: Algae are classified into different groups based on their color, such as green, brown, and red algae.

Question: Describe the experimental method to observe chloroplast movement in Hydrilla or Vallisneria leaves.

Answer: Observe a small section of Hydrilla or Vallisneria leaf under a microscope to see how chloroplasts move towards the direction of sunlight for photosynthesis.

Question: How is the chemical formula of magnesium nitrate written?

Answer: The chemical formula of magnesium nitrate is  $\text{Mg}(\text{NO}_3)_2$ , indicating one magnesium ion and two nitrate ions.

Question: What are permanent tissues?

Answer: Permanent tissues are tissues that have lost the ability to divide and have specialized to perform particular functions.

Question: What is the function of vitamin K?

Answer: Vitamin K is important for producing components needed for blood clotting.

Question: What is the relationship between force and mass for a given acceleration?

Answer: For a given acceleration, force is directly proportional to mass. An increase in mass results in an increase in force required to achieve the same acceleration.

Question: How do viruses evade immune detection?

Answer: Viruses evade immune detection by mutating rapidly, hiding within host cells, and producing proteins that interfere with the host's immune response.

Question: What is the siphon method and how does it work?

Answer: The siphon method involves transferring liquid from a higher level container to a lower level container using a tube filled with liquid. The higher pressure in the upper container pushes the liquid through the tube to the lower container.

Question: What is the concentration of a solution containing 0.2 mol of urea in  $1 \text{ dm}^3$  of water?

Answer: The concentration is  $0.2 \text{ mol/dm}^3$ .

Question: What is the function of neurons in the nervous tissue?

Answer: Neurons transmit impulses, receive information from receptors or other neurons, and transmit them to effectors (muscles) or other neurons.

Question: What characterizes weak acids?

Answer: Weak acids only partially ionize in an aqueous medium, meaning only a fraction of the acid molecules dissociate into ions.

Question: What example is provided for collinear forces acting in opposite directions?

Answer: An example is pulling ropes in a national sport during the Sinhala new year season.

Question: How does pressure influence the rate of reaction for gaseous reactants?

Answer: Increased pressure raises the concentration of gas molecules, leading to more collisions and a faster reaction rate.



Question: What is the role of manganese dioxide in the decomposition of hydrogen peroxide?

Answer: Manganese dioxide acts as a catalyst, increasing the rate of decomposition without being consumed in the reaction.

Question: How do different waveforms affect the quality of sound produced by musical instruments?

Answer: Different waveforms create unique sound qualities or timbres, allowing us to distinguish between different instruments playing the same note.

Question: If a force of 7.5 N acts on an object and displaces it by 8 m, what is the work done?

Answer: The work done is 60 Joules (J).

Question: How do intermolecular forces affect the boiling points of covalent compounds?

Answer: Intermolecular forces affect the boiling points of covalent compounds by determining the amount of energy required to separate the molecules. Stronger intermolecular forces result in higher boiling points.

Question: Why should acids used in laboratories not be tasted?

Answer: Laboratory acids should not be tasted because they can be corrosive and harmful.

Question: What is the principle behind ultrasound imaging?

Answer: Ultrasound imaging uses high-frequency sound waves to create images of internal body structures based on the reflection of sound waves.

Question: How does an electrochemical gradient drive the production of ATP in chloroplasts?

Answer: In chloroplasts, an electrochemical gradient created by the transport of protons across the thylakoid membrane during photosynthesis drives the production of ATP through chemiosmosis, where protons flow back into the stroma through ATP synthase, generating ATP.

Question: How is a fluorine molecule ( $F_2$ ) formed through covalent bonding?

Answer: A fluorine molecule ( $F_2$ ) is formed when two fluorine atoms share a pair of electrons, resulting in a covalent bond that gives each atom a stable configuration similar to neon.

Question: How do corrective lenses work for astigmatism?

Answer: Corrective lenses for astigmatism are specially shaped to compensate for irregular curvature in the cornea or lens of the eye.

Question: What is the significance of the high specific heat capacity of water in climate regulation?

Answer: Water's high specific heat capacity plays a crucial role in climate regulation by absorbing and storing large amounts of heat, moderating temperature fluctuations and contributing to stable and mild climates.

Question: How much heat is required to increase the temperature of 2 kg of iron from 25°C to 65°C?

Answer: The heat required is 36,800 J, calculated using the formula  $Q = mc\Delta T = 2 \times 460 \times (65 - 25)$ .

Question: How do animals, wind, and water contribute to pollination?

Answer: Animals, wind, and water contribute to pollination by transferring pollen from one flower to another, facilitating fertilization.

Question: What is the role of the plasma membrane in signal transduction?

Answer: The plasma membrane contains receptors that detect extracellular signals, triggering intracellular pathways that regulate cellular responses and activities.

Question: How do geneticists use CRISPR technology in genetic research?

Answer: CRISPR technology allows geneticists to precisely edit genes by targeting specific DNA sequences, enabling the study of gene function and the development of gene therapies for genetic disorders.

Question: How do you apply a couple of forces to rotate a rod without causing linear motion?

Answer: Apply a couple of forces by exerting equal and opposite forces along the same plane at different points on the rod, resulting in rotation around a point between the forces without causing linear motion.

Question: What is the composition of gastric juice, and what are its functions?

Answer: Gastric juice contains hydrochloric acid (HCl) and the enzyme pepsin, which together help digest proteins and activate digestive enzymes.

Question: What is electronegativity?

Answer: Electronegativity is the ability of an atom to attract electrons towards itself in a chemical bond.

Question: How does surface area affect the rate of reaction between a solid and a liquid or gas?

Answer: The reaction occurs only on the surface of the solid because the particles of reactants collide only on the surface, increasing the rate of reaction with increased surface area.

Question: How do covalent compounds conduct electricity in aqueous solutions?

Answer: Covalent compounds generally do not conduct electricity in aqueous solutions because they do not dissociate into ions; their molecules remain intact, preventing the flow of electric charge.

Question: How do centrioles assist in cell division?

Answer: Centrioles organize the mitotic spindle, which separates chromosomes during cell division, ensuring accurate distribution of genetic material to daughter cells.

Question: What are the main features of the Domain Bacteria?

Answer: The Domain Bacteria includes prokaryotes that are sensitive to antibiotics, can be pathogenic, and are found everywhere in the environment.

Question: How is the hydrogen fluoride (HF) molecule polarized?

Answer: In the hydrogen fluoride (HF) molecule, the fluorine atom is more electronegative than hydrogen, attracting the bond pair of electrons more towards itself, resulting in polarization with a partial negative charge on fluorine and a partial positive charge on hydrogen.

Question: How does distance differ from displacement?

Answer: Distance depends on the path taken, while displacement is the shortest distance between two points in a specific direction.

Question: What happens during the menstrual phase of the uterine cycle?

Answer: During the menstrual phase, the uterine lining degrades and is expelled from the body as menstrual flow, typically lasting about four days.

Question: How does the length of the conductor affect the force in a magnetic field?

Answer: A longer conductor experiences a greater force, as the force is directly proportional to the conductor's length.

Question: How do you measure the resistance of a nichrome wire coil in a circuit?

Answer: Connect the nichrome wire coil in series with an ammeter and a power supply, measure the current, and use a voltmeter to measure the voltage across the coil. Calculate the resistance using Ohm's Law.

Question: How does the specific heat capacity of a substance affect its ability to store heat?

Answer: Substances with higher specific heat capacities can store more heat for a given temperature change, making them useful for applications requiring thermal energy storage.

Question: How do mitochondria and chloroplasts generate energy in eukaryotic cells?

Answer: Mitochondria generate ATP through cellular respiration, while chloroplasts convert light energy into chemical energy stored in glucose through photosynthesis in eukaryotic cells.

Question: How does the pressure inside a balloon compare to atmospheric pressure?

Answer: The pressure inside a balloon is greater than atmospheric pressure because the compressed air inside the balloon exerts additional pressure on the liquid in the connected U-tube, causing the water level to change.

Question: What is the resultant force if one child pushes an object with 5 N and another child pulls it with 7 N in the same direction?

Answer: The resultant force is 12 N in the same direction.

Question: How does mass affect the momentum of an object?

Answer: Mass directly affects the momentum of an object. Momentum is the product of mass and velocity, so an increase in mass results in an increase in momentum for a given velocity.

Question: How can you identify the anode of a 5 mm LED?

Answer: The anode of a 5 mm LED is the longer terminal, or if the base of the LED is pointed towards you, the terminal near the cut is the cathode.

Question: Explain the operation of a servo motor in robotic systems.

Answer: A servo motor uses feedback control to adjust its position or speed precisely, driven by a control signal that determines its movement based on the desired position or speed.

Question: How does the number of turns in a coil affect the induced electromotive force?

Answer: More turns in a coil increase the induced electromotive force, making the device more efficient.

Question: What role does a circuit breaker play in household wiring?

Answer: A circuit breaker protects household wiring from overcurrent by automatically disconnecting the circuit when the current exceeds a safe level.

Question: What is an energy pyramid?

Answer: An energy pyramid shows the flow of energy through different trophic levels in an ecosystem, with the energy decreasing at each successive level.

Question: How is the chemical formula of sodium chloride written?

Answer: The chemical formula of sodium chloride is NaCl, indicating one sodium ion and one chloride ion.

Question: What role does the magnetic field play in the operation of a bicycle dynamo?

Answer: The magnetic field interacts with the rotating coil, inducing an electromotive force that generates electrical power for the bicycle's lights.

Question: What are the three domains introduced by Carl Woese?

Answer: The three domains introduced by Carl Woese are Archaea, Bacteria, and Eukarya.

Question: How do homologous chromosomes differ from non-homologous chromosomes?

Answer: Homologous chromosomes are pairs that carry the same genes in the same order, while non-homologous chromosomes carry different sets of genes and are not paired during meiosis.

Question: Place the trolley on a table and fix the ring to one side of the trolley and attach two strong strings to the ring . Pass the two strings over the two pulleys and connect the two Newton balances B and C to the other ends of the strings. Fix the other end of the trolley to a wall through the third Newton balance A.What is observed when applying two forces from two Newton balances ?

Answer: The sum of the readings of B and C balances is equal to the reading of balance A.

Question: Explain the operation of a solenoid in electromechanical systems.

Answer: A solenoid converts electrical energy into mechanical movement by using an electromagnet to move a metal plunger, providing linear actuation for various applications.

Question: Give an example of a polyatomic ion.

Answer: An example of a polyatomic ion is the nitrate ion ( $\text{NO}_3^-$ ) with a valency of 1.

Question: What is the significance of Michael Faraday's experiments on electromagnetic induction?

Answer: Faraday's experiments established the principles of electromagnetic induction, leading to the development of electrical generators and transformers.

Question: What is the resultant force when two forces of 8 N and 6 N act in opposite directions?

Answer: The resultant force is 2 N in the direction of the larger force (8 N).

Question: How does the taste of acids and bases differ?

Answer: Acids have a sour taste, while bases typically have a bitter taste.

Question: How does the use of renewable energy sources enhance the sustainability of electrochemical processes?

Answer: The use of renewable energy sources enhances the sustainability of electrochemical processes by providing clean and abundant energy, reducing reliance on fossil fuels, lowering carbon emissions, and enabling the development of environmentally friendly technologies.

Question: What is dry ice, and how is it formed?

Answer: Dry ice is solid carbon dioxide, formed by cooling carbon dioxide under high pressure. It sublimates directly from solid to gas without becoming a liquid.

Question: How does the color of visible light change with wavelength?

Answer: The color changes from violet at the shortest wavelengths to red at the longest wavelengths, with intermediate colors like indigo, blue, green, yellow, and orange.

Question: How does the speed of a rotating coil influence the dynamo's output?

Answer: A faster rotating coil increases the rate of change of the magnetic field, generating higher voltage and more electrical power.

Question: What is the significance of the vertical line passing through the center of gravity in maintaining equilibrium?

Answer: The vertical line passing through the center of gravity indicates the line of action of the weight. For equilibrium, the lines of action of other forces must intersect this vertical line and lie in the same plane.

Question: Describe the principle of operation of a transformer.

Answer: A transformer operates on the principle of electromagnetic induction, where a changing current in the primary coil induces a voltage in the secondary coil, allowing the transfer of electrical energy between circuits with different voltage levels.

Question: How does the solubility of a solid solute in a liquid solvent change with temperature?

Answer: The solubility of a solid solute in a liquid solvent generally increases with temperature, allowing more solute to dissolve.

Question: What is the purpose of a light-dependent resistor (LDR)?

Answer: A light-dependent resistor (LDR) changes its resistance based on the intensity of light it is exposed to, making it useful in light-sensing applications such as automatic lighting and alarm systems.

Question: What happens to the induced current when the coil in a dynamo is vertical?

Answer: When the coil is vertical, the induced current becomes zero as the conductors do not intersect the magnetic field lines.

Question: Explain the term 'half reactions' in the context of electrochemical cells.

Answer: Half reactions' refer to the separate oxidation and reduction reactions that occur in an electrochemical cell. Each half reaction shows the conversion of one chemical species to another by losing or gaining electrons.

Question: What is the reaction between sodium and water?

Answer: Sodium reacts vigorously with water to form sodium hydroxide and hydrogen gas:  $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$ .

Question: What is an example of a food chain?

Answer: An example of a food chain is: grass → grasshopper → toad → cobra → hawk.

Question: What conclusions can be drawn from the operation of a transformer?

Answer: A current is induced in the secondary coil when there is a change in the magnetic field caused by the primary coil. Transformers only work with alternating currents or changing direct currents.

Question: How does the density of elements change across a period?

Answer: The density of elements generally increases across a period from left to right.

Question: What is the mass of an object if a force of 8 N results in an acceleration of  $2 \text{ m/s}^2$ ?

Answer: The mass of the object is  $F/a = 8/2 = 4 \text{ kg}$ .

Question: What is binomial nomenclature?

Answer: Binomial nomenclature is a system of naming organisms using two epithets (a generic name and a specific epithet) introduced by Carolus

Linnaeus in 1753. It is regulated by the International Commission on Botanical Nomenclature (ICBN) and the International Commission on Zoological Nomenclature (ICZN).

Question: What are the advantages of vegetative propagation?

Answer: Vegetative propagation enables the propagation of plants that do not produce seeds, produces offspring identical to the mother plant, and allows the propagation of disease-resistant and early-fruited plants.

Question: How does an optical fiber transmit light?

Answer: Light entering one end of the fiber undergoes repeated total internal reflections within the fiber, transmitting light with minimal loss.

Question: What is the pH value of neutral substances like water?

Answer: The pH value of neutral substances is 7.

Question: How does the electrolysis of water illustrate the principles of oxidation and reduction?

Answer: The electrolysis of water illustrates oxidation and reduction by showing the reduction of  $H^+$  ions to hydrogen gas at the cathode and the oxidation of  $OH^-$  ions to oxygen gas at the anode, demonstrating the transfer of electrons in redox reactions.

Question: How does genetic engineering contribute to environmental conservation?

Answer: Genetic engineering contributes to environmental conservation by developing crops that require fewer chemical inputs, creating bioengineered organisms to clean up pollution, and preserving genetic diversity through biobanking and genetic rescue efforts.

Question: What is the central atom in an ammonia molecule?

Answer: The central atom in an ammonia ( $NH_3$ ) molecule is nitrogen.

Question: How do fungi reproduce?

Answer: Fungi reproduce through both sexual and asexual methods, including spore formation, budding, and fragmentation, depending on the species and environmental conditions.

Question: What is the valency of sodium?

Answer: The valency of sodium is 1.

Question: What are the safety precautions when handling bases in the laboratory?

Answer: Bases should be handled with care, using protective equipment to avoid skin contact and potential burns.

Question: What is the significance of the resultant force in practical applications?

Answer: The resultant force allows the effective use of multiple small forces to achieve the effect of a single large force.

Question: What is the valency of phosphorus?

Answer: The valency of phosphorus is 5 and 3.

Question: How does the power consumption of LED televisions compare to that of older CRT televisions?

Answer: LED televisions consume significantly less power than older CRT televisions, making them more energy-efficient and cost-effective.

Question: What are some examples of stimuli that organisms respond to?

Answer: Examples of stimuli include light, sound, chemicals, temperature, and mechanical touch.

Question: Experimental determination of the heat change of the reaction between sodium hydroxide (NaOH) and hydrochloric acid (HCl) Materials required : - 50 cm<sup>3</sup> of 2 mol dm<sup>-3</sup> sodium hydroxide solution, 50 cm<sup>3</sup> of 2 mol dm<sup>-3</sup> hydrochloric acid solution, two 100 cm<sup>3</sup> beakers, a thermometer of range 0-100 °C, a polystyrene cup, a glass rod Method : - To two beakers, measure 50 cm<sup>3</sup> of the sodium hydroxide solution and 50 cm<sup>3</sup> of the hydrochloric acid solution separately using the measuring cylinder. With the thermometer, measure the initial temperatures of the two solutions. (After measuring the temperature of the solution of the base, wash the thermometer before measuring the temperature of the acid solution . Mix these two solutions in a polystyrene cup, stir with the glass rod and record the maximum temperature. Why is a polystyrene cup used in the Activity ?

Answer: To minimize heat loss to the surroundings and absorption of heat by the container.

Question: What is an example of a scientific name given in the document?

Answer: An example of a scientific name is *Mangifera indica*.

Question: What factors influence the efficiency of electromagnetic induction?

Answer: Factors influencing efficiency include the number of coil turns, the strength of the magnetic field, and the speed of relative motion between the coil and magnet.

Question: What is the composition of gastric juice, and what are its functions?

Answer: Gastric juice contains hydrochloric acid (HCl) and the enzyme pepsin, which together help digest proteins and activate digestive enzymes.

Question: What is the resultant force if two forces of 10 N and 6 N act in opposite directions?

Answer: The resultant force is 4 N in the direction of the 10 N force.

Question: How is potassium permanganate used to prepare oxygen gas in the laboratory?

Answer: Potassium permanganate is heated to decompose it into potassium manganate, manganese dioxide, and oxygen gas, collected by downward displacement of water.

Question: How does the magnetic effect of a current explain compass needle deflection?



Answer: The magnetic effect creates a field around the conductor, influencing the compass needle and causing it to deflect in the field's direction.

Question: What is the first ionisation energy of beryllium?

Answer: The first ionisation energy of beryllium is 899 kJ/mol.

Question: What is the significance of the renal capsule in kidney structure?

Answer: The renal capsule is a protective outer layer that encases the kidney, maintaining its shape and protecting it from damage.

Question: How do geneticists study the genetic basis of complex diseases?

Answer: Geneticists study the genetic basis of complex diseases by identifying genetic variants associated with disease risk, conducting genome-wide association studies, and investigating gene-environment interactions that contribute to disease development.

Question: How is momentum calculated?

Answer: Momentum is calculated as  $p=mv$ , where  $p$  is momentum,  $m$  is mass, and  $v$  is velocity.

Question: How does the induced current in a dynamo vary during one complete rotation?

Answer: The induced current alternates direction during one complete rotation, producing a sinusoidal wave of alternating current.

Question: How are fatty acids and glycerol absorbed in the small intestine?

Answer: Fatty acids and glycerol are absorbed into lacteals within the villi and transported to the lymphatic system before entering the bloodstream.

Question: What is the reaction between potassium and water?

Answer: Potassium reacts vigorously with water to form potassium hydroxide and hydrogen gas:  $2K + 2H_2O \rightarrow 2KOH + H_2$ .

Question: How do you prepare 250 cm<sup>3</sup> of a 1 mol/dm<sup>3</sup> sodium chloride solution?

Answer: Weigh 14.625g of NaCl and dissolve it in water to make the final volume 250 cm<sup>3</sup>.

Question: What is a quaternary consumer?

Answer: A quaternary consumer is a predator at the top of the food chain, feeding on tertiary consumers.

Question: What causes renal failure, and what are its symptoms?

Answer: Renal failure occurs when the kidneys cannot filter blood effectively, caused by infections, heavy metals, or toxins. Symptoms include edema, increased blood pressure, and reduced blood pH.

Question: Define heat capacity and specific heat capacity, and describe an experiment to compare the heat capacities of different substances.

Answer: Heat Capacity: The amount of heat required to increase the temperature of an object by one degree. It is measured in joules per Kelvin (J/K) or joules per degree Celsius (J/°C). Specific Heat Capacity: The amount

of heat required to increase the temperature of one kilogram of a substance by one degree. It is a property of the substance and is measured in joules per kilogram per Kelvin ( $\text{J/kg}\cdot\text{K}$ ) or joules per kilogram per degree Celsius ( $\text{J/kg}\cdot^\circ\text{C}$ ). Experiment to Compare Heat Capacities: Materials Required: Three identical beakers, water, coconut oil, three thermometers, three Bunsen burners, and a stirrer. Procedure: Pour a measured volume of water into one beaker, an equal volume of coconut oil into another beaker, and twice the initial volume of water into the third beaker. Measure the initial temperatures of the liquids in all three beakers. Heat the liquids simultaneously for an equal time interval (about 5 minutes) using three identical Bunsen burners. Measure the final temperatures of the liquids. Observations: Despite receiving approximately the same amount of heat, the temperature rise in the three beakers will be different. The beaker with double the volume of water will have a smaller temperature rise compared to the beaker with a single volume of water. The temperature rise in the beaker with coconut oil will also differ from that of water due to the different heat capacities of the substances. Conclusion: This experiment demonstrates that different substances and different masses of the same substance have different heat capacities. The heat capacity of an object depends on its mass and the specific heat capacity of the substance it is made of.

Question: What is the molar mass of carbon dioxide ( $\text{CO}_2$ )?

Answer: The molar mass of carbon dioxide is 44 grams per mole, calculated as 12 for carbon plus  $2 \times 16$  for oxygen.

Question: What is the significance of Gregor Mendel's experiments with pea plants?

Answer: Mendel's experiments with pea plants provided the first scientific evidence of how traits are inherited, leading to the discovery of the principles of genetics.

Question: How is the Kingdom Plantae divided?

Answer: The Kingdom Plantae is divided into flowering and non-flowering plants.

Question: What occurs when zinc reacts with copper sulfate solution?

Answer: When zinc reacts with copper sulfate solution, zinc displaces copper, forming zinc sulfate and copper:  $\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$ . The solution's blue color fades, and a brown copper deposit forms.

Question: How can sound waves be visualized using a cathode ray oscilloscope?

Answer: A microphone connected to an oscilloscope can display the waveform of sound waves, showing variations in amplitude and frequency.

Question: Why is it important to disconnect appliances during lightning strikes?

Answer: Disconnecting appliances during lightning strikes prevents potential damage from power surges and reduces the risk of electrical fires.

Question: What materials are required for observing different plant tissues under a microscope?

Answer: Thin peel of lower epidermis of betel leaf, thin section of a potato tuber, and thin cross section of a stem of a plant like Balsam.

Question: What are the two main categories of plant tissues based on their ability to divide?

Answer: Plant tissues are categorized into meristematic tissues and permanent tissues.

Question: How do you prepare a  $1 \text{ mol/dm}^3$  solution of sodium hydroxide?

Answer: Weigh the required mass of NaOH, dissolve it in water, and adjust the final volume in a volumetric flask.

Question: What factors influence the induced electromotive force in a coil?

Answer: Factors influencing the induced electromotive force include the number of coil turns, magnetic field strength, and speed of relative motion.

Question: What is the resistance of a bulb connected to a 9 V power supply with a current of 1.5 A?

Answer: Using Ohm's Law,  $R = V/I$ , the resistance is  $R = 9 \text{ V} / 1.5 \text{ A} = 6 \Omega$ .

Question: What is the significance of the extracellular matrix in animal cells?

Answer: The extracellular matrix is a network of proteins and polysaccharides that provide structural support, facilitate cell adhesion, and mediate cell signaling in animal tissues.

Question: How do you investigate the equilibrium of an object under the action of two forces using a block of wood and Newton balances?

Answer: Attach the Newton balances to the block of wood and pull in opposite directions with varying forces. The object remains in equilibrium when the forces are equal in magnitude and opposite in direction, resulting in no net movement.

Question: What is the importance of the solubility of gases in natural water bodies?

Answer: The solubility of gases like oxygen and carbon dioxide in natural water bodies is crucial for aquatic life and maintaining ecological balance.

Question: What function do xylem fibers serve in xylem tissue?

Answer: Xylem fibers, which are narrower and shorter than tracheids, provide additional support to the xylem tissue.

Question: How does the sharing of electrons lead to the formation of covalent bonds?

Answer: The sharing of electrons between atoms allows them to achieve a stable electronic configuration, resulting in the formation of covalent bonds that hold the atoms together.

Question: How do viruses evade the immune system?

Answer: Viruses evade the immune system by rapidly mutating, hiding within host cells, and disrupting immune responses, making it challenging for the body to detect and eliminate them.

Question: How do you determine the number of moles in a given mass of a compound?

Answer: The number of moles in a given mass of a compound is determined by dividing the mass by the molar mass of the compound,  $n = m/M$ .

Question: What is the speed of light in diamond?

Answer: 124,000 km/s.

Question: What is the relationship between liquid pressure and the depth of the liquid?

Answer: The pressure exerted by a liquid increases with the depth of the liquid because the weight of the liquid above that point increases.

Question: What are the common examples of endothermic reactions in daily life?

Answer: Photosynthesis in plants and the thermal decomposition of compounds like limestone.

Question: What are the harmful effects of protozoans to humans?

Answer: Protozoans can cause diseases like Amoebiasis, Malaria, and Sleeping sickness.

Question: What are the three domains of life?

Answer: The three domains of life are Archaea, Bacteria, and Eukarya.

Question: What is the role of accessory pigments in photosynthesis?

Answer: Accessory pigments like carotenoids and phycobilins capture additional light energy and transfer it to chlorophyll, broadening the range of light used for photosynthesis.

Question: What changes occur in the fetus during the sixth month of development?

Answer: During the sixth month, the fetus develops eyebrows and eyelashes.

Question: What is the magnitude of the resultant force if two collinear forces of 10 N and 6 N act in the same direction?

Answer: The magnitude of the resultant force is 16 N.

Question: How do bacteria reproduce?

Answer: Bacteria reproduce primarily through binary fission, a process where a single bacterial cell divides into two identical daughter cells.

Question: Describe how kinetic energy and potential energy can transform into each other.

Answer: Kinetic energy can transform into potential energy and vice versa, depending on the position and motion of the object, such as in a pendulum or a roller coaster.

Question: What happens when the coil and split rings in a DC motor rotate 180 degrees?

Answer: When the coil and split rings rotate 180 degrees, the brushes make contact with different split rings, reversing the current flow and continuing the rotation.

Question: How is the chemical formula of sodium hydroxide written?

Answer: The chemical formula of sodium hydroxide is NaOH, indicating one sodium ion and one hydroxide ion.

Question: How does temperature affect the solubility of a solute in a solvent?

Answer: Temperature can increase or decrease the solubility of a solute, depending on the solute and solvent involved.

Question: How does Newton's first law apply to a passenger standing in a moving bus when it starts moving?

Answer: When a bus at rest suddenly starts moving, the passenger tends to fall backward due to inertia. The lower part of the body starts moving with the bus, but the upper part remains at rest, demonstrating Newton's first law.

Question: What are the features of invertebrates in the phylum Arthropoda?

Answer: Invertebrates in the phylum Arthropoda are triploblastic, coelomic, have jointed limbs, segmented bodies forming functional segments called Tagma, a chitinous cuticle acting as an exoskeleton, bilateral symmetry, and show sexual dimorphism.

Question: What are the effects of ground-level ozone on human health?

Answer: The effects of ground-level ozone on human health include respiratory problems, aggravated asthma, reduced lung function, and increased risk of respiratory infections.

Question: What are the potential complications of untreated kidney stones?

Answer: Untreated kidney stones can cause severe pain, block urine flow, lead to infections, and potentially damage the kidneys.

Question: What is the significance of naturally occurring magnets in history?

Answer: Naturally occurring magnets have been known for thousands of years and were crucial in the development of navigation tools like the compass.

Question: What is atmospheric pressure and how is it measured?

Answer: Atmospheric pressure is the pressure exerted by the weight of the air above a point. It can be measured using a mercury barometer, where the height of the mercury column represents the atmospheric pressure.

Question: What is the chemical formula for potassium carbonate?

Answer: The chemical formula for potassium carbonate is  $K_2CO_3$ , indicating two potassium ions and one carbonate ion.

Question: How does temperature affect the speed of sound in air?

Answer: The speed of sound in air increases with temperature, as warmer air allows sound waves to propagate faster.

Question: What are the properties of strong acids?

Answer: Strong acids completely ionize in water, releasing a high concentration of hydrogen ions ( $H^+$ ).

Question: What are the advantages of using electroplating for coating metal objects?

Answer: Electroplating provides a durable and attractive finish, enhances corrosion resistance, improves wear resistance, and offers cost-effective surface treatment.

Question: What is the significance of the 1:2:1 ratio in Mendel's monohybrid crosses?

Answer: The 1:2:1 ratio in Mendel's monohybrid crosses represents the distribution of genotypes (homozygous dominant, heterozygous, and homozygous recessive) in the F<sub>2</sub> generation.

Question: What is the role of chromosomes in genetic inheritance?

Answer: Chromosomes carry genes that determine traits and transmit genetic information from one generation to the next, playing a crucial role in inheritance.

Question: What is the significance of the hearing range in humans and animals?

Answer: The hearing range defines the range of frequencies that can be perceived, influencing how different species interact with their environment and communicate.

Question: What is the relationship between temperature and kinetic energy in particles?

Answer: Temperature is directly related to the kinetic energy of particles; higher temperatures correspond to higher kinetic energy and more vigorous particle motion.

Question: What causes gene mutations, and what are their effects?

Answer: Gene mutations can occur spontaneously or be induced by radiation and chemicals. They cause changes in the DNA sequence, leading to various genetic disorders and altered traits.

Question: How is speed different from velocity?

Answer: Speed is a scalar quantity with only magnitude, while velocity is a vector quantity with both magnitude and direction.

Question: How is the gradient of a velocity-time graph calculated?

Answer: The gradient of a velocity-time graph is calculated by dividing the difference between the y-coordinates (velocity) of any two points on the graph by the difference between the corresponding x-coordinates (time).

Question: How should a voltmeter be connected in a circuit?

Answer: A voltmeter should be connected in parallel with the component or points across which the potential difference is to be measured.

Question: What lifestyle changes can help maintain healthy kidney function?

Answer: Healthy kidney function can be maintained through proper hydration, a balanced diet low in sodium and saturated fats, regular exercise, avoiding smoking, and limiting alcohol consumption.

Question: How do you determine if a potential difference exists across a bulb in a circuit?

Answer: Use a voltmeter to measure the potential difference across the terminals of the bulb in the circuit.

Question: What is the significance of the rate of reaction in chemical processes?

Answer: The rate of reaction determines how quickly products are formed, affecting the efficiency and feasibility of chemical processes.

Question: How do the physical properties of metalloids compare to metals and non-metals?

Answer: Metalloids have physical properties that are intermediate between metals and non-metals, such as semiconducting abilities.

Question: What is the potential energy of a 6.5 kg object at a height of 3.5 m?

Answer: The potential energy is 227.5 Joules (J).

Question: What causes AIDS, and what are its symptoms?

Answer: AIDS is caused by the Human Immunodeficiency Virus (HIV) and can be fatal. Symptoms may appear 2-15 years after infection.

Question: How do you investigate the effect of perpendicular distance on the moment of force using a stick and Newton balance?

Answer: Investigate the effect by attaching a loop and Newton balance to different points on the stick, applying a constant force, and measuring the distance required to initiate rotation.

Question: Explain the structure, operation, and types of transistors, including their use as amplifiers.

Answer: Transistors are semiconductor devices used to amplify and switch electronic signals. They consist of two p-n junctions formed by connecting three semiconductor regions of type p and n. Structure: Types: There are two types of transistors: npn and pnp. npn Transistor: Consists of a layer of p-type semiconductor sandwiched between two n-type layers. pnp Transistor: Consists of a layer of n-type semiconductor sandwiched between two p-type layers. Terminals: Each transistor has three terminals: emitter, collector, and base. Emitter (E): Emits charge carriers (electrons or holes). Collector (C): Collects charge carriers. Base (B): Controls the flow of carriers between the emitter and collector. Operation: Biasing: Proper voltages must be provided to the terminals for the transistor to operate. Forward Bias (Emitter-Base Junction): The emitter-base junction should be forward biased. Reverse Bias (Base-Collector Junction): The base-collector junction should be reverse biased. Current Flow: npn Transistor: Electrons flow from the emitter to the collector, with the current flowing from the

collector to the emitter. pnp Transistor: Holes flow from the emitter to the collector, with the current flowing from the emitter to the collector. Types and Uses: Current Amplifier: Transistors amplify small input currents into larger output currents. Example: Constructing a current amplifier circuit with a 2SD400 (D400) transistor, two 2.5 V torch bulbs, and dry cells to observe current amplification. Signal Amplifier: Transistors amplify audio or other signals. Example: Amplifying an audio signal using a 2SD400 transistor, a 22 k $\Omega$  resistor, an 8 $\Omega$  speaker, and an audio frequency generator to hear an amplified sound. Switch: Transistors can act as electronic switches, controlled by an input signal. Example: Using a 2SD313 transistor, a multimeter, a 2.5 V bulb, and a 10 k $\Omega$  volume controller to observe the switching action when varying the base-emitter voltage.

Question: How is solubility related to the concept of saturation?

Answer: Solubility defines the maximum amount of solute that can dissolve in a solvent at a given temperature, with saturation occurring when this limit is reached.

Question: How does the position of an object affect the nature of the image formed by a concave mirror?

Answer: Depending on whether the object is placed between the mirror and the focal point, at the focal point, or beyond the center of curvature, the image can be virtual or real, upright or inverted, and larger or smaller than the object.

Question: What are the characteristics of organisms in the Domain Archaea?

Answer: Organisms in the Domain Archaea are prokaryotes that can live in extreme environments and are not sensitive to most antibiotics.

Question: What is the significance of the electrochemical series in predicting the outcome of electrolysis?

Answer: The electrochemical series ranks elements based on their tendency to lose or gain electrons. It helps predict which ions will be reduced or oxidized during electrolysis.

Question: What is the function of the coelenteron in Cnidarians?

Answer: The coelenteron acts as the digestive tract in Cnidarians.

Question: What are the features of cardiac muscle tissue?

Answer: Cardiac muscle tissue is composed of uninucleate, striated, short cells with intercalated discs, contracts rhythmically, does not fatigue, and is controlled involuntarily.

Question: What is the significance of the lines of action of forces in maintaining equilibrium in a system of three non-parallel forces?

Answer: The lines of action of the three non-parallel forces must intersect at a common point for equilibrium to be maintained. This ensures that the resultant of any two forces is equal in magnitude and opposite in direction to the third force.

Question: How much heat is required to increase the temperature of 2 kg of water by 10 K?



Answer: The heat required is 84,000 J, calculated using the formula  $Q = mc\Delta T = 2 \times 4200 \times 10$ .

Question: What is the displacement of a body moving at a uniform acceleration of  $2 \text{ m/s}^2$  for 6 seconds?

Answer: The displacement is 36 m.

Question: Describe the role of an integrated circuit (IC) in modern electronics.

Answer: An integrated circuit (IC) combines multiple electronic components, such as transistors, resistors, and capacitors, on a single chip, enabling compact, efficient, and reliable electronic systems.

Question: What is the formula for calculating distance using speed and time?

Answer:  $\text{Distance} = \text{Speed} \times \text{Time}$ .

Question: How does urbanization impact air quality?

Answer: Urbanization impacts air quality by increasing emissions from vehicles, industrial activities, and construction, leading to higher levels of air pollutants such as particulate matter, nitrogen oxides, and volatile organic compounds.

Question: Who first introduced the Periodic Table?

Answer: Dmitri Mendeleev, a Russian scientist, first introduced the Periodic Table.

Question: What is the significance of a displacement-time graph?

Answer: A displacement-time graph shows how the displacement of a body varies with time.

Question: How do you express the composition of a mixture in terms of volume/volume (v/v)?

Answer:  $v/v = \text{Volume of component} / \text{Total volume of mixture}$ .

Question: What is the formula for velocity?

Answer:  $\text{Velocity} = \text{Displacement} / \text{Time}$

Question: How is atmospheric pressure measured using a mercury barometer?

Answer: Atmospheric pressure is measured using a mercury barometer by the height of the mercury column in a glass tube. The height of the column represents the atmospheric pressure exerted on the mercury in the container.

Question: What are the products of photosynthesis?

Answer: The products of photosynthesis are glucose ( $\text{C}_6\text{H}_{12}\text{O}_6$ ) and oxygen ( $\text{O}_2$ ).

Question: What is the importance of the electromagnetic spectrum in astronomy?

Answer: The electromagnetic spectrum allows astronomers to study celestial objects across different wavelengths, revealing information about

their composition, temperature, and distance.

Question: How many people were needed to push the motor car to make it move?

Answer: Three people were needed to push the motor car to make it move.

Question: What is the molar mass of sodium hydroxide (NaOH)?

Answer: The molar mass of NaOH is 40 g/mol.

Question: How does genetic diversity benefit a species?

Answer: Genetic diversity allows a species to adapt to changing environments, resist diseases, and maintain healthy populations. It provides a genetic pool that can respond to natural selection and environmental pressures.

Question: What are the units of measuring work and energy?

Answer: The units of measuring work and energy are Joules (J).

Question: What is the significance of sound waves being longitudinal?

Answer: As longitudinal waves, sound waves propagate through compressions and rarefactions, requiring a medium for transmission.

Question: How do concave mirrors form real images?

Answer: Concave mirrors form real images when light rays from an object converge after reflecting off the mirror's surface.

Question: Activity: Consider a cube of marble ( $\text{CaCO}_3$ ), of a side 2 cm, put into dilute hydrochloric acid solution. Calculate the surface area of marble that comes into contact with the acid. What is the purpose of activity involving marble cubes and acid?

Answer: The Activity demonstrates how increasing the surface area of marble cubes affects their reaction rate with dilute hydrochloric acid.

Question: How do sound waves interact with solid objects?

Answer: Sound waves can cause solid objects to vibrate, transferring energy through the material and potentially amplifying the sound.

Question: How does pressure influence the rate of reaction for gaseous reactants?

Answer: Increased pressure raises the concentration of gas molecules, leading to more collisions and a faster reaction rate.

Question: How do geneticists use probability in the study of inheritance?

Answer: Geneticists use probability to predict the likelihood of certain traits appearing in offspring, based on the known genotypes of the parents.

Question: How is the chemical formula of calcium oxide represented?

Answer: The chemical formula of calcium oxide is  $\text{CaO}$ , indicating one calcium ion and one oxide ion.

Question: How do microwaves interact with food in a microwave oven?

Answer: Microwaves cause water molecules in food to vibrate, generating heat and cooking the food.

Question: How does the use of synthetic fertilizers impact soil health?

Answer: The use of synthetic fertilizers can degrade soil health by disrupting natural nutrient cycles, reducing soil fertility, and causing soil acidification. Over time, it can lead to decreased agricultural productivity and environmental harm.

Question: How many electrons can the first energy level hold?

Answer: The first energy level can hold a maximum of 2 electrons.

Question: Explain the role of ribosomes in gene expression.

Answer: Ribosomes translate mRNA into proteins, which are essential for expressing genetic information and carrying out cellular functions.

Question: How does genetic engineering improve livestock production?

Answer: Genetic engineering improves livestock production by creating animals with desirable traits such as faster growth rates, disease resistance, and improved milk or meat quality.

Question: How do the melting points and boiling points of ionic compounds compare to covalent compounds?

Answer: The melting points and boiling points of ionic compounds are relatively high compared to covalent compounds, which generally have lower melting and boiling points.

Question: How does gravitational acceleration vary with altitude?

Answer: Gravitational acceleration decreases with altitude, causing the weight of an object to decrease as it moves to higher altitudes, while its mass remains constant.

Question: What is the role of the endocrine system in animals?

Answer: The endocrine system regulates physiological processes through the release of hormones, which act as chemical messengers to coordinate various body functions.

Question: Explain the energy transformation in a roller coaster ride.

Answer: In a roller coaster ride, potential energy at the highest points is converted to kinetic energy as the coaster descends, and kinetic energy is converted back to potential energy as it ascends.

Question: How does the direction of induced current change with coil rotation?

Answer: The direction of induced current changes periodically with coil rotation, resulting in an alternating current output.

Question: What safety precautions should be taken when installing electrical wiring in damp environments?

Answer: Safety precautions include using moisture-resistant cables, proper insulation, and weatherproof enclosures to prevent electric shocks and short circuits.

Question: What are the reproductive structures of fungi?

Answer: Fungi reproduce through structures like spores, which can be observed under a microscope.

Question: What is the difference between evaporation and boiling in terms of heat transfer?

Answer: Evaporation is the gradual conversion of a liquid to gas at temperatures below the boiling point, while boiling is the rapid conversion of a liquid to gas at its boiling point. Both processes involve heat transfer but occur under different conditions.

Question: How does the boiling point of elements change across a period?

Answer: The boiling point of elements generally increases across a period from left to right.

Question: Explain the significance of a printed circuit board (PCB) in electronic devices.

Answer: A printed circuit board (PCB) provides a platform for mounting electronic components and interconnecting them with conductive tracks, ensuring reliable and compact circuit assembly.

Question: How does the solubility of a gas change with an increase in temperature?

Answer: The solubility of a gas in a liquid decreases with an increase in temperature, as higher temperatures cause the gas to escape more readily from the solution.

Question: How do bacteria benefit the environment?

Answer: Bacteria decompose dead bodies and structures, fix atmospheric nitrogen, and aid in the production of curd, yoghurt, and cheese.

Question: Calculate the mole fraction of sodium hydroxide in a solution made by dissolving 40g of NaOH in 180g of water.

Answer: The mole fraction of NaOH is  $\frac{1}{11}$ .

Question: What are the main features of the Kingdom Protista?

Answer: The Kingdom Protista includes eukaryotic organisms that can be unicellular or multicellular without specialized tissues and live in water-associated environments.

Question: What is the role of the stationary phase in paper chromatography?

Answer: The stationary phase (paper) provides a medium for the components to interact with and separate based on their affinities.

Question: How do copper and sulfate ions combine to form copper sulfate?

Answer: Copper ions ( $\text{Cu}^{2+}$ ) and sulfate ions ( $\text{SO}_4^{2-}$ ) combine through electrostatic attraction to form copper sulfate ( $\text{CuSO}_4$ ) with ionic bonds.

Question: What is the function of microtubules in cells?

Answer: Microtubules are part of the cytoskeleton, providing structural support, facilitating intracellular transport, and playing a role in cell division and movement.

Question: How does the strength of the magnetic field affect the performance of a dynamo?

Answer: A stronger magnetic field increases the induced electromotive force, improving the dynamo's performance and electricity generation.

Question: Items required: A piece of a PVC tube, a piece of polythene, a neon bulb, conducting wires, a stand 1. Arrange the set-up by connecting the conducting wires to the neon bulb as shown in Figure 19.4. Connect one terminal of the neon bulb to the earth 2. Charge the PVC rod by rubbing with polythene. 3. Touch the terminal of the neon bulb with the charged rod. 4. Repeat the above steps several times and observe the lighting of the neon bulb What materials are required for this Activity ?

Answer: A piece of PVC tube, a piece of polythene, a neon bulb, conducting wires, and a stand are required for Activity 19.1.

Question: What is the role of a catalyst in biological systems?

Answer: In biological systems, catalysts (often enzymes) accelerate biochemical reactions, ensuring efficient metabolic processes.

Question: What is the role of the extracellular matrix in multicellular organisms?

Answer: The extracellular matrix provides structural support, facilitates cell adhesion, and regulates intercellular communication, playing a crucial role in tissue organization and function.

Question: What is the significance of the blast furnace in iron extraction?

Answer: The blast furnace facilitates the reduction of iron ore to produce liquid iron through a series of high-temperature reactions.

Question: How are glucose and other monosaccharides absorbed in the small intestine?

Answer: Glucose, galactose, and fructose are absorbed into the blood capillaries of the villi and transported to the liver and other body parts.

Question: What is the significance of the 1:2:1 ratio in Mendel's monohybrid crosses?

Answer: The 1:2:1 ratio in Mendel's monohybrid crosses represents the distribution of genotypes (homozygous dominant, heterozygous, and homozygous recessive) in the F<sub>2</sub> generation, supporting the principles of inheritance.

Question: What is the role of a reference electrode in electrochemical measurements?

Answer: A reference electrode provides a stable and known potential against which the potential of the working electrode can be measured. It is essential for accurate and reproducible electrochemical measurements.

Question: How does tightening a screw affect the moment of force required to rotate a stick?

Answer: Tightening the screw increases the moment of force required to rotate the stick, confirming that the moment depends on the magnitude of the force.

Question: How do animals obtain carbon in the ecosystem?

Answer: Animals obtain carbon by consuming green plants or other organisms.

Question: How do scientists study the genetic basis of inherited traits?

Answer: Scientists study the genetic basis of inherited traits through experiments, genetic crosses, and analysis of DNA sequences to understand how traits are passed down from one generation to the next.

Question: How do you measure the heat change in the reaction between sodium hydroxide and hydrochloric acid?

Answer: Mix the solutions in a polystyrene cup, stir with a glass rod, and record the maximum temperature, then calculate the heat change using the formula  $Q = mc\theta$ .

Question: When did life originate on Earth according to the document?

Answer: Life originated on Earth about 3.6 billion years ago.

Question: What are the potential health risks of high uric acid levels (hyperuricemia) for kidney function?

Answer: Hyperuricemia can lead to the formation of uric acid crystals in the kidneys, causing kidney stones and potential kidney damage.

Question: How does the electrolyte composition affect the performance of an electrochemical cell?

Answer: The electrolyte composition affects the ion conductivity, reaction kinetics, and overall efficiency of an electrochemical cell. Optimal electrolyte composition ensures efficient ion transport, stable electrode reactions, and improved cell performance.

Question: Explain the components and functions of a domestic electric circuit, including safety devices used to protect residents and electrical equipment.

Answer: A domestic electric circuit comprises several components designed to distribute electrical energy safely and efficiently within a household. Key components include: Service Cable: Delivers electricity from the national grid to the household. Consists of live and neutral wires. Overload Circuit Breaker (Service Fuse): Connected to the live wire to prevent excessive current flow. Automatically disconnects the circuit when current exceeds 40 A. Electricity Meter: Measures the amount of electricity consumed in kilowatt-hours (kWh). Essential for billing purposes. Isolator (Main Switch with Main Fuse): Disconnects the household circuit from the main supply. Capable of handling 30 A current and can disconnect both live and neutral wires. Residual Current Circuit Breaker (RCCB): Protects against electric shocks by detecting leakage currents. Disconnects the circuit if leakage current exceeds 35 mA. Distribution Box: Distributes electricity to various circuits within the household. Contains Miniature Circuit Breakers (MCBs) that provide overcurrent protection for individual circuits. Safety Devices: RCCB (Trip Switch): Protects residents from electric shocks by disconnecting the circuit during leakage currents. Provides additional safety by disconnecting the circuit during short circuits. Fuses and MCBs: Prevent excessive current flow that could cause overheating and fires. Automatically disconnect the circuit when the current exceeds the safe

limit. Protective Measures: Regularly check the functioning of RCCBs and MCBs. Use appropriate fuses for different circuits (6 A for lighting, 13 A for plug circuits). Avoid overloading plug sockets with multiple high-current devices. Use three-pin plugs for appliances with metal casings to ensure proper earthing.

Question: How do geneticists study the inheritance of complex traits?  
Answer: Geneticists study the inheritance of complex traits by analyzing the contributions of multiple genes and environmental factors, using statistical methods and large population studies to identify genetic and non-genetic influences.

Question: What is the purpose of tissue culture in plant propagation?  
Answer: Tissue culture produces a large number of genetically identical plants quickly and efficiently, using vegetative tissues in a controlled culture medium.

Question: How do plants perform photosynthesis?  
Answer: Plants perform photosynthesis by using light energy to convert carbon dioxide and water into glucose and oxygen, with chlorophyll acting as the primary pigment in this process.

Question: How do mitochondria regulate cellular metabolism?  
Answer: Mitochondria regulate cellular metabolism by producing ATP through aerobic respiration, controlling energy production, and modulating metabolic pathways.

Question: What is the primary voltage in a transformer with 1000 primary turns and 100 secondary turns if the input voltage is 230V?  
Answer: The secondary voltage is  $V_s = V_p * (N_s/N_p) = 230V * (100/1000) = 23V$ .

Question: What is the importance of the magnetic poles in a DC motor?  
Answer: The magnetic poles create the necessary magnetic field to interact with the current-carrying coil, generating rotational motion.

Question: What are some uses of silicon?  
Answer: Silicon is used in making transistors, diodes, solar cells, and computer equipment.

Question: How do different musical instruments create unique sound qualities?  
Answer: Unique sound qualities are created by the specific construction and vibration patterns of each instrument, resulting in distinctive waveforms.

Question: Where are protons and neutrons located in an atom?  
Answer: Protons and neutrons are located in the nucleus at the center of an atom.

Question: What is the significance of cyclic voltammetry in electrochemical analysis?

Answer: Cyclic voltammetry is a technique used in electrochemical analysis to study redox reactions, reaction kinetics, and electroactive species. It provides information on the oxidation and reduction potentials, current responses, and reaction mechanisms.

Question: What is the significance of the cell wall in plants?

Answer: The cell wall provides structural support, protection, and rigidity to plant cells, helping them maintain shape and withstand external pressures.

Question: How are images in plane mirrors laterally inverted?

Answer: Images in plane mirrors are laterally inverted, meaning the left and right sides are reversed.

Question: What are some common physical properties of non-metals?

Answer: Non-metals are generally dull, brittle, poor conductors of heat and electricity, and have lower density compared to metals.

Question: How do you determine the number of moles in a given mass of a compound?

Answer: The number of moles in a given mass of a compound is determined by dividing the mass by the molar mass of the compound,  $n = m/M$ .

Question: Explain the concept of "pure breeding" in Mendel's experiments.

Answer: Pure breeding refers to plants that consistently produce offspring with the same traits over many generations, indicating they are homozygous for those traits.

Question: What is the significance of the overall electrolytic reaction for sodium chloride?

Answer: The overall electrolytic reaction for sodium chloride highlights the production of hydrogen and chlorine gases and the remaining sodium hydroxide in the solution.

Question: What role did Mendel's work play in the development of the field of genetics?

Answer: Mendel's work established the foundational principles of inheritance, leading to the development of the field of genetics and the study of hereditary traits.

Question: What is the potential difference across a  $15\ \Omega$  resistor with a current of  $2\text{ A}$  flowing through it?

Answer: Using Ohm's Law,  $V = IR$ , the potential difference is  $V = 2\text{ A} \times 15\ \Omega = 30\text{ V}$ .

Question: What charge does a neutron have?

Answer: A neutron has no charge.

Question: What are hydrocarbons?

Answer: Hydrocarbons are compounds formed by the combination of carbon and hydrogen in different ratios.

Question: What is a biogeochemical cycle?



Answer: A biogeochemical cycle is the cyclic circulation of essential chemical components through the atmosphere, hydrosphere, and lithosphere of the biosphere.

Question: How does the reduction of  $H^+$  ions at the cathode during the electrolysis of acidulated water occur?

Answer:  $H^+$  ions are reduced at the cathode by gaining electrons to form hydrogen gas:  $2H^+ (aq) + 2e^- \rightarrow H_2 (g)$ .

Question: What is the importance of the number of turns in a coil for electromagnetic devices?

Answer: More turns in a coil increase the induced electromotive force, enhancing the performance of electromagnetic devices like generators and transformers.

Question: What was the original use of solar panels?

Answer: Originally, solar panels were developed for use in satellites.

Question: How does electronegativity change down a group?

Answer: Electronegativity decreases down a group.

Question: How does the Golgi apparatus sort and package proteins?

Answer: The Golgi apparatus sorts proteins based on their destinations, modifies them, and packages them into vesicles for transport to specific locations within or outside the cell.

Question: How do sound waves propagate through different media?

Answer: Sound waves propagate by causing particles in the medium to vibrate, transferring energy through air, liquids, or solids.

Question: How does surface area affect the rate of reaction in heterogeneous systems?

Answer: In heterogeneous systems, a larger surface area of reactants increases the interaction sites, thus accelerating the rate of reaction.

Question: How does the latent heat of vaporization affect the cooling effect of sweating?

Answer: The latent heat of vaporization allows sweat to absorb a large amount of heat from the body as it evaporates, providing a cooling effect and helping to regulate body temperature.

Question: What is the work done in lifting a 5 kg object upwards by 3 m?

Answer: The work done is 150 Joules (J).

Question: What is the significance of the perpendicular distance in the moment of a couple of forces?

Answer: The perpendicular distance in the moment of a couple of forces determines the magnitude of the moment. A greater distance results in a larger moment for the same force, enhancing the rotational effect.

Question: How do bacteria acquire genetic diversity?

Answer: Bacteria acquire genetic diversity through mechanisms such as mutation, horizontal gene transfer (conjugation, transformation, and

transduction), and recombination.

Question: How does a convex mirror affect the path of parallel light rays?

Answer: Parallel light rays diverge after reflecting from a convex mirror, appearing to come from the focal point behind the mirror.

Question: What is Archimedes' principle and its significance?

Answer: Archimedes' principle states that when an object is partially or completely submerged in a fluid, the upthrust acting on it is equal to the weight of the fluid displaced by the object. It explains why objects float or sink.

Question: What is cellular respiration, and why is it considered an exothermic reaction?

Answer: Cellular respiration is the process of breaking down glucose to produce energy, releasing heat in the process.

Question: What is the significance of Hertz (Hz) in measuring frequency?

Answer: Hertz (Hz) is the unit of frequency, representing the number of cycles or oscillations per second.

Question: How is the valency of an element determined?

Answer: The valency of an element is determined by the number of electrons lost, gained, or shared during chemical combination.

Question: How is a chemical equation balanced using the inspection method?

Answer: The inspection method balances chemical equations by adjusting the coefficients of reactants and products to ensure the same number of each type of atom on both sides of the equation.

Question: What is a bulbil?

Answer: A bulbil is a special reproductive structure formed by the modification of a vegetative bud or a flower bud. Examples include pineapple, jute, and hondala.

Question: What is the chemical formula for potassium fluoride?

Answer: The chemical formula for potassium fluoride is  $\text{KF}$ .

Question: What is the role of the principal axis in determining the reflection of light rays?

Answer: The principal axis serves as the reference line for measuring angles of incidence and reflection, helping to determine the path of reflected rays.

Question: How does friction affect motion?

Answer: Friction is a resistive force that opposes the motion of an object. If the applied force is small, it balances with the resistive force, preventing motion. When the applied force is sufficiently large, it overcomes friction, allowing the object to move.

Question: Are lipids soluble in water?

Answer: No, lipids are insoluble in polar solvents like water but soluble in organic solvents.

Question: How many elements have been discovered so far?

Answer: More than 115 elements have been discovered so far.

Question: Materials required ; - Two small beakers about 100 cm<sup>3</sup> , A thermometer, a glass rod, solid sodium hydroxide (NaOH), solid ammonium chloride (NH<sub>4</sub>Cl) Method; - Add about half full of water to a beaker, measure its temperature and note it down. Add a little amount of solid sodium hydroxide to the same beaker, stir with the glass rod and again measure and record the temperature. State your observations. Fill half of a beaker with water and record its temperature. Add a little amount of solid ammonium chloride to this beaker. Stir with the glass rod and record the temperature again. State your observations. What is the general observation about temperature changes in chemical reactions based on Activity ?

Answer: Temperature changes can be considered as a measure of the amount of heat either evolved or absorbed during a chemical reaction.

Question: What are the two main types of electricity?

Answer: The two main types of electricity are static electricity and current electricity.

Question: What is the function of mucus in the digestive tract?

Answer: Mucus lubricates food, eases its passage, and protects the inner lining of the digestive tract from digestive enzymes.

Question: What is the chemical formula for calcium chloride?

Answer: The chemical formula for calcium chloride is CaCl<sub>2</sub>.

Question: How can living organisms be distinguished from non-living things?

Answer: Living organisms can be distinguished from non-living things by their ability to grow, reproduce, respond to stimuli, and carry out metabolic processes.

Question: Describe the energy transformation in a pendulum.

Answer: In a pendulum, potential energy at the highest points converts to kinetic energy at the lowest point and back to potential energy as it swings up.

Question: How does a commutator improve the efficiency of a DC motor?

Answer: The commutator alternates the current direction in the coil, preventing reverse motion and ensuring continuous, efficient rotation.

Question: What are simple permanent tissues, and what are the three types identified in plants?

Answer: Simple permanent tissues are composed of similar cells. The three types identified in plants are parenchyma, collenchyma, and sclerenchyma.

Question: Explain the operation of a boost converter in power supply systems.

Answer: A boost converter steps up a lower DC voltage to a higher DC voltage, enabling devices to operate from lower voltage sources with increased efficiency.

Question: What does a negative acceleration indicate?

Answer: A negative acceleration indicates a decrease in velocity, also known as deceleration.

Question: What is population density?

Answer: Population density is the number of organisms of a species living in a unit area of a selected habitat.

Question: What are the main parts of a flower involved in sexual reproduction?

Answer: The main parts of a flower involved in sexual reproduction are the calyx, corolla, androecium, and gynoecium.

Question: How does a magnetic sensor detect the presence of a magnetic field?

Answer: A magnetic sensor detects the presence of a magnetic field by producing a voltage or current change proportional to the field strength, used in applications like position sensing and proximity detection.

Question: How do lenses aid in the function of optical instruments like binoculars?

Answer: Lenses in binoculars magnify distant objects by converging light rays to create clear, enlarged images.

Question: How does smoking affect the respiratory system?

Answer: Smoking can cause lung cancer, bronchitis, and other respiratory diseases, potentially leading to severe health consequences or death.

Question: What is the principle behind the magnifying glass?

Answer: A magnifying glass uses a convex lens to enlarge the appearance of small objects by converging light rays to a focal point.

Question: What is the role of a printed circuit board (PCB) in electronic devices?

Answer: A printed circuit board (PCB) provides a platform for mounting electronic components and interconnecting them with conductive tracks, ensuring reliable and compact circuit assembly.

Question: What is the impact of solubility on the formation of solutions?

Answer: Solubility determines whether a solute will dissolve in a solvent, affecting the formation, stability, and properties of solutions.

Question: How many molecules are there in 0.2 moles of water (H<sub>2</sub>O)?

Answer: There are  $1.204 \times 10^{23}$  molecules in 0.2 moles of water, calculated as  $0.2 \times 6.022 \times 10^{23}$ .

Question: What are the applications of electroplating?

Answer: Electroplating is used to coat objects with a thin layer of metal to improve appearance, prevent corrosion, reduce friction, and enhance

electrical conductivity.

Question: How do intermolecular forces influence the properties of substances like water and ethanol?

Answer: Intermolecular forces influence properties like boiling point, surface tension, and solubility in substances like water and ethanol by determining the strength of attraction between molecules.

Question: What is the significance of the diversity observed in cats and parrots?

Answer: The diversity observed in cats and parrots illustrates the variation within a species, highlighting differences in features like fur color and pattern in cats, and feather colors in parrots.

Question: How does an AC current circuit with a dynamo and center-zero galvanometer behave?

Answer: In an AC current circuit, the galvanometer oscillates in positive and negative directions, indicating that the current direction varies with time. When plotted against time, the current forms a sinusoidal curve.

Question: How does urbanization impact air quality?

Answer: Urbanization increases emissions from vehicles, industrial activities, and construction, leading to higher levels of air pollutants such as particulate matter, nitrogen oxides, and volatile organic compounds, which degrade air quality.

Question: How is the chemical formula of sodium oxide written?

Answer: The chemical formula of sodium oxide is  $\text{Na}_2\text{O}$ , indicating two sodium ions and one oxide ion.

Question: How do geneticists use genome-wide association studies (GWAS)?

Answer: GWAS identify genetic variants associated with specific traits or diseases by scanning the genomes of large populations, helping to uncover the genetic basis of complex traits and identify potential therapeutic targets.

Question: What is the speed of light in water?

Answer: 225,000 km/s.

Question: How do you apply a couple of forces to unscrew a nail using a screw driver?

Answer: Apply a couple of forces by rotating the screw driver handle with both hands in opposite directions, creating a moment that unscrews the nail.

Question: What is the kinetic energy of a 3 kg object moving at 5 m/s?

Answer: The kinetic energy is 37.5 Joules (J).

Question: How does the absence of large central vacuoles affect meristematic cells?

Answer: The absence of large central vacuoles in meristematic cells allows for a higher density of organelles like mitochondria, supporting active cell

division and growth.

Question: How do inherited traits vary within a species?

Answer: Inherited traits vary within a species due to the combination of different alleles, leading to a wide range of phenotypic variations among individuals.

Question: How is the acceleration of a body calculated if its velocity varies uniformly from 10 m/s to 25 m/s in 5 seconds?

Answer: Acceleration = (Final velocity - Initial velocity) / Time = (25 m/s - 10 m/s) / 5 s = 3 m/s<sup>2</sup>.

Question: What is the purpose of the galvanometer in demonstrating electromagnetic induction?

Answer: The galvanometer measures the induced current, indicating the presence and magnitude of electromagnetic induction in a circuit.

Question: What is the significance of sterilized conditions in tissue culture?

Answer: Sterilized conditions prevent contamination and ensure the successful growth of plant tissues in the culture medium.

Question: How does a digital-to-analog converter (DAC) interface with audio systems?

Answer: A DAC converts digital audio signals into corresponding analog voltages, enabling digital audio sources to be played through analog speakers and audio systems.

Question: Explain the concept of electron-hole recombination in semiconductors.

Answer: Electron-hole recombination occurs when a free electron recombines with a hole, neutralizing both charge carriers and releasing energy, often in the form of heat or light.

Question: What is the significance of the 1:2:1 ratio in Mendel's monohybrid crosses?

Answer: The 1:2:1 ratio in Mendel's monohybrid crosses represents the distribution of genotypes (homozygous dominant, heterozygous, and homozygous recessive) in the F<sub>2</sub> generation, supporting the principles of inheritance.

Question: How can typhoid fever be prevented?

Answer: Typhoid fever can be prevented by consuming boiled water, avoiding contaminated food, maintaining hygiene, and getting vaccinated.

Question: How does the tension of a string affect the sound produced by string instruments?

Answer: Increased tension in the string results in higher frequency vibrations, producing higher-pitched sounds.

Question: How do parenchyma tissues contribute to the storage of starch?

Answer: Parenchyma tissues store starch, a form of carbohydrate, in their large central vacuoles, providing an energy reserve for the plant.

Question: How does the latent heat of vaporization affect the cooling effect of sweating?

Answer: The latent heat of vaporization allows sweat to absorb a large amount of heat from the body as it evaporates, providing a cooling effect and helping to regulate body temperature.

Question: How does the structure of collenchyma cells differ from that of parenchyma cells?

Answer: Collenchyma cells have thickened corners and may lack intercellular spaces, whereas parenchyma cells have thin walls, large central vacuoles, and intercellular spaces.

Question: What is irritability in living organisms?

Answer: Irritability is the ability of living organisms to respond to changes in their external or internal environment.

Question: What are metals?

Answer: Metals are elements that generally have a shiny surface, are good conductors of heat and electricity, are malleable, ductile, and typically have a high density.

Question: What test can be conducted to identify starch?

Answer: A starch test involves grinding a small amount of food with water and adding a drop of iodine solution to observe a purplish blue color.

Question: How is the direction of the magnetic field around a current-carrying conductor determined?

Answer: The corkscrew rule determines the direction of the magnetic field: if a corkscrew is rotated in the direction of current flow, the direction of rotation gives the direction of the magnetic field lines.

Question: Describe the operation of a relay in an electrical circuit.

Answer: A relay is an electrically operated switch that uses a small control current to open or close a larger load circuit, providing isolation and control in various applications.

Question: What is the atomic number of aluminium?

Answer: The atomic number of aluminium is 13.

Question: What is the role of slag in the blast furnace?

Answer: Slag, formed from impurities reacting with calcium oxide, floats on molten iron, allowing it to be removed separately, and protects the iron from re-oxidation.

Question: Describe the function of the endoplasmic reticulum in lipid synthesis.

Answer: The smooth endoplasmic reticulum synthesizes lipids, including phospholipids and steroids, and transports them within the cell, contributing to membrane formation and maintenance.

Question: What is the significance of gene-environment interactions in health and disease?

Answer: Gene-environment interactions highlight how genetic factors and environmental influences work together to affect health and disease, demonstrating that both genetics and the environment play crucial roles in the development of traits and conditions.

Question: Explain the significance of impedance matching in RF circuits.

Answer: Impedance matching ensures maximum power transfer and minimizes signal reflection in RF circuits by matching the impedance of the source and load, optimizing performance.

Question: How can an n-type extrinsic semiconductor be formed?

Answer: An n-type extrinsic semiconductor can be formed by doping an intrinsic semiconductor with a group V element.

Question: What is the focal point of a convex mirror?

Answer: The focal point of a convex mirror is the point from which reflected rays appear to diverge.

Question: How does the reaction of zinc with hydrochloric acid demonstrate a single displacement reaction?

Answer: Zinc displaces hydrogen from hydrochloric acid, forming zinc chloride and hydrogen gas:  $\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$ .

Question: What are the effects of excessive agrochemical usage?

Answer: Excessive agrochemical usage can cause ill effects on the environment and pose health hazards to humans and wildlife.

Question: What is the process of digestion?

Answer: Digestion converts complex organic compounds into simple organic products that can be absorbed by the body.

Question: How are standard electrode potentials used to predict the direction of redox reactions?

Answer: Standard electrode potentials are used to predict the direction of redox reactions by comparing the potentials of the reactants and products. A positive cell potential indicates a spontaneous reaction, while a negative cell potential indicates a non-spontaneous reaction.

Question: How is the purity of crystals ensured during recrystallization?

Answer: By dissolving the impure solid in a hot solvent and filtering out impurities before cooling the solution to form pure crystals.

Question: How does the tension of a string affect the pitch of sound in string instruments?

Answer: Increased tension in the string results in higher frequency vibrations, producing higher-pitched sounds.

Question: What are some examples of Chondrichthyes?

Answer: Examples of Chondrichthyes include Shark and Skate.

Question: How do images formed by convex lenses change with varying object distances?



Answer: As object distance increases, the image becomes smaller and remains real and inverted.

Question: What is the resistance of a bulb connected to a 9 V power supply with a current of 1.5 A?

Answer: Using Ohm's Law,  $R = V/I$ , the resistance is  $R = 9 \text{ V} / 1.5 \text{ A} = 6 \Omega$ .

Question: How do percussion instruments generate sound through vibrations?

Answer: Percussion instruments generate sound when their membranes, rods, or metal plates are struck, causing them to vibrate and produce sound waves.

Question: How do parenchyma tissues contribute to food storage in plants?

Answer: Parenchyma tissues store food in various plant parts such as tubers (potato), roots (carrot, sweet potato), and fruits (papaya, banana).

Question: What method is used to investigate the effect of salt on rusting?

Answer: Place two cleaned iron nails in separate boiling tubes, add water mixed with sodium chloride to one tube and ordinary cold water to the other. Observe after one day.

Question: What is the effect of the radius of curvature on the image formation in spherical mirrors?

Answer: The radius of curvature determines the focal length and the degree to which the mirror can converge or diverge light rays, affecting image size and position.

Question: What are the two groups of non-flowering plants based on seed production?

Answer: Non-flowering plants are divided into non-flowering seedless plants and non-flowering seed plants.

Question: How does climate change affect agricultural productivity?

Answer: Climate change alters precipitation patterns, increases the frequency of extreme weather events, and affects crop growth and yields. It poses challenges to food security and sustainable agriculture.

Question: What is the significance of the 1:2:1 ratio in Mendel's monohybrid crosses?

Answer: The 1:2:1 ratio in Mendel's monohybrid crosses represents the distribution of genotypes (homozygous dominant, heterozygous, and homozygous recessive) in the F<sub>2</sub> generation, supporting the principles of inheritance.

Question: What happens to a light ray that enters a convex lens along the principal axis?

Answer: The light ray will leave the lens without bending.

Question: How does the electrolysis of sodium chloride solution demonstrate the production of sodium hydroxide?

Answer: The electrolysis of sodium chloride solution produces hydrogen and chlorine gases, leaving behind Na<sup>+</sup> and OH<sup>-</sup> ions in the solution, which

combine to form sodium hydroxide (NaOH).

Question: What is the role of the overload circuit breaker in a domestic electric circuit?

Answer: The overload circuit breaker disconnects the power supply to the house if the current exceeds a set limit, preventing potential fire hazards from overheated cables.

Question: What are the main functions of the large intestine?

Answer: The large intestine absorbs water from indigestible food matter, forms feces, and eliminates waste from the body.

Question: How does the body respond to inflammation?

Answer: The body responds to inflammation by increasing blood flow, recruiting immune cells to the affected area, and releasing inflammatory mediators to promote healing

Question: Calculate the relative molecular mass of carbon dioxide (CO<sub>2</sub>).

Answer: The relative molecular mass of carbon dioxide is 44, calculated as 12 for carbon plus 2 x 16 for oxygen.

Question: How do chloroplasts and mitochondria interact in plant cells?

Answer: Chloroplasts produce glucose and oxygen through photosynthesis, which mitochondria use in cellular respiration to produce ATP, creating an interdependent energy cycle in plant cells.

Question: How do environmental stimuli affect living organisms?

Answer: Environmental stimuli trigger responses in living organisms, such as movement, growth, or behavioral changes, enabling them to adapt and survive in their environment.

Question: What is the role of a thermistor in temperature control circuits?

Answer: A thermistor is a temperature-sensitive resistor whose resistance changes significantly with temperature, used in temperature control and sensing applications.

Question: How is the molar mass of sulfuric acid (H<sub>2</sub>SO<sub>4</sub>) calculated?

Answer: The molar mass of sulfuric acid is calculated by summing the molar masses of its constituent atoms: 2 x 1 for hydrogen, 32 for sulfur, and 4 x 16 for oxygen, resulting in 98 grams per mole.

Question: What is the resultant force when two forces of 8 N and 6 N act in opposite directions?

Answer: The resultant force is 2 N in the direction of the larger force (8 N).

Question: What is ionisation energy?

Answer: Ionisation energy is the energy required to remove an electron from an atom in the gaseous state to form a positive ion.

Question: What is the function of the corpus luteum?

Answer: The corpus luteum forms from the remains of the graafian follicle after ovulation and secretes progesterone to maintain the uterine lining for potential pregnancy.

Question: What is the electronic configuration of an element with atomic number 5?

Answer: The electronic configuration is 2, 3 for an element with atomic number 5 (Boron).

Question: What are gymnosperms and their characteristics?

Answer: Gymnosperms are non-flowering seed plants with seeds that are not covered by a fruit, possess true tissue differentiation, and reproduce sexually by seeds.

Question: How do plant cells utilize the central vacuole for storage?

Answer: The central vacuole stores water, nutrients, waste products, and pigments, maintaining turgor pressure, and contributing to cell growth and structural integrity.

Question: How do spherical mirrors differ from plane mirrors in image formation?

Answer: Spherical mirrors can form both real and virtual images depending on the object's position, while plane mirrors always form virtual images.

Question: Who is considered the father of genetics, and what did he study?

Answer: Gregor Mendel, an Austrian priest and science graduate, is considered the father of genetics. He studied the transmission of inherited characteristics.

Question: How does natural vegetative propagation occur in plants?

Answer: Natural vegetative propagation occurs through roots, leaves, suckers, runners, bulbils, and underground stems.

Question: What is a variable resistor, and where is it used?

Answer: A variable resistor, also known as a potentiometer or rheostat, allows the resistance value to be adjusted. It is used in applications such as volume control in radios and adjusting electronic circuits.

Question: What happens when a zinc metal strip is placed in dilute sulfuric acid?

Answer: When a zinc metal strip is placed in dilute sulfuric acid, gas bubbles are liberated near the zinc strip, and the strip gradually dissolves as zinc atoms (Zn) go into solution as zinc ions ( $\text{Zn}^{2+}$ ), leaving electrons on the metal.

Question: What is the significance of carbohydrates in nucleic acids?

Answer: Carbohydrates are a constituent of nucleic acids.

Question: What role does light energy play in photosynthesis?

Answer: Light energy is absorbed by chlorophyll in the chloroplasts of green plants, driving the synthesis of glucose from carbon dioxide and water.

Question: What is the significance of ionisation energy in chemical reactions?

Answer: Ionisation energy indicates the energy required to remove an electron from an atom, affecting the atom's ability to participate in chemical reactions.

Question: What changes occur in the fetus during the ninth month of development?

Answer: During the ninth month, the nails of the fingers are fully grown, testes descend into the scrotum, and the body shows a full-grown nature, weighing about 2-3 kg.

Question: What is the significance of Mendel's work in the field of genetics?

Answer: Mendel's work established the foundational principles of inheritance, leading to the development of the field of genetics and our understanding of how traits are passed down through generations.

Question: How are carbohydrates produced?

Answer: Carbohydrates are produced during the photosynthesis of green plants.

Question: Why is RNA important in some viruses?

Answer: RNA stores genetic information in some viruses.

Question: What is the effect of temperature on the pH of a solution?

Answer: Temperature can affect the ionization of acids and bases, potentially altering the pH of a solution.

Question: How do plants respond to environmental stress?

Answer: Plants respond to environmental stress through various mechanisms, such as closing stomata to reduce water loss, producing stress-related hormones, and altering growth patterns.

Question: What are the two types of layering in vegetative propagation?

Answer: The two types of layering are ground layering and aerial layering.

Question: What is the relative molecular mass of glucose ( $C_6H_{12}O_6$ )?

Answer: The relative molecular mass of glucose is 180, calculated as  $6 \times 12$  for carbon,  $12 \times 1$  for hydrogen, and  $6 \times 16$  for oxygen.

Question: How is potential energy used to generate electricity in high reservoirs?

Answer: Water stored in high reservoirs is allowed to fall, transforming potential energy into kinetic energy, which is used to rotate a turbine to generate electricity.

Question: What is the relationship between relative atomic mass and molar mass?

Answer: The relative atomic mass is a dimensionless quantity, while the molar mass is the mass of one mole of the element, expressed in grams per mole. They are numerically equal but have different units.

Question: What are the features of invertebrates in the phylum Echinodermata?

Answer: Invertebrates in the phylum Echinodermata are marine, triploblastic, coelomic organisms with bodies separated into 5 radial arms, a sharp spiny body covering, a water vascular system, tube feet for locomotion and respiration, and penta-radial symmetry.

Question: What is the significance of genetic drift in small populations?

Answer: Genetic drift is a random process that can lead to significant changes in allele frequencies in small populations, potentially reducing genetic diversity and increasing the risk of inbreeding and genetic disorders.

Question: What is the power dissipated by a resistor with a resistance of  $8\ \Omega$  and a voltage drop of  $16\text{ V}$  across it?

Answer: Using  $P=V^2/R$ , the power dissipated is  $P=(16\text{ V})^2/8\ \Omega=32\text{ W}$ .

Question: What is the role of the nuclear envelope in regulating gene expression?

Answer: The nuclear envelope controls the exchange of materials between the nucleus and cytoplasm, regulating the accessibility of transcription factors and RNA molecules, thus influencing gene expression.

Question: How does the specific heat capacity of water influence its use in climate control systems?

Answer: Water's high specific heat capacity allows it to absorb and release large amounts of heat with minimal temperature change, making it effective for climate control systems in buildings and industrial processes.

Question: What are bio molecules?

Answer: Bio molecules are organic compounds that build up living matter, including carbohydrates, proteins, lipids, and nucleic acids.

Question: How do catalysts affect the activation energy of a reaction?

Answer: Catalysts lower the activation energy, making it easier for reactants to collide and form products, thus increasing the reaction rate.

Question: What is the effect of amplitude on the perception of sound?

Answer: Higher amplitude sound waves are perceived as louder, while lower amplitude waves are perceived as softer.

Question: Describe the structure and function of mitochondria.

Answer: Mitochondria are oval or rod-shaped organelles with a double membrane. They perform aerobic respiration to produce ATP, the energy currency of the cell, and are known as the powerhouses of the cell.

Question: What are the key characteristics of non-flowering seedless plants?

Answer: Non-flowering seedless plants can have a thalloid body or small fern type, are autotrophic and photosynthetic, and reproduce asexually by spores and vegetative fragmentation.

Question: What are the signs and symptoms of renal artery stenosis?

Answer: Symptoms of renal artery stenosis include high blood pressure, reduced kidney function, and abdominal pain.

Question: How do you apply a couple of forces to rotate a rod without causing linear motion?

Answer: Apply a couple of forces by exerting equal and opposite forces along the same plane at different points on the rod, resulting in rotation around a point between the forces without causing linear motion.

Question: What characterizes the exponential phase of population growth?

Answer: The exponential phase represents maximum growth rate as organisms are well-adapted to the environment and the number of reproducing organisms is high.

Question: How does the number of turns in a transformer's coils affect its voltage transformation?

Answer: The voltage transformation is directly proportional to the ratio of the number of turns in the primary coil to the secondary coil.

Question: What are the signs and symptoms of glomerulonephritis?

Answer: Symptoms of glomerulonephritis include blood in urine, proteinuria, swelling, high blood pressure, and reduced urine output.

Question: How does electromagnetic induction enable the operation of a moving coil microphone?

Answer: Electromagnetic induction enables the microphone to convert sound waves into electrical signals by inducing a current in the vibrating coil.

Question: What are metals?

Answer: Metals are elements that have properties such as metallic lustre, being good conductors of heat and electricity, malleability, ductility, and high density.

Question: How does the voltage of a galvanic cell depend on the concentration of reactants and products?

Answer: The voltage of a galvanic cell depends on the concentration of reactants and products as described by the Nernst equation. Changes in concentration affect the reaction quotient ( $Q$ ), altering the cell potential.

Question: What are the environmental impacts of using agrochemicals in agriculture?

Answer: The environmental impacts of using agrochemicals in agriculture include soil and water contamination, harm to non-target species, reduced biodiversity, and potential health risks to humans and wildlife.

Question: How is the energy level diagram for an exothermic reaction represented?

Answer: Reactants at a higher energy level than products, with energy released.

Question: How do you measure the voltage across a resistor in a parallel circuit?

Answer: Use a voltmeter connected in parallel with the resistor to measure the voltage across it.

Question: What is the difference between a dominant trait and a recessive trait?

Answer: A dominant trait is expressed when at least one dominant allele is present, while a recessive trait is expressed only when both alleles are recessive.

Question: How do sound waves propagate through solids?

Answer: Sound waves propagate through solids by causing particles to vibrate and transfer energy through the material.

Question: What is the reaction of potassium permanganate when heated in a boiling tube?

Answer: When potassium permanganate is heated, it decomposes to form potassium manganate, manganese dioxide, and oxygen gas, which can relight a glowing splint:  $2\text{KMnO}_4 \rightarrow \text{K}_2\text{MnO}_4 + \text{MnO}_2 + \text{O}_2$ .

Question: Describe the reaction of magnesium with steam.

Answer: Magnesium reacts with steam to form magnesium oxide and hydrogen gas:  $\text{Mg} + \text{H}_2\text{O} \rightarrow \text{MgO} + \text{H}_2$ .

Question: How do covalent compounds conduct electricity in aqueous solutions?

Answer: Covalent compounds generally do not conduct electricity in aqueous solutions because they do not dissociate into ions; their molecules remain intact, preventing the flow of electric charge.

Question: How does the force on a current-carrying conductor relate to the magnetic field and current?

Answer: The force is directly proportional to the current, the length of the conductor, and the strength of the magnetic field.

Question: How does the depletion region change under reverse bias?

Answer: Under reverse bias, the depletion region of a p-n junction broadens, and no current flows across the junction.

Question: Calculate the number of molecules in 0.2 moles of carbon dioxide ( $\text{CO}_2$ ).

Answer: The number of molecules in 0.2 moles of carbon dioxide is  $1.204 \times 10^{23}$ , calculated as  $0.2 \times 6.022 \times 10^{23}$ .

Question: What are the advantages of using mercury in thermometers?

Answer: Mercury is used in thermometers because it has a uniform expansion over a broad range of temperatures, is a good thermal conductor, and is a liquid over a broad range of temperatures ( $-39^\circ\text{C}$  to  $357^\circ\text{C}$ ).

Question: What is the role of genes in determining an organism's traits?

Answer: Genes are specific segments of DNA that code for particular traits, determining the physical and physiological characteristics of an organism.

Question: What is the relationship between mass and weight on different celestial bodies?

Answer: Mass remains constant, but weight varies depending on the gravitational acceleration of the celestial body. An object weighs less on the moon than on Earth due to the lower gravitational acceleration on the moon.

Question: How do concave lenses affect light rays coming from a distant object?

Answer: Concave lenses diverge light rays, making them appear to originate from a focal point on the same side as the object.

Question: What is the function of the lens in a human eye?

Answer: The lens in the human eye refracts light to focus images on the retina, enabling clear vision.

Question: What are some common inherited traits observed in plants?

Answer: Common inherited traits in plants include flower color, seed shape, pod shape, and plant height, which can vary among different varieties of the same species.

Question: How does solubility influence the stability of pharmaceutical formulations?

Answer: Solubility influences the stability of pharmaceutical formulations by affecting the dissolution rate, bioavailability, and shelf-life of active ingredients.

Question: What is the significance of glycogen storage in the liver?

Answer: The liver stores glucose as glycogen, which can be converted back to glucose and released into the blood when energy is needed.

Question: What is the process of dialysis, and when is it used?

Answer: Dialysis is a medical procedure that filters blood to remove waste products and excess fluid, used when kidneys are unable to perform these functions adequately.

Question: What is a magnetic field?

Answer: A magnetic field is a region around a magnet where magnetic forces can be observed. It is invisible but can influence other magnets or moving charges.

Question: How does the process of photophosphorylation contribute to ATP production in photosynthesis?

Answer: Photophosphorylation uses light energy to generate a proton gradient across the thylakoid membrane, driving ATP synthesis through ATP synthase.

Question: What is the role of a photodiode in electronics?

Answer: A photodiode converts light into electrical current by generating electron-hole pairs when exposed to light, making it useful in light detection and solar energy applications.

Question: How does an electric train utilize DC motors?

Answer: Electric trains use DC motors to convert electrical energy into mechanical energy, driving the train's wheels and providing efficient



transportation.

Question: What is distance?

Answer: Distance is the total path length traveled from one point to another.

Question: Materials required :- A beaker, clay, water, a piece of cloth

Method : (i) Take about 500 ml of water into a beaker. Add about 10g of clayey soil to it, stir well and allow to stand still for about one minute. Then filter the muddy coloured water into another beaker using a piece of cloth. Allow to stand still for about an hour and see whether the muddy colour is uniformly distributed throughout the solution. See if the clearness of the solution is similar from top to bottom. (ii) Take a piece of a metal sheet with a lustrous surface. As shown in figure 3.1.2, take two identical drops of the solution from two places A and B with a pipette or glass rod, place them on the spots marked as A and B respectively, on the piece of metal and let them vaporize. Check to see which water sample contains more residual matter. See, water obtained from which place contains more residual matter. How are components in a mixture distributed according to Activity ?

Answer: The distribution of components in a mixture can vary, with different amounts of particles present in different parts of the solution, as shown by the non-uniform distribution of clay particles in water.

Question: How is the chemical formula of calcium chloride represented?

Answer: The chemical formula of calcium chloride is  $\text{CaCl}_2$ , indicating one calcium ion and two chloride ions.

Question: What are some common methods of asexual reproduction in plants?

Answer: Common methods of asexual reproduction in plants include vegetative propagation, such as runners, tubers, bulbs, and cuttings.

Question: What are the signs and symptoms of kidney stones?

Answer: Symptoms of kidney stones include severe pain in the back or side, blood in urine, frequent urination, and nausea.

Question: What role does the axle play in an alternating current dynamo?

Answer: The axle rotates the coil within the magnetic field, enabling continuous induction of electromotive force and generation of alternating current.

Question: What is the significance of electron sharing in the formation of covalent bonds?

Answer: Electron sharing allows atoms to achieve a stable electronic configuration, forming covalent bonds that hold the atoms together in molecules.

Question: What are some useful effects of bacteria to humans?

Answer: Useful effects of bacteria include producing curd, yoghurt, and cheese, decomposing dead bodies, and fixing atmospheric nitrogen to increase soil nitrate levels.

Question: What is the importance of solubility in waste treatment processes?

Answer: Solubility is important in waste treatment for separating and removing contaminants, optimizing the efficiency of filtration, precipitation, and chemical treatments.

Question: What is the function of the endoplasmic reticulum in cells?

Answer: The endoplasmic reticulum (ER) is involved in protein and lipid synthesis, with the rough ER studded with ribosomes for protein production and the smooth ER involved in lipid metabolism and detoxification.

Question: How does the electrolyte composition affect the performance of an electrochemical cell?

Answer: The electrolyte composition affects the ion conductivity, reaction kinetics, and overall efficiency of an electrochemical cell. Optimal electrolyte composition ensures efficient ion transport, stable electrode reactions, and improved cell performance.

Question: What is the role of acids and bases in chemical reactions?

Answer: Acids and bases participate in various chemical reactions, including neutralization, precipitation, and redox reactions, affecting reaction outcomes and products.

Question: What is the significance of Mendel's choice of the garden pea plant for his experiments?

Answer: The garden pea plant's ease of cultivation, short generation time, and clear contrasting traits made it an ideal choice for Mendel's genetic experiments, allowing for accurate observations of inheritance patterns.

Question: What is the incident ray in the context of light refraction?

Answer: The incident ray is the ray that strikes the surface of the medium.

Question: How do the kidneys contribute to the regulation of blood pH levels?

Answer: The kidneys regulate blood pH by excreting hydrogen ions and reabsorbing bicarbonate, maintaining acid-base balance.

Question: What are the methods of dispersal of fruits and seeds?

Answer: The four principal methods of dispersal are by animals, water, wind, and explosive mechanisms.

Question: What role do villi and microvilli play in nutrient absorption?

Answer: Villi and microvilli increase the surface area of the intestinal lining, allowing for more efficient absorption of nutrients into the blood capillaries and lacteals.

Question: How does the renal medulla contribute to urine concentration?

Answer: The renal medulla contains the loops of Henle and collecting ducts, creating a concentration gradient that allows for the reabsorption of water and the concentration of urine.

Question: What is the significance of glycogen storage in the liver?

Answer: The liver stores glucose as glycogen, which can be converted back to glucose and released into the blood when energy is needed.

Question: What are the environmental impacts of improper disposal of batteries?

Answer: Improper disposal of batteries can lead to the release of toxic metals and chemicals into the environment, contaminating soil and water, harming wildlife, and posing health risks to humans.

Question: What are the conditions for maintaining equilibrium in a system of forces acting on an object?

Answer: The conditions for maintaining equilibrium are that the forces must be coplanar, their lines of action must intersect at a common point, and the resultant of any two forces must be equal in magnitude and opposite in direction to the third force.

Question: How do inhibitors influence chemical reactions?

Answer: Inhibitors decrease the rate of chemical reactions by interfering with the reactant collisions, making reactions slower.

Question: What happens when the forces acting on an object are not aligned along the same line?

Answer: When the forces acting on an object are not aligned along the same line, the object will experience a net moment, causing it to rotate or move, indicating that it is not in equilibrium.

Question: How does the body remove excess potassium through the kidneys?

Answer: The kidneys filter and excrete excess potassium in urine, maintaining electrolyte balance and preventing hyperkalemia.

Question: What is the focal length of a mirror if the radius of curvature is 20 cm?

Answer: The focal length is 10 cm, as it is half of the radius of curvature.

Question: Describe the physical properties of silicon.

Answer: Silicon is the second most abundant element in the Earth's crust. It exists in both crystalline and amorphous forms, with a melting point of  $1410^{\circ}\text{C}$ . Crystalline forms include quartz, sand, and gems like emerald, while clay is an amorphous silicon compound.

Question: What is the general formula for alkanes, and how is it derived?

Answer: The general formula for alkanes is  $\text{C}_n\text{H}_{2n+2}$ , where 'n' is the number of carbon atoms. It is derived based on the number of hydrogen atoms needed to satisfy the valency of each carbon atom.

Question: What are alkalis?

Answer: Alkalis are bases that readily dissolve in water, forming hydroxyl ions ( $\text{OH}^-$ ).

Question: What is mean speed?

Answer: Mean speed, also known as average speed, is the total distance traveled divided by the total time taken.

Question: How is the chemical formula of potassium hydroxide written?

Answer: The chemical formula of potassium hydroxide is KOH, indicating one potassium ion and one hydroxide ion.

Question: What is the role of the liver in the excretion of waste products?

Answer: The liver detoxifies blood, converts ammonia to urea, and excretes bilirubin and other waste products into bile for elimination through the digestive tract.

Question: What causes appendicitis, and what are its symptoms?

Answer: Appendicitis is caused by infection and swelling of the appendix, leading to symptoms such as abdominal pain, fever, and digestive disturbances.

Question: How does the electronic configuration of chlorine influence its reactivity?

Answer: The electronic configuration of chlorine (2, 8, 7) makes it highly reactive, as it needs to gain one electron to achieve a stable configuration, readily forming bonds with other elements.

Question: What is the purpose of using black polythene in the light energy experiment?

Answer: Black polythene blocks light, preventing photosynthesis in the covered area and demonstrating the necessity of light for the process.

Question: Explain the difference between electromagnets and permanent magnets, and describe their uses.

Answer: Magnets are materials that produce a magnetic field, which attracts ferromagnetic materials such as iron, nickel, and cobalt. There are two main types of magnets: electromagnets and permanent magnets.

**Electromagnets: Structure and Function:** Electromagnets consist of a coil of wire, usually wound around a core of iron or another ferromagnetic material. When an electric current passes through the coil, it generates a magnetic field. The strength of this magnetic field can be adjusted by changing the amount of current flowing through the wire. The magnetism in an electromagnet exists only while the current is flowing; once the current stops, the magnetic field disappears.

**Uses:** Electromagnets are widely used in various applications, such as in cranes for lifting and moving scrap iron and steel, in electric motors and generators, in magnetic locks, in MRI machines for medical imaging, and in numerous other electronic devices.

**Permanent Magnets: Structure and Function:** Permanent magnets are made from materials that are magnetized and maintain a constant magnetic field without the need for an electric current. The magnetism in these materials is a permanent property due to the alignment of their internal magnetic domains.

**Uses:** Permanent magnets are used in a wide range of applications, including in refrigerator magnets, speakers, electric motors, sensors, magnetic storage media like hard drives, and in various toys and tools. Both types of magnets play crucial roles in modern technology and everyday life, offering versatile solutions based on their magnetic properties.

Question: Where are bacteria commonly found?

Answer: Bacteria are widely distributed in air, water, soil, and within the bodies of organisms.

Question: What are some common sexually transmitted diseases?

Answer: Common sexually transmitted diseases include gonorrhea, syphilis, herpes, and AIDS.

Question: What is the role of a light microscope in biological studies?

Answer: A light microscope allows scientists to observe and study the structures and functions of cells and microorganisms that are not visible to the naked eye.

Question: How does the orientation of the coil affect the induced voltage in a dynamo?

Answer: The orientation of the coil affects the induced voltage, with maximum values generated when the coil is perpendicular to the magnetic field lines.

Question: What is the weight of an object of mass 2 kg on Earth?

Answer: The weight of a 2 kg object on Earth is  $2 \times 9.8 = 19.6$  N.

Question: Items required: A piece of a PVC tube, a piece of polythene, a neon bulb, conducting wires, a stand 1. Arrange the set-up by connecting the conducting wires to the neon bulb as shown in Figure 19.4. Connect one terminal of the neon bulb to the earth 2. Charge the PVC rod by rubbing with polythene. 3. Touch the terminal of the neon bulb with the charged rod. 4. Repeat the above steps several times and observe the lighting of the neon bulb How is the neon bulb lit in Activity ?

Answer: The neon bulb is lit by rubbing a PVC rod with polythene, creating electrostatic charges that flow through the bulb when the rod touches the conducting wires.

Question: How do you calculate the acceleration of an object that changes its velocity from 2 m/s to 10 m/s in 4 seconds?

Answer: Acceleration =  $(10 \text{ m/s} - 2 \text{ m/s}) / 4 \text{ s} = 2 \text{ m/s}^2$ .

Question: How is the concentration of a solution expressed in mol/dm<sup>3</sup>?

Answer: By dividing the number of moles of solute by the volume of the solution in cubic decimeters.

Question: What is the significance of the hearing range in humans and animals?

Answer: The hearing range defines the range of frequencies that can be perceived, influencing how different species interact with their environment and communicate.

Question: What is the purpose of the neutral wire in an electric circuit?

Answer: The neutral wire completes the electrical circuit by carrying the current back to the power source, ensuring a continuous flow of electricity.

Question: How do plants protect themselves from excess light and photodamage?

Answer: Plants use mechanisms like non-photochemical quenching and the production of antioxidants to dissipate excess light energy and prevent photodamage.

Question: What is the significance of potassium in the human body?

Answer: Potassium is important for controlling the ionic balance of the fluid in the cell, heart and muscle activity, and transmission of nerve impulses.

Question: What is the resultant force of two forces of 8 N and 16 N acting on a trolley?

Answer: The resultant force is 24 N.

Question: How does Newton's third law apply to the motion of a jet plane?

Answer: In a jet plane, the expulsion of exhaust gases (action) generates a force that propels the plane forward (reaction) due to the equal and opposite force exerted by the gases.

Question: What happens when carbon dioxide reacts with lime water?

Answer: Carbon dioxide reacts with lime water (calcium hydroxide) to form calcium carbonate, which turns the solution milky. Further reaction with carbon dioxide forms soluble calcium bicarbonate, clearing the milkiness.

Question: How does the specific heat capacity of ethanol make it suitable for use in thermometers?

Answer: Ethanol has a high expansion relative to most other liquids and increases uniformly with temperature, making it suitable for use in thermometers.

Question: What happens during the deceleration phase of population growth?

Answer: During the deceleration phase, the growth rate of the population decreases due to competition for resources, food shortage, disease, predation, and parasitism.

Question: What is the significance of Michael Faraday's experiments on electromagnetic induction?

Answer: Faraday's experiments established the principles of electromagnetic induction, leading to the development of electrical generators and transformers.

Question: Define a food web.

Answer: A food web is the mutual relationship for food among organisms, with different trophic levels of many food chains interconnected in a web-like structure.

Question: What steps are involved in preparing a 1 mol/dm<sup>3</sup> sodium chloride solution?

Answer: Weigh the required mass of NaCl, transfer it to a volumetric flask, add water, dissolve, and adjust the volume to the mark.

Question: What is environmental equilibrium?

Answer: Environmental equilibrium is the balanced relationship between organisms and the physical environment.

Question: What is the role of magnesium hydroxide in medicine?

Answer: Magnesium hydroxide is used as an antacid to relieve stomach acidity.

Question: What is the structure and function of the uterus?

Answer: The uterus is a hollow structure positioned in the pelvic area, consisting of the fundus, body, and cervix. It provides a site for embryo implantation and fetal development.

Question: What is the significance of magnetic field strength in a solenoid?

Answer: The field strength determines the solenoid's effectiveness in generating a magnetic force and performing work.

Question: How do animals perform excretion?

Answer: Animals perform excretion by eliminating metabolic waste products such as urea, carbon dioxide, and excess salts through organs like the kidneys, lungs, and skin.

Question: What is the trend in reactivity of Group I elements?

Answer: The reactivity of Group I elements increases down the group.

Question: How does the reaction of zinc with hydrochloric acid demonstrate a single displacement reaction?

Answer: Zinc displaces hydrogen from hydrochloric acid, forming zinc chloride and hydrogen gas:  $\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$ .

Question: What is the significance of the perpendicular distance in determining the moment of a force?

Answer: The perpendicular distance is significant because it determines the magnitude of the moment. A greater distance results in a larger moment for the same force, making it easier to rotate the object.

Question: What is environmental management?

Answer: Environmental management is the maintenance of natural resources by using them in an environmentally friendly manner to fulfill human needs.

Question: What are the potential benefits and risks of genetically modified organisms (GMOs)?

Answer: Potential benefits of GMOs include increased crop yields, improved nutritional content, and resistance to pests and diseases. Potential risks include environmental impacts, the development of resistance in pests, and ethical concerns about altering the genetic makeup of organisms.

Question: How does a lithium-ion battery differ from a nickel-metal hydride battery?

Answer: A lithium-ion battery offers higher energy density, lower self-discharge, and longer cycle life compared to a nickel-metal hydride battery. Lithium-ion batteries are lighter and provide higher voltage, making them suitable for portable electronics and electric vehicles.

Question: How do you plot a graph of voltage (V) against current (I) for a nichrome wire coil?

Answer: Measure multiple sets of voltage and current values, plot voltage on the y-axis and current on the x-axis, and draw a straight line through the points. The slope of the line represents the resistance.

Question: What is the pressure exerted by a mercury column of height 10 cm with a density of  $13600 \text{ kg/m}^3$ ?

Answer: The pressure exerted is calculated using the formula  $P = h\rho g$ . For a height of 10 cm (0.1 m), the pressure is  $P = 0.1 \text{ m} * 13600 \text{ kg/m}^3 * 10 \text{ m/s}^2 = 13,600 \text{ Pa}$ .

Question: What is the valency of phosphorus?

Answer: The valency of phosphorus is 5 and 3.

Question: What is the role of denitrifying bacteria in the nitrogen cycle?

Answer: Denitrifying bacteria convert nitrates back into atmospheric nitrogen, completing the nitrogen cycle.

Question: What is parturition?

Answer: Parturition, or childbirth, is the process of delivering the fetus from the uterus through the vagina, facilitated by the contraction of uterine muscles.

Question: What is an example of a scientific name given in the document?

Answer: An example of a scientific name is *Mangifera indica*.

Question: What are the global importance and functions of photosynthesis?

Answer: Photosynthesis converts light energy into chemical energy, provides food for all organisms, releases oxygen for aerobic respiration, removes  $\text{CO}_2$  from the atmosphere, and maintains the carbon cycle.

Question: What is the role of normal reaction in frictional forces?

Answer: The normal reaction is the perpendicular force exerted by a surface on an object in contact, affecting the limiting frictional force.

Question: What is the role of vacuoles in plant cells?

Answer: Vacuoles store nutrients, waste products, and water, helping to maintain turgor pressure, support cell structure, and regulate intracellular conditions.

Question: How is the chemical formula of silicon dioxide written?

Answer: The chemical formula of silicon dioxide is  $\text{SiO}_2$ , indicating one silicon atom and two oxygen atoms.

Question: What is the significance of the latent heat of vaporization in phase change processes?

Answer: The latent heat of vaporization is significant in phase change processes because it quantifies the energy required to convert a liquid into a gas at its boiling point, providing insight into the energy dynamics of phase transitions.

Question: Name some biogeochemical cycles.



Answer: Some biogeochemical cycles include the carbon cycle, nitrogen cycle, and phosphorus cycle.

Question: What is natural classification?

Answer: Natural classification groups organisms based on their evolutionary relationships, considering morphological, physiological, cytological, and molecular biological features.

Question: How does the structure of covalent compounds affect their melting and boiling points?

Answer: The structure of covalent compounds, with weaker intermolecular forces compared to ionic bonds, results in generally lower melting and boiling points.

Question: How does the use of organic pest control methods benefit agriculture?

Answer: Organic pest control methods reduce chemical input dependency, support biodiversity, and promote sustainable agricultural practices. They minimize environmental impact and health risks.

Question: How do lysosomes contribute to cellular defense?

Answer: Lysosomes digest and destroy pathogens, such as bacteria and viruses, that are engulfed by the cell, protecting the cell from infections.

Question: What is the significance of electron sharing in the formation of heteroatomic molecules?

Answer: Electron sharing allows atoms of different elements to combine and form stable heteroatomic molecules with unique chemical properties and functions.

Question: What is the water cycle?

Answer: The water cycle is the continuous movement of water on, above, and below the surface of the Earth.

Question: What safety measures should be taken when using electric appliances?

Answer: Safety measures include using appropriate fuses, avoiding overloading sockets, using three-pin plugs for high-power appliances, and ensuring proper grounding.

Question: What are the environmental impacts of using agrochemicals in agriculture?

Answer: The environmental impacts of using agrochemicals in agriculture include soil and water contamination, harm to non-target species, reduced biodiversity, and potential health risks to humans and wildlife.

Question: What are the potential health risks of high-protein diets for kidney health?

Answer: High-protein diets can increase the kidneys' workload, potentially leading to kidney damage in individuals with pre-existing kidney conditions.

Question: What is the current flowing through a nichrome wire coil with a resistance of  $6\ \Omega$  connected to a  $3\ \text{V}$  power supply?

Answer: Using Ohm's Law,  $I = V/R$ , the current is  $I = 3 \text{ V} / 6 \Omega = 0.5 \text{ A}$ .

Question: What is the chemical formula for magnesium sulfide?

Answer: The chemical formula for magnesium sulfide is  $\text{MgS}$ .

Question: How much heat is required to increase the temperature of a 500 g block of aluminium from  $30^\circ\text{C}$  to  $50^\circ\text{C}$ ?

Answer: The heat required is 9,000 J, calculated using the formula  $Q = mc\Delta T = 0.5 \times 900 \times (50 - 30)$ .

Question: What is the pressure exerted by a cubic-shaped box with a weight of 400 N and a bottom area of  $0.2 \text{ m}^2$ ?

Answer: The pressure exerted is 2000 Pa, calculated as  $400 \text{ N} / 0.2 \text{ m}^2$ .

Question: What is the effect of plano-concave lenses on light rays?

Answer: Plano-concave lenses diverge parallel light rays, making them appear to originate from a focal point on the concave side.

Question: How is atmospheric pressure measured using a mercury barometer?

Answer: Atmospheric pressure is measured using a mercury barometer by the height of the mercury column in a glass tube. The height of the column represents the atmospheric pressure exerted on the mercury in the container.

Question: What is the significance of the focal point in lenses?

Answer: The focal point is where light rays converge (convex) or appear to diverge (concave), determining the lens's magnifying power.

Question: What is the focal point of a convex mirror, and how does it affect reflected rays?

Answer: The focal point of a convex mirror is behind the mirror, and rays parallel to the principal axis diverge as if they are coming from this focal point.

Question: What are the features of invertebrates in the phylum Echinodermata?

Answer: Invertebrates in the phylum Echinodermata are marine, triploblastic, coelomic organisms with bodies separated into 5 radial arms, a sharp spiny body covering, a water vascular system, tube feet for locomotion and respiration, and penta-radial symmetry.

Question: What is the significance of clean energy for sustainable development?

Answer: Clean energy is significant for sustainable development because it reduces greenhouse gas emissions, improves air quality, and provides reliable and affordable energy.

Question: What is the effect of particle size on the rate of reaction?

Answer: Smaller particles have a larger surface area-to-volume ratio, leading to more collision sites and a higher rate of reaction.

Question: What are greenhouse gases?

Answer: Greenhouse gases are gases that trap heat in the atmosphere, contributing to global warming and climate change.

Question: What are some ways to prevent sexually transmitted diseases?

Answer: Prevention methods include avoiding risky sexual activities, using protection during intercourse, and avoiding blood transmission from infected individuals.

Question: What causes hypertension, and what are its effects on the body?

Answer: Hypertension is caused by the buildup of cholesterol in arteries, reducing lumen size and increasing blood pressure, leading to potential damage to blood vessels and organs.

Question: Calculate the energy consumption of a 100W bulb used for 5 hours daily over a week.

Answer: The energy consumption is  $(100\text{W} \times 5 \text{ hours} \times 7 \text{ days}) / 1000 = 3.5 \text{ kWh}$ .

Question: How does height affect the potential energy of an object?

Answer: Height affects potential energy directly; doubling the height doubles the potential energy.

Question: How does the sharing of electrons result in the formation of covalent bonds in heteroatomic molecules?

Answer: The sharing of electrons between atoms of different elements in heteroatomic molecules allows them to achieve stable electronic configurations, forming covalent bonds.

Question: How do you calculate the moment of a force applied to a stick pivoted at one end?

Answer: Calculate the moment by multiplying the applied force by the perpendicular distance from the pivot point to the line of action of the force (Moment = Force  $\times$  Perpendicular distance).

Question: How is the quantity of heat evolved during the reaction between sodium and chlorine represented in an energy level diagram?

Answer: The reactants ( $2\text{Na (s)} + \text{Cl}_2 \text{ (g)}$ ) are at a higher energy level than the products ( $2\text{NaCl (s)}$ ), with the difference in energy released as heat.

Question: What is the function of the diaphragm in a moving coil microphone?

Answer: The diaphragm in a moving coil microphone vibrates in response to sound waves, moving the attached coil and inducing an electromotive force.

Question: How does the addition of sulfuric acid to water affect the electrolysis process?

Answer: Adding sulfuric acid increases the concentration of  $\text{H}^+$  ions, enhancing the conductivity of the solution and improving the efficiency and speed of the electrolysis process.

Question: How does the strength of the magnetic field affect the performance of a dynamo?

Answer: A stronger magnetic field increases the induced electromotive force, improving the dynamo's performance and electricity generation.

Question: What is the significance of Mendel's work in the field of genetics?

Answer: Mendel's work established the foundational principles of inheritance, leading to the development of the field of genetics and our understanding of how traits are passed down through generations.

Question: How do you prepare a 1 mol/dm<sup>3</sup> solution of sodium carbonate?

Answer: Weigh the required mass of Na<sub>2</sub>CO<sub>3</sub>, dissolve it in water, and adjust the final volume in a volumetric flask.

Question: How does a voltaic cell differ from an electrolytic cell?

Answer: A voltaic cell generates electrical energy from spontaneous chemical reactions, while an electrolytic cell uses electrical energy to drive non-spontaneous chemical reactions.

Question: What is the role of the umbilical cord in fetal development?

Answer: The umbilical cord connects the fetus to the placenta, allowing the exchange of nutrients, oxygen, and waste products between the mother and fetus.

Question: How does the electrolysis of copper sulfate solution demonstrate the reduction of Cu<sup>2+</sup> ions?

Answer: The reduction of Cu<sup>2+</sup> ions to copper metal at the cathode demonstrates the electrochemical reduction process.

Question: What is an example of a scientific name given in the document?

Answer: An example of a scientific name is *Mangifera indica*.

Question: How does the efficiency of electric cookers impact energy consumption?

Answer: Efficient electric cookers convert more of the supplied electric energy into useful heat, reducing energy consumption and cooking time compared to less efficient models.

Question: How do connective tissues facilitate repair and healing in the body?

Answer: Connective tissues produce extracellular matrix components and support the formation of new tissues during the healing process.

Question: How is the heat change expressed with regard to the physical state of reactants and products?

Answer: The physical state of reactants and products (solid, liquid, gas, aqueous) should be indicated.

Question: What is the role of ultraviolet rays in the environment?

Answer: Ultraviolet rays from the sun play a role in the production of vitamin D in the skin, but excessive exposure can cause skin damage and increase the risk of skin cancer.

Question: Who first observed the magnetic effect of a current?

Answer: The Danish scientist Hans Christine Oersted first observed the magnetic effect in the vicinity of a current-carrying conductor.

Question: What is the significance of the physical state of reactants and products in expressing heat change?

Answer: The physical state (solid, liquid, gas, aqueous) affects the heat change and should be indicated for accurate representation.

Question: What is the role of a diaphragm or membrane in some electrolytic cells?

Answer: A diaphragm or membrane in electrolytic cells separates the anode and cathode compartments, preventing the mixing of products and allowing selective ion transport to improve cell efficiency and prevent unwanted side reactions.

Question: What are some applications of gamma rays in science and medicine?

Answer: Gamma rays are used in cancer treatment, sterilization of medical equipment, and as tracers in medical imaging and research.

Question: What are the key takeaways from the document regarding heat changes in chemical reactions?

Answer: Understanding exothermic and endothermic reactions, calculating heat changes, and recognizing the significance of temperature changes in reactions.

Question: What are complex permanent tissues, and what are the two types identified in plants?

Answer: Complex permanent tissues consist of different types of cells working together. The two types identified in plants are xylem and phloem.

Question: How does a seat belt help in a moving vehicle?

Answer: A seat belt helps by exerting a force on the upper part of the body, ensuring that the whole body remains at the velocity of the vehicle even when brakes are applied, preventing the passenger from being thrown forward.

Question: Why is radiation an effective method of heat transfer in space?

Answer: Radiation is an effective method of heat transfer in space because it does not require a material medium, allowing heat to travel through the vacuum of space in the form of electromagnetic waves.

Question: What is the formula for calculating work?

Answer: Work done by a force = Magnitude of the force  $\times$  Distance moved in the direction of the force.

Question: What observations indicate that chlorine gas is produced during the electrolysis of sodium chloride solution?

Answer: The production of chlorine gas is indicated by the formation of gas bubbles at the anode and the characteristic greenish-yellow color and strong odor of chlorine.

Question: Explain the principle of electromagnetic induction.

Answer: Electromagnetic induction is the process of generating an electric current in a conductor by changing the magnetic field around it, as discovered by Michael Faraday.

Question: How does the endoplasmic reticulum contribute to cellular function?

Answer: The endoplasmic reticulum (ER) facilitates the transport of proteins and lipids within the cell. The rough ER is involved in protein synthesis, while the smooth ER synthesizes lipids and detoxifies harmful substances.

Question: How does the accumulation of heavy metals in the environment affect wildlife?

Answer: The accumulation of heavy metals in the environment affects wildlife by causing toxicity, bioaccumulation in the food chain, and harmful effects on reproduction, growth, and survival.

Question: What is the kinetic energy of a 2.5 kg object moving at 7 m/s?

Answer: The kinetic energy is 61.25 Joules (J).

Question: What is the role of a Bourdon gauge in measuring pressure?

Answer: A Bourdon gauge measures pressure through the deformation of a curved tube that straightens under pressure, moving an indicator to display the pressure level.

Question: What is the effect of particle size on the rate of reaction?

Answer: Smaller particles have a larger surface area-to-volume ratio, leading to more collision sites and a higher rate of reaction.

Question: Give two benefits of friction.

Answer: Two benefits of friction are providing traction for walking without slipping and enabling vehicles to stop effectively with brakes.

Question: How do inherited traits vary within a species?

Answer: Inherited traits vary within a species due to the combination of different alleles, leading to a wide range of phenotypic variations among individuals.

Question: What is the significance of Michael Faraday's experiments on electromagnetic induction?

Answer: Faraday's experiments established the principles of electromagnetic induction, leading to the development of electrical generators and transformers.

Question: What components are involved in the operation of a bicycle dynamo?

Answer: Components of a bicycle dynamo include the rotating coil, magnetic field, and mechanical connection to the bicycle tire.

Question: How does acid rain affect aquatic ecosystems?

Answer: Acid rain affects aquatic ecosystems by increasing the acidity of water, which can harm or kill aquatic organisms and disrupt the balance of the ecosystem.

Question: How is the relative atomic mass of an element defined?

Answer: The relative atomic mass of an element is defined as the weighted average mass of the atoms in a naturally occurring sample of the element, compared to  $1/12$  of the mass of a carbon-12 atom.

Question: Describe the process of DNA replication during the S phase of the cell cycle.

Answer: During the S phase, the cell's DNA is replicated, resulting in two identical copies of each chromosome, ensuring that each daughter cell receives a complete set of genetic information.

Question: What is the effect of gravitational acceleration on weight?

Answer: Gravitational acceleration directly affects weight. Weight is the product of mass and gravitational acceleration, so an increase in gravitational acceleration results in an increase in weight.

Question: Explain how potential energy converts to kinetic energy in a falling object.

Answer: In a falling object, potential energy converts to kinetic energy as the object falls, with the total mechanical energy remaining constant if air resistance is negligible.

Question: How does the strength of the magnetic field affect the force on a conductor?

Answer: A stronger magnetic field increases the force on a current-carrying conductor, enhancing its movement and efficiency in devices like motors.

Question: How do you connect two dry cells to ensure a potential difference across a bulb?

Answer: Connect the positive terminal of one cell and the negative terminal of the other cell to the terminals of the bulb to create a potential difference and allow current to flow.

Question: What is industrial nitrogen fixation?

Answer: Industrial nitrogen fixation is the conversion of atmospheric nitrogen into nitrates during the production of chemical fertilizers.

Question: How does electromagnetic induction enable the operation of a moving coil microphone?

Answer: Electromagnetic induction enables the microphone to convert sound waves into electrical signals by inducing a current in the vibrating coil.

Question: Explain the importance of using the appropriate cross-sectional area for connecting wires.

Answer: Using the appropriate cross-sectional area for connecting wires ensures they can safely carry the required current without overheating or causing electrical faults.

Question: What is the significance of wavelength in determining the properties of waves?

Answer: Wavelength determines the wave's energy, frequency, and propagation characteristics, influencing its behavior and applications.

Question: What is the relationship between liquid pressure and the depth of the liquid?

Answer: The pressure exerted by a liquid increases with the depth of the liquid because the weight of the liquid above that point increases.

Question: What is the significance of the plasma membrane's selective permeability?

Answer: Selective permeability of the plasma membrane allows the cell to regulate the internal environment by controlling the entry and exit of ions, nutrients, and waste products.

Question: What is a force?

Answer: A force is an influence that can change the state of motion of an object. It can cause an object at rest to move or an object in motion to change its velocity or direction.

Question: What is the role of phosphorous in the human body?

Answer: Phosphorous is essential for the growth of bones and teeth, as a constituent of nucleic acids, and for carbohydrate and fat metabolism.

Question: What are lone pairs and bond pairs in a Lewis structure?

Answer: Lone pairs are valence electrons that are not involved in bonding and are represented by dots, while bond pairs are shared electrons between atoms represented by lines.

Question: Explain the process of cell division in mitosis.

Answer: Mitosis involves the division of a parent cell into two identical daughter cells, maintaining the chromosome number, and consists of stages like prophase, metaphase, anaphase, and telophase.

Question: What is the impact of gene flow on genetic diversity?

Answer: Gene flow, the movement of genes between populations, increases genetic diversity by introducing new alleles into a population, reducing the risk of inbreeding and promoting genetic variation.

Question: What are free electrons?

Answer: Free electrons are electrons in the outermost shell of metallic atoms that can easily detach from the atom and move freely.

Question: How does the concentration of a solution change during recrystallization?

Answer: The concentration of the solution increases as it cools, causing the solute to exceed its solubility limit and form pure crystals.

Question: What is the purpose of a load cell in weighing systems?

Answer: A load cell measures force or weight by converting mechanical stress into an electrical signal, providing accurate weight measurement in scales and industrial applications.

Question: Explain the concept of forward voltage in diodes.



Answer: Forward voltage is the minimum voltage required to overcome the potential barrier in a diode's p-n junction and allow current to flow in the forward direction.

Question: What are the primary functions of the skeletal system?

Answer: The skeletal system provides structural support, protects internal organs, facilitates movement, produces blood cells, and stores minerals.

Question: What is the potential difference across a bulb connected to two dry cells with a total voltage of 3 V and a resistance of 6  $\Omega$ ?

Answer: Using Ohm's Law,  $V = IR$ , the potential difference is  $V = 3 \text{ V}$ .

Question: How does the coil's position affect the electromotive force in an alternating current dynamo?

Answer: The electromotive force varies with the coil's position, reaching maximum values when the coil intersects the magnetic field lines perpendicularly.

Question: How does the perpendicular distance to the line of action of the force affect the force required to rotate an object?

Answer: The force required to rotate an object decreases as the perpendicular distance to the line of action of the force from the rotation axis increases.

Question: How does wavelength affect the color of visible light?

Answer: The wavelength of visible light determines its color; shorter wavelengths correspond to blue/violet light, while longer wavelengths correspond to red/orange light.

Question: What is the pressure exerted by a 1-meter-high column of mercury with a density of 13,600 kg/m<sup>3</sup>?

Answer: The pressure exerted is calculated using  $P = h\rho g$ . For a height of 1 m, the pressure is  $P = 1 \text{ m} * 13,600 \text{ kg/m}^3 * 10 \text{ m/s}^2 = 136,000 \text{ Pa}$ .

Question: How does the power consumption of LED televisions compare to that of older CRT televisions?

Answer: LED televisions consume significantly less power than older CRT televisions, making them more energy-efficient and cost-effective.

Question: How are essential oils used in the production of perfumes?

Answer: Essential oils are used as aromatic components in perfumes, providing unique and natural scents.

Question: What are the features of invertebrates in the phylum Echinodermata?

Answer: Invertebrates in the phylum Echinodermata are marine, triploblastic, coelomic organisms with bodies separated into 5 radial arms, a sharp spiny body covering, a water vascular system, tube feet for locomotion and respiration, and penta-radial symmetry.

Question: What is the function of RNA?

Answer: RNA is responsible for protein synthesis.

Question: What is the role of sodium in the human body?

Answer: Sodium activates enzymes, is a constituent of digestive juice, maintains constant osmotic pressure in cells, and aids in the transmission of nerve impulses.

Question: What are some useful effects of fungi?

Answer: Fungi can be used as a protein supplement (e.g., mushrooms), aid in bread and alcohol fermentation (e.g., yeast), and produce antibiotics (e.g., Penicillium).

Question: What is the role of villi in the small intestine?

Answer: Villi increase the surface area for nutrient absorption, with each villus containing blood capillaries and lacteals to transport absorbed nutrients.

Question: What is the function of the epithelial tissue in the urinary bladder?

Answer: Epithelial tissue in the urinary bladder provides a protective lining that can expand and contract, allowing the bladder to store and release urine.

Question: How does an electric heater convert electrical energy into heat?

Answer: An electric heater converts electrical energy into heat through resistive heating, where electric current flows through a resistive element, generating heat.

Question: What are the industrial applications of electrolysis for metal extraction?

Answer: Industrial applications include extracting metals like sodium and aluminum from their ores, refining impure metals, and producing chemicals like sodium hydroxide and chlorine.

Question: How do you prepare a 1 mol/dm<sup>3</sup> solution of sulfuric acid?

Answer: Measure the required volume of H<sub>2</sub>SO<sub>4</sub>, dilute it with water, and adjust the final volume in a volumetric flask.

Question: How does the diaphragm contribute to breathing?

Answer: The diaphragm contracts and flattens during inhalation, increasing thoracic cavity volume and drawing air into the lungs; it relaxes during exhalation, decreasing volume and expelling air.

Question: Calculate the kinetic energy of a 1.2 kg object moving at 5 m/s.

Answer: The kinetic energy is 15 Joules (J).

Question: How do you express the composition of a solution in terms of molar concentration?

Answer: Molar concentration = Amount of moles of solute / Volume of solution in dm<sup>3</sup>.

Question: How does the pressure exerted by a gas differ from that of a liquid?

Answer: Gas pressure is caused by the collisions of gas molecules with container walls, while liquid pressure is due to the weight of the liquid.

column above the point of measurement.

Question: What is the significance of the electronic configuration in the Periodic Table?

Answer: The electronic configuration determines the position of an element in the Periodic Table and its chemical properties.

Question: How does gravitational potential energy depend on mass and height?

Answer: Gravitational potential energy depends directly on both the mass and the height of the object.

Question: Explain the role of a function generator in electronics laboratories.

Answer: A function generator produces various electrical waveforms, such as sine, square, and triangle waves, used for testing, troubleshooting, and developing electronic circuits.

Question: Explain the process of anodization and its applications.

Answer: Anodization is an electrochemical process that forms a protective oxide layer on the surface of metals like aluminum. It enhances corrosion resistance, wear resistance, and aesthetic appearance, used in aerospace, automotive, and consumer products.

Question: How do corrective lenses work for nearsightedness?

Answer: Corrective lenses for nearsightedness use concave lenses to diverge light rays before they enter the eye, aiding in clear vision of distant objects.

Question: How does the presence of a catalyst affect the energy barrier of a reaction?

Answer: A catalyst lowers the activation energy required for the reaction, increasing the rate of reaction.

Question: How do you calculate the mean velocity of an object with varying displacement?

Answer:  $\text{Mean velocity} = \frac{\text{Total Displacement}}{\text{Total Time}}$

Question: How does the depth of a liquid column affect the buoyant force on a submerged object?

Answer: The buoyant force on a submerged object is determined by the volume of the displaced liquid, not directly by the depth, but deeper objects may experience higher pressure.

Question: How do you maintain equilibrium in an object under the action of more than three forces?

Answer: Maintain equilibrium by applying the forces in such a way that their resultant is zero, meaning the sum of the forces and moments balance out, resulting in no net force or moment acting on the object.

Question: How is the resultant force of two collinear forces acting in opposite directions calculated?

Answer: The resultant force is calculated by subtracting the smaller force from the larger force, in the direction of the larger force.

Question: Explain the significance of power factor correction in electrical systems.

Answer: Power factor correction improves the efficiency of electrical systems by reducing reactive power, minimizing energy losses, and lowering utility bills.

Question: Calculate the mass of potassium carbonate required to prepare 500 cm<sup>3</sup> of a 1 mol/dm<sup>3</sup> solution.

Answer: The mass required is 69g.

Question: What is the purpose of a resistor in an electrical circuit?

Answer: A resistor is used to control the current flow through a circuit by providing a specific amount of resistance.

Question: What are some common inherited characteristics in the human population?

Answer: Common inherited characteristics in humans include skin color, hair type, earlobe attachment, and the ability to fold the tongue.

Question: What is the relative molecular mass of sulfuric acid (H<sub>2</sub>SO<sub>4</sub>)?

Answer: The relative molecular mass of sulfuric acid is 98, calculated as 2 x 1 for hydrogen, 32 for sulfur, and 4 x 16 for oxygen.

Question: How do non-flowering seedless plants differ from flowering plants?

Answer: Non-flowering seedless plants do not produce flowers or seeds, while flowering plants produce flowers and have seeds covered by a fruit.

Question: What is the nature of the image formed by a concave lens?

Answer: A concave lens forms a virtual, upright, and smaller image of the object.

Question: What is the role of the endocrine system in coordination?

Answer: The endocrine system secretes hormones into the blood, which regulate various body functions based on hormone concentration.

Question: How does thermal expansion affect the design of bridges?

Answer: Thermal expansion affects the design of bridges by requiring expansion joints to accommodate changes in length due to temperature variations, preventing structural damage and ensuring stability.

Question: What is the kinetic energy of a 3.5 kg object moving at 4 m/s?

Answer: The kinetic energy is 28 Joules (J).

Question: What is the main method of carbon fixation in an ecosystem?

Answer: The main method of carbon fixation in an ecosystem is photosynthesis.

Question: What are the main components of the human urinary system?

Answer: The urinary system includes the kidneys, ureters, urinary bladder, and urethra.

Question: How is the chemical formula of silicon dioxide written?

Answer: The chemical formula of silicon dioxide is  $\text{SiO}_2$ , indicating one silicon atom and two oxygen atoms.

Question: What is the formula to calculate the pressure exerted by a liquid column?

Answer: The formula to calculate the pressure exerted by a liquid column is  $P = h\rho g$ , where  $h$  is the height of the column,  $\rho$  is the density of the liquid, and  $g$  is gravitational acceleration.

Question: What is the significance of the direction of rotation in determining the moment of force?

Answer: The direction of rotation determines whether the moment of force is classified as clockwise or anti-clockwise, influencing the net rotational effect on the object.

Question: What is the function of a heat sink in power electronics?

Answer: A heat sink dissipates heat generated by power electronic components, such as transistors and ICs, preventing overheating and ensuring reliable operation.

Question: What is the balanced chemical equation for the reaction between magnesium and oxygen?

Answer: The balanced chemical equation for magnesium reacting with oxygen is:  $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$ .

Question: What role does the axle play in an alternating current dynamo?

Answer: The axle rotates the coil within the magnetic field, enabling continuous induction of electromotive force and generation of alternating current.

Question: What is the unit of the moment of a force?

Answer: The unit of the moment of a force is Newton meter (N m).

Question: What are the changes that occur in the female reproductive system during puberty?

Answer: Changes in the female reproductive system during puberty include the growth of pubertal hair, widened pubic region, growth of mammary glands, increased body fat, and the start of the menstrual cycle.

Question: What is the autonomic nervous system, and what is its role?

Answer: The autonomic nervous system controls involuntary body functions and coordinates opposite actions through the sympathetic and parasympathetic nervous systems.

Question: What is the mass number of protium?

Answer: The mass number of protium is 1.

Question: What is the electronic configuration of a chlorine atom?

Answer: The electronic configuration of a chlorine atom is 2, 8, 7.

Question: What is the significance of the triple point in phase diagrams?  
Answer: The triple point is the unique set of conditions (temperature and pressure) at which all three phases (solid, liquid, gas) of a substance coexist in equilibrium.

Question: What is the primary function of carbohydrates?  
Answer: The primary function of carbohydrates is to provide energy for the body's metabolic processes.

Question: Explain the concept of holes in semiconductor physics.  
Answer: In semiconductor physics, holes are the absence of an electron in a semiconductor's lattice structure. They act as positive charge carriers and move through the lattice when electrons move to fill these vacancies.

Question: What happens to the speed of a pencil when tapped on a table until it comes to rest?  
Answer: When a pencil is tapped on a table, its speed gradually decreases until it ultimately comes to rest because the surface exerts a frictional force that opposes its motion.

Question: What causes appendicitis, and what are its symptoms?  
Answer: Appendicitis is caused by infection and swelling of the appendix, leading to symptoms such as abdominal pain, fever, and digestive disturbances.

Question: What is the impact of wavelength on the propagation of electromagnetic waves?  
Answer: Wavelength affects the propagation characteristics of electromagnetic waves, including their ability to penetrate materials and travel long distances.

Question: What factors affect the rate of dissolution of a solute in a solvent?  
Answer: Factors affecting the rate of dissolution include temperature, agitation, surface area of the solute, and the nature of the solute and solvent.

Question: What is the effect of increasing the cross-sectional area of a nichrome wire on its resistance?  
Answer: Increasing the cross-sectional area of a nichrome wire decreases its resistance.

Question: What is the function of vitamin B?  
Answer: Vitamin B is important for the maintenance of nerves, healthy skin, formation of bone marrow, maturation of red blood cells, and antibody production.

Question: What is the specific heat capacity of aluminium, and how is it measured?  
Answer: The specific heat capacity of aluminium is  $900 \text{ J kg}^{-1} \text{ K}^{-1}$ . It is measured by supplying a known amount of heat to a known mass of aluminium and recording the resulting temperature change.

Question: How does the density of seawater compare to freshwater and how does this affect buoyancy?

Answer: Seawater is denser than freshwater due to the dissolved salts, providing greater buoyant force and making objects more buoyant in seawater.

Question: What are the uses of oxygen gas in respiration?

Answer: Oxygen gas is essential for the respiration of all organisms, supporting cellular respiration and energy production.

Question: How does the structure of diamond differ from that of graphite?

Answer: Diamond has a three-dimensional lattice structure where each carbon atom forms four covalent bonds with other carbon atoms, making it extremely hard. Graphite consists of layers of carbon atoms bonded in two dimensions, with weak forces between layers, making it soft and slippery.

Question: What is the speed of sound in air at 0°C?

Answer: The speed of sound in air at 0°C is about 330 m/s.

Question: What occurs during a chemical decomposition reaction?

Answer: During a chemical decomposition reaction, a compound breaks down into simpler substances or elements. For example, potassium permanganate decomposes into potassium manganate, manganese dioxide, and oxygen:  $2\text{KMnO}_4 \rightarrow \text{K}_2\text{MnO}_4 + \text{MnO}_2 + \text{O}_2$ .

Question: What is Fleming's left-hand rule used for?

Answer: Fleming's left-hand rule is used to determine the direction of force acting on a current-carrying conductor in a magnetic field.

Question: What are the features of invertebrates in the phylum Echinodermata?

Answer: Invertebrates in the phylum Echinodermata are marine, triploblastic, coelomic organisms with bodies separated into 5 radial arms, a sharp spiny body covering, a water vascular system, tube feet for locomotion and respiration, and penta-radial symmetry.

Question: What are some methods of artificial vegetative propagation in plants?

Answer: Artificial vegetative propagation methods include stem cuttings, layering, grafting, and tissue culture.

Question: How is the Kingdom Plantae divided?

Answer: The Kingdom Plantae is divided into flowering and non-flowering plants.

Question: How does the body regulate blood pressure?

Answer: Blood pressure is regulated by the autonomic nervous system, hormones like adrenaline and ADH, and the kidneys' control of blood volume.

Question: What are the environmental impacts of industrial waste disposal?

Answer: The environmental impacts of industrial waste disposal include soil and water contamination, harm to wildlife, and the release of toxic substances into the environment.

Question: What is the importance of green spaces in urban areas?

Answer: Green spaces in urban areas are important for providing recreational opportunities, improving air quality, supporting biodiversity, and enhancing mental and physical well-being.

Question: How do you calculate the total current in a parallel circuit?

Answer: The total current in a parallel circuit is the sum of the currents through each branch:  $I_{\text{total}} = I_1 + I_2 + I_3 + \dots$

Question: What is the absolute zero temperature in the Kelvin scale?

Answer: Absolute zero temperature in the Kelvin scale is 0 K, which corresponds to  $-273.15^{\circ}\text{C}$ , where the kinetic energy of particles is zero.

Question: What is global warming, and what are its consequences?

Answer: Global warming is the increase in Earth's average surface temperature due to the greenhouse effect caused by excess greenhouse gases. Its consequences include melting polar glaciers, rising sea levels, and changing global climatic patterns.

Question: What is the chemical formula for monosaccharides?

Answer: The chemical formula for monosaccharides is  $\text{C}_6\text{H}_{12}\text{O}_6$ .

Question: What is the chemical formula for magnesium oxide?

Answer: The chemical formula for magnesium oxide is  $\text{MgO}$ .

Question: What are the environmental impacts of using fossil fuels for energy?

Answer: The environmental impacts of using fossil fuels for energy include greenhouse gas emissions, air and water pollution, habitat destruction, and contribution to climate change.

Question: Calculate the amount of sulfuric acid ( $\text{H}_2\text{SO}_4$ ) in moles in 49 grams.

Answer: The amount of sulfuric acid in 49 grams is 0.5 moles, calculated as  $49/98 = 0.5$  moles.

Question: How can the presence of starch in leaves be tested to confirm photosynthesis?

Answer: A leaf can be boiled in water, then in alcohol, and tested with iodine solution. If the leaf turns blue or dark purple, starch is present, indicating photosynthesis.

Question: How do sound waves propagate through solids?

Answer: Sound waves propagate through solids by causing particles in the solid to vibrate, transferring energy through the material.

Question: What is the significance of hydrogen bonds in biological molecules like DNA and proteins?



Answer: Hydrogen bonds are significant in biological molecules like DNA and proteins because they stabilize the structures, allowing for specific shapes and functions essential for biological processes.

Question: What is a rectifier diode used for?

Answer: A rectifier diode is used to convert alternating current (AC) to direct current (DC).

Question: How do viruses impact the health of host organisms?

Answer: Viruses impact the health of host organisms by causing diseases, triggering immune responses, and sometimes leading to chronic infections or immune system suppression.

Question: How is aluminum extracted using electrolysis?

Answer: Aluminum is extracted using electrolysis of molten aluminum oxide (alumina) dissolved in cryolite. At the cathode, aluminum ions ( $\text{Al}^{3+}$ ) are reduced to form aluminum metal, and at the anode, oxide ions ( $\text{O}^{2-}$ ) are oxidized to form oxygen gas.

Question: What are the potential risks of gene editing in humans?

Answer: Potential risks of gene editing in humans include off-target effects, unintended genetic changes, ethical concerns about germline editing, and the possibility of creating genetic inequalities.

Question: What is the role of a fractionating column in fractional distillation?

Answer: A fractionating column provides multiple stages of condensation and vaporization, enhancing the separation of components with close boiling points.

Question: How does the electrolysis of copper sulfate solution demonstrate the reduction of  $\text{Cu}^{2+}$  ions?

Answer: The reduction of  $\text{Cu}^{2+}$  ions to copper metal at the cathode demonstrates the electrochemical reduction process, where  $\text{Cu}^{2+}$  ions gain electrons and are deposited as solid copper on the electrode.

Question: How are polysaccharides formed?

Answer: Polysaccharides are formed by the polymerization of a large number of monosaccharides.

Question: Who introduced the nuclear model of the atom and when?

Answer: Ernest Rutherford introduced the nuclear model of the atom in 1911.

Question: What is parthenocarpy?

Answer: Parthenocarpy is the development of fruits without fertilization, resulting in seedless fruits. Artificial growth substances can induce parthenocarpy.

Question: What is Snell's law?

Answer: The ratio of the sine of the incident angle to the sine of the refracted angle is constant and depends on the two media.

Question: What is reforestation, and why is it important?

Answer: Reforestation is the process of planting trees in suitable areas to reestablish environmental balance. It is crucial for maintaining natural forest cover, which helps mitigate the harmful effects of deforestation.

Question: What is the role of ultrasound waves in lithotripsy?

Answer: Ultrasound waves are used to break down bladder stones into smaller fragments, which can then be passed out of the body naturally.

Question: What is the significance of the lines of action of forces in maintaining equilibrium in a system of three non-parallel forces?

Answer: The lines of action of the three non-parallel forces must intersect at a common point for equilibrium to be maintained. This ensures that the resultant of any two forces is equal in magnitude and opposite in direction to the third force.

Question: What are the features of vertebrates in the class Reptilia?

Answer: Vertebrates in the class Reptilia have dry skin with scales, pentadactyle limbs, a heart with two atria and an incompletely divided ventricle, lungs for respiration, and are cold-blooded with internal fertilization.

Question: Describe the relationship between speed and distance.

Answer: Speed is the rate at which distance is traveled, calculated as Distance / Time.

Question: What causes gonorrhea, and what are its symptoms?

Answer: Gonorrhea is caused by the bacterium *Neisseria gonorrhoeae* and is characterized by secretions from sex organs, pain, and blockage of the fallopian tube.

Question: What are periods in the Periodic Table?

Answer: Periods are the horizontal rows in the Periodic Table.

Question: How is the Kingdom Plantae divided?

Answer: The Kingdom Plantae is divided into flowering and non-flowering plants.

Question: What instrument is used to measure electric current?

Answer: An ammeter is used to measure electric current.

Question: What is the significance of the line of action of force?

Answer: The line of action of force is a straight line indicating the direction of force acting on a point. It helps visualize the direction and point of application of the force.

Question: What is the momentum of a 5 kg object moving at 3 m/s?

Answer: The momentum is  $p = m \times v = 5 \times 3 = 15$  kg m/s.

Question: How does paper chromatography separate different components of a chlorophyll extract?

Answer: Components of chlorophyll extract move at different rates on the paper strip due to varying affinities for the stationary phase, resulting in

separation.

Question: Describe the role of ribosomes in gene expression.

Answer: Ribosomes translate mRNA into proteins, essential for expressing genetic information and carrying out cellular functions.

Question: Why is it important to use appropriate fuses in domestic circuits?

Answer: Appropriate fuses protect domestic circuits from overcurrent, preventing potential damage to appliances and reducing the risk of electrical fires.

Question: What are alkanes?

Answer: Alkanes are hydrocarbons containing only single bonds between carbon atoms and have the general formula  $C_nH_{2n+2}$ .

Question: How do xylem vessels facilitate water transport in plants?

Answer: Xylem vessels, formed by elongated cells stacked end to end with dissolved cross walls, create a continuous tube that facilitates water transport.

Question: How does the surface area of a reactant influence the rate of a chemical reaction?

Answer: A larger surface area provides more collision sites for reactants, increasing the rate of reaction.

Question: How much heat is required to increase the temperature of 1 kg of water by  $1^\circ\text{C}$ ?

Answer: The heat required is 4200 J, which is the specific heat capacity of water.

Question: What is the reaction between aluminum and copper sulfate solution?

Answer: Aluminum displaces copper from copper sulfate, forming aluminum sulfate and copper:  $2\text{Al} + 3\text{CuSO}_4 \rightarrow \text{Al}_2(\text{SO}_4)_3 + 3\text{Cu}$ .

Question: What are the characteristics of electromagnetic waves?

Answer: Electromagnetic waves are not affected by external electric or magnetic fields, do not require a medium for propagation, and travel at the speed of light in a vacuum.

Question: Who discovered the double helical structure of DNA, and when?

Answer: James Watson and Francis Crick discovered the double helical structure of DNA in 1953.

Question: What is the significance of the Convention on Biological Diversity (CBD)?

Answer: The Convention on Biological Diversity (CBD) is an international agreement aimed at conserving biodiversity, using biological resources sustainably, and sharing the benefits of genetic resources fairly.

Question: How does the volume of a gas change with temperature according to Charles's Law?

Answer: According to Charles's Law, the volume of a gas increases with temperature, provided the pressure remains constant, as gas molecules move faster and spread out more.

Question: How does electroplating enhance the properties of metal objects?

Answer: Electroplating enhances properties like corrosion resistance, appearance, and durability by applying a thin layer of a less reactive metal, such as gold, silver, or chromium, onto the surface of the object.

Question: What is the voltage drop across a  $20\ \Omega$  resistor with a current of  $1\text{ A}$  flowing through it?

Answer: Using Ohm's Law,  $V=IR$ , the voltage drop is  $V=1\text{A}\times 20\Omega=20\text{V}$ .

Question: What happens to the image size when an object is moved toward the pole of a concave mirror?

Answer: The image becomes larger.

Question: What factors affect population density?

Answer: Factors affecting population density include births, deaths, immigration, and emigration.

Question: How does a supercapacitor differ from a traditional capacitor?

Answer: A supercapacitor differs from a traditional capacitor by offering much higher capacitance and energy storage capability, achieved through electrostatic charge separation at the electrode-electrolyte interface, allowing rapid charging and discharging.

Question: How is the voltage ratio in a transformer calculated?

Answer: The voltage ratio is calculated using the formula  $V_p/V_s = N_p/N_s$ , where  $V_p$  and  $V_s$  are the primary and secondary voltages, and  $N_p$  and  $N_s$  are the number of turns in the primary and secondary coils.

Question: What are some harmful effects of fungi to humans?

Answer: Harmful effects of fungi include causing diseases in plants and animals (e.g., Pityriasis by Candida) and food spoilage.

Question: What are the roles of the liver and pancreas in digestion?

Answer: The liver produces bile to emulsify fats, and the pancreas secretes digestive enzymes like amylase, lipase, and proteases into the small intestine.

Question: How does a phase shift oscillator generate oscillations?

Answer: A phase shift oscillator generates oscillations by using a feedback network that shifts the phase of the signal by  $180$  degrees, creating a continuous loop of signal amplification and phase shift.

Question: Describe the image formed by a concave lens when viewed through the lens.

Answer: The image is virtual, upright, and smaller than the object, regardless of the object distance.

Question: How do dolphins use ultrasound waves for communication and navigation?

Answer: Dolphins emit and receive ultrasound waves to communicate with each other, locate prey, and avoid predators like sharks.

Question: Give an example of isotopes.

Answer: Hydrogen has three isotopes: protium, deuterium, and tritium.

Question: Why is it important to use insulated tools when working with electrical wiring?

Answer: Insulated tools prevent the risk of electric shocks by providing a non-conductive barrier between the user and live electrical parts.

Question: What are the functions of blood tissue?

Answer: Blood tissue transports respiratory gases, nutrients, excretory materials, and hormones; protects the body by destroying foreign bodies through phagocytosis and antibody production; and maintains homeostasis.

Question: How does the direction of induced current change with coil rotation?

Answer: The direction of induced current changes with coil rotation, alternating periodically to produce an alternating current.

Question: What is the electronic configuration of lithium?

Answer: The electronic configuration of lithium is 2, 1.

Question: How much heat is required to increase the temperature of 6 kg of copper by 20 K?

Answer: The heat required to increase the temperature of 6 kg of copper by 20 K is 48,000 J, calculated using the formula  $Q = mc\Delta T = 6 \times 400 \times 20$ .

Question: What components are essential for the operation of a bicycle dynamo?

Answer: Essential components of a bicycle dynamo include the rotating coil, magnetic field, mechanical connection to the tire, and electrical circuit.

Question: Activity: Consider a cube of marble ( $\text{CaCO}_3$ ), of a side 2 cm, put into dilute hydrochloric acid solution. Calculate the surface area of marble that comes into contact with the acid. What is the purpose of activity involving marble cubes and acid?

Answer: Activity demonstrates how increasing the surface area of marble cubes affects their reaction rate with dilute hydrochloric acid.

Question: Why is sodium metal stored in paraffin oil or kerosene?

Answer: Sodium metal is stored in paraffin oil or kerosene to prevent it from coming into contact with air. Sodium is highly reactive and can react with moisture and oxygen in the air, causing it to tarnish and possibly ignite.

Question: What is the distance traveled by an object moving at 4 m/s for 10 seconds?

Answer: Distance = 4 m/s  $\times$  10 s = 40 meters.

Question: What are the conditions necessary for an object to maintain equilibrium under the action of three parallel forces?

Answer: For an object to maintain equilibrium under three parallel forces, the forces must be coplanar, one force must act in the opposite direction to the other two, and the resultant of any two forces must be equal in magnitude and opposite in direction to the third force.

Question: What is the purpose of cross-pollination in Mendel's experiments?

Answer: Cross-pollination allowed Mendel to combine different traits from two parent plants to observe how those traits were inherited in the offspring.

Question: What is the importance of electromagnets in modern technology?

Answer: Electromagnets are crucial for various applications, including electric motors, magnetic cards, MRI machines, and scientific instruments.

Question: What is the significance of genetic linkage maps?

Answer: Genetic linkage maps show the relative positions of genes on a chromosome, helping geneticists understand how traits are inherited and identify genes associated with specific disorders.

Question: What are the weaknesses of artificial classification?

Answer: Artificial classification does not depict evolutionary relationships and can group unrelated organisms together based on superficial similarities.

Question: What are the signs and symptoms of nephrotic syndrome?

Answer: Symptoms of nephrotic syndrome include severe proteinuria, hypoalbuminemia, edema, and hyperlipidemia.

Question: What is the significance of the vertical line passing through the center of gravity in maintaining equilibrium?

Answer: The vertical line passing through the center of gravity indicates the line of action of the weight. For equilibrium, the lines of action of other forces must intersect this vertical line and lie in the same plane.

Question: What changes occur in the male reproductive system during puberty?

Answer: Changes in the male reproductive system during puberty include the growth of pubertal hair, widened shoulders, deepened voice, accelerated growth of bones and muscles, production of sperms, and growth of genitals.

Question: What is the function of brushing rings in an alternating current dynamo?

Answer: Brushing rings connect the rotating coil to the external circuit, allowing current to flow continuously despite the coil's rotation.

Question: What are the potential impacts of global warming on polar regions?

Answer: Potential impacts of global warming on polar regions include the melting of ice caps and glaciers, rising sea levels, loss of habitat for polar species, and changes in ocean circulation patterns.

Question: What role does the magnetic field play in the operation of a bicycle dynamo?

Answer: The magnetic field interacts with the rotating coil, inducing an electromotive force that generates electrical power for the bicycle's lights.

Question: What is the principle of a compound microscope?

Answer: A compound microscope uses multiple lenses to achieve high magnification of small objects by converging light rays through several focal points.

Question: What are the products of the reaction between zinc and sulfuric acid?

Answer: The reaction between zinc and sulfuric acid produces zinc sulfate ( $\text{ZnSO}_4$ ) and hydrogen gas ( $\text{H}_2$ ).

Question: What is the importance of the meniscus in volumetric measurements?

Answer: The meniscus ensures accurate volume measurement by marking the correct level at the volume mark.

Question: How does an aneroid barometer measure atmospheric pressure?

Answer: An aneroid barometer measures atmospheric pressure using a sealed, air-evacuated cavity with flexible walls. Changes in pressure cause the walls to flex, moving an indicator to show the pressure on a scale.

Question: What adaptations do fruits dispersed by wind have?

Answer: Fruits dispersed by wind have thread-like structures, wing-like structures, light seeds, and are produced in large numbers.

Question: What are the features of vertebrates in the class Aves?

Answer: Vertebrates in the class Aves have a light bony endoskeleton, streamlined bodies, feathers covering their skin, beaks adapted for different modes of nutrition, eyes with eyelids, pentadactyle limbs (forelimbs converted into wings), a four-chambered heart, and are warm-blooded.

Question: Explain the significance of cyclic voltammetry in studying redox reactions.

Answer: Cyclic voltammetry is significant in studying redox reactions as it provides information on the electrochemical behavior, reaction kinetics, and mechanisms of electroactive species by measuring current response to varying potential.

Question: What is the significance of the octet rule in covalent bonding?

Answer: The octet rule is significant in covalent bonding because it explains why atoms share electrons to achieve a stable configuration of eight electrons in their valence shell, similar to noble gases.

Question: How is the electronic configuration of fluorine related to the formation of a fluorine molecule?

Answer: The electronic configuration of fluorine (2, 7) allows two fluorine atoms to share a pair of electrons, forming a fluorine molecule (F<sub>2</sub>) with a stable electronic configuration.

Question: What are the properties of bases?

Answer: Bases have a slimy texture, react with acids to form salts and water, and turn red litmus blue.

Question: What is the molar mass of glucose (C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>)?

Answer: The molar mass of glucose is 180 grams per mole, calculated as 6 x 12 for carbon, 12 x 1 for hydrogen, and 6 x 16 for oxygen.

Question: Explain the relationship between voltage, current, and power in an electric circuit.

Answer: Power (P) in an electric circuit is the product of voltage (V) and current (I), expressed as  $P = VI$ . Higher voltage or current results in higher power output.

Question: What is an aneroid barometer and how does it measure pressure?

Answer: An aneroid barometer measures pressure without using a liquid. It has a sealed, air-evacuated cavity with flexible walls. Changes in external pressure cause the walls to flex, moving an indicator that shows the pressure on a scale.

Question: How does the specific heat capacity of water influence its role in the human body's temperature regulation?

Answer: Water's high specific heat capacity allows it to absorb and store large amounts of heat, helping to regulate body temperature by distributing heat throughout the body and through processes like sweating.

Question: What is the resultant force when a 4 N force and a 6 N force act in opposite directions?

Answer: The resultant force is 2 N in the direction of the larger force.

Question: What is the formula for calculating the moment of a force applied to a pivoted rod?

Answer: The formula for calculating the moment of a force applied to a pivoted rod is  $\text{Moment} = \text{Force} \times \text{Perpendicular distance from the pivot point to the line of action of the force}$ .

Question: What is the significance of alveoli in the lungs?

Answer: Alveoli are the sites of gas exchange where oxygen diffuses into blood capillaries, and carbon dioxide diffuses out to be exhaled.

Question: How does the radius of curvature relate to the focal length in spherical mirrors?

Answer: The radius of curvature is twice the focal length, providing a geometric relationship between these two measurements.

Question: What are autosomal chromosomes?



Answer: Autosomal chromosomes are the 22 pairs of chromosomes in humans that do not determine sex. They carry genes that affect the general characteristics and traits of an individual.

Question: What does the intensity of the purple color in potassium permanganate solutions indicate?

Answer: The intensity indicates the concentration of potassium permanganate, with a more intense purple color showing a higher concentration.

Question: What are some harmful effects of bacteria to humans?

Answer: Harmful effects of bacteria include causing diseases like Tuberculosis, Pneumonia, Diarrhoea, Tetanus, and Leprosy.

Question: What is the effect of a plano-concave lens on light rays?

Answer: Plano-concave lenses diverge light rays, creating virtual, upright, and smaller images.

Question: How does electromagnetic induction enable the operation of a moving coil microphone?

Answer: Electromagnetic induction enables the microphone to convert sound waves into electrical signals by inducing a current in the vibrating coil.

Question: Describe the process of meiosis and its significance in sexual reproduction.

Answer: Meiosis reduces the chromosome number by half, producing haploid gametes (sperm and eggs), ensuring genetic diversity and maintaining the chromosome number in offspring after fertilization.

Question: What is the highest proportion of the body mass of living organisms composed of?

Answer: The highest proportion of the body mass of living organisms is composed of water.

Question: Why is it important to stir the mixture in heat change experiments?

Answer: To ensure uniform temperature distribution throughout the mixture.

Question: What are some examples of genetic disorders caused by mutations?

Answer: Examples include cystic fibrosis, sickle cell anemia, and Huntington's disease. These disorders result from mutations in specific genes that affect normal cellular functions.

Question: How is the chemical formula of sulphuric acid written?

Answer: The chemical formula of sulphuric acid is  $\text{H}_2\text{SO}_4$ , indicating two hydrogen atoms, one sulphur atom, and four oxygen atoms.

Question: How do lysosomes maintain cellular health?

Answer: Lysosomes degrade damaged or unnecessary cellular components, preventing the accumulation of waste and maintaining

cellular health through autophagy.

Question: What is the function of the calyx?

Answer: The calyx, comprised of sepals, protects the flower parts when the flower is in the bud stage.

Question: How are standard electrode potentials used to predict the direction of redox reactions?

Answer: Standard electrode potentials are used to predict the direction of redox reactions by comparing the potentials of the reactants and products. A positive cell potential indicates a spontaneous reaction, while a negative cell potential indicates a non-spontaneous reaction.

Question: What is the function of a relay in an electric circuit?

Answer: A relay is an electrically operated switch that uses a small control signal to switch a larger load, providing isolation and control in circuits.

Question: How do you measure the voltage across a bulb in a circuit with two dry cells?

Answer: Connect a voltmeter in parallel with the bulb and read the voltage value displayed on the voltmeter.

Question: What are the three methods of heat transfer, and how do they operate?

Answer: The three methods of heat transfer are conduction, convection, and radiation. Conduction transfers heat through direct contact, convection transfers heat through fluid motion, and radiation transfers heat through electromagnetic waves.

Question: What is the trend in ionisation energy across the third period?

Answer: The trend in ionisation energy across the third period is an increase from left to right.

Question: What is a convex lens, and how does it affect light rays?

Answer: A convex lens is a lens with two outward-curved surfaces that converges parallel light rays to a focal point.

Question: What are the advantages of vegetative propagation?

Answer: Vegetative propagation enables the propagation of plants that do not produce seeds, produces offspring identical to the mother plant, and allows the propagation of disease-resistant and early-fruited plants.

Question: What is the function of mitochondria in energy production?

Answer: Mitochondria produce ATP through aerobic respiration, converting glucose and oxygen into energy, carbon dioxide, and water, powering cellular activities.

Question: What reactions occur in the blast furnace during iron extraction?

Answer: Reactions in the blast furnace include the burning of coke to form carbon dioxide, the reaction of carbon dioxide with coke to form carbon monoxide, and the reduction of iron ore by carbon monoxide to produce liquid iron.

Question: What is the significance of using proper grounding in electric circuits?

Answer: Proper grounding provides a safe path for electric current to flow to the earth in case of a fault, preventing electric shocks and protecting appliances from damage.

Question: What is the reaction between calcium carbonate and hydrochloric acid?

Answer: Calcium carbonate reacts with hydrochloric acid to form calcium chloride, water, and carbon dioxide:  $\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$ .

Question: What is upthrust and how is it experienced by objects in a liquid?

Answer: Upthrust is the upward force exerted by a liquid on an object immersed in it. It is experienced as a reduction in the apparent weight of the object due to the liquid's buoyant force.

Question: What is the composition of bone tissue?

Answer: Bone tissue is composed of bone cells embedded in a hard matrix of collagen fibers and inorganic mineral salts, primarily calcium phosphate.

Question: Activity: Requirement: Three pieces of cleaned magnesium ribbon of equal surface area, three test tubes, dilute hydrochloric acid, water  
Take three test tubes and add 15 ml of water to each tube. Mark the water level of each tube with a rubber band and empty the water. Add 2.5 ml, 5.0 ml, and 7.5 ml of dilute hydrochloric acid to the three test tubes, and fill water to the rubber band mark of each tube. Introduce to each test tube a piece of magnesium ribbon and observe the speed of fizzing. What is the purpose of carrying out this activity with magnesium ribbon and hydrochloric acid?

Answer: This demonstrates how varying the concentration of hydrochloric acid affects the rate of reaction with magnesium ribbon.

Question: How is the specific heat capacity of a substance measured?

Answer: The specific heat capacity of a substance is measured by supplying a known amount of heat to a known mass of the substance and measuring the resulting temperature change.

Question: How do potassium and chlorine atoms achieve stability in potassium chloride?

Answer: Potassium atoms lose one electron to form  $\text{K}^+$  ions, and chlorine atoms gain one electron to form  $\text{Cl}^-$  ions. The electrostatic attraction between these ions forms potassium chloride (KCl).

Question: How does a moving coil microphone generate electrical signals?

Answer: A moving coil microphone generates electrical signals by vibrating a coil within a magnetic field, inducing an electromotive force corresponding to sound waves.

Question: What is the relationship between surface area and reaction rate?

Answer: A larger surface area increases the rate of reaction by providing more sites for reactant collisions.

Question: What happens to the components with higher boiling points in a fractionating tower?

Answer: They are deposited at the bottom of the tower as the temperature increases.

Question: How does reducing the mass of a vehicle affect its acceleration for a given force?

Answer: Reducing the mass of a vehicle increases its acceleration for a given force, as acceleration is inversely proportional to mass.

Question: What is the relationship between the focal length and image formation in spherical mirrors?

Answer: The focal length determines the point at which rays converge or appear to diverge, influencing the size, position, and nature of the image.

Question: How are gases such as oxygen and nitrogen separated from atmospheric air?

Answer: By fractional distillation of liquefied air, where components boil off at their respective boiling points.

Question: How does a compressed gas exert pressure?

Answer: A compressed gas exerts pressure due to the force of the gas molecules colliding with the walls of the container. The more the gas is compressed, the higher the pressure.

Question: How is body temperature regulated?

Answer: Body temperature is regulated by the hypothalamus through mechanisms like adjusting blood flow to the skin, sweating, and shivering.

Question: How do translucent materials affect light passage?

Answer: Translucent materials allow light to pass through but scatter it, making objects on the other side appear blurry. Examples include tissue paper and oil paper.

Question: How do viruses spread between hosts?

Answer: Viruses spread between hosts through various transmission methods, including direct contact, airborne particles, bodily fluids, and vectors such as insects.

Question: What is the significance of polar and non-polar covalent bonds in chemical reactions?

Answer: Polar and non-polar covalent bonds influence chemical reactions by determining the reactivity, solubility, and interaction of molecules with other substances, affecting the course and outcome of reactions.

Question: What are the harmful effects of protozoans to humans?

Answer: Protozoans can cause diseases like Amoebiasis, Malaria, and Sleeping sickness.

Question: How does the electrolysis of water demonstrate the decomposition of water molecules?

Answer: The electrolysis of water decomposes water molecules into hydrogen and oxygen gases, illustrating the breakdown of water into its

constituent elements.

Question: How does the weight of an object in water compare to its weight in air?

Answer: The weight of an object in water is less than its weight in air because the upthrust exerted by the water reduces the apparent weight of the object.

Question: What is the relationship between mass and weight in different gravitational fields?

Answer: Mass remains constant, but weight varies depending on the gravitational acceleration of the field. An object weighs more in a stronger gravitational field and less in a weaker gravitational field.

Question: What are the four types of cells that make up phloem tissue?

Answer: The four types of cells in phloem tissue are sieve tube elements, companion cells, phloem fibers, and phloem parenchyma.

Question: How does Newton's first law explain the need for helmets in sports?

Answer: Helmets provide protection by distributing the force of impact and reducing the acceleration experienced by the head. Newton's first law explains that the head tends to remain in motion during impact, and the helmet provides the necessary external force to stop the motion.

Question: How do you express the composition of a mixture as a percentage?

Answer: Percentage composition = (Fraction of component)  $\times$  100.

Question: How does a solar inverter convert energy from solar panels?

Answer: A solar inverter converts the DC electricity generated by solar panels into AC electricity, making it compatible with the power grid and household appliances.

Question: What is the significance of a double bond in an oxygen (O<sub>2</sub>) molecule?

Answer: A double bond in an oxygen (O<sub>2</sub>) molecule involves the sharing of two pairs of electrons between two oxygen atoms, resulting in a strong and stable bond.

Question: What is the principle of differential expansion in bimetallic strips?

Answer: Differential expansion in bimetallic strips occurs because two metals with different expansion rates bend when heated, allowing the strip to make or break electrical contacts, regulating temperature in devices like thermostats.

Question: How does genetic diversity benefit a species?

Answer: Genetic diversity allows a species to adapt to changing environments, resist diseases, and maintain healthy populations. It provides a genetic pool that can respond to natural selection and environmental pressures.

Question: What is the function of the nucleus in eukaryotic cells?

Answer: The nucleus houses the cell's genetic material (DNA) and controls cellular activities by regulating gene expression and facilitating DNA replication and transcription.

Question: How does the reactivity of alkali metals change with increasing atomic number?

Answer: The reactivity of alkali metals increases with increasing atomic number because the outer electron is more easily lost.

Question: How do lenses in cameras focus light?

Answer: Camera lenses adjust their curvature and position to focus light on the film or sensor, capturing clear images of objects at different distances.

Question: How do you calculate the power supplied by a power source in a circuit with multiple resistors?

Answer: Measure the total current and voltage supplied by the power source and use  $P=IV$  to calculate the power supplied.

Question: What are the main types of animal tissues?

Answer: The main types of animal tissues are epithelial tissue, connective tissue, muscle tissue, and nervous tissue.

Question: How is the chemical formula of ammonia represented?

Answer: The chemical formula of ammonia is  $\text{NH}_3$ , indicating one nitrogen atom and three hydrogen atoms.

Question: How does the magnetic field around a solenoid differ from that around a straight conductor?

Answer: The field inside a solenoid is uniform and parallel, while the field around a straight conductor forms concentric circles.

Question: What is a chemical change?

Answer: A chemical change involves the formation of new substances from existing substances, such as burning wood or rusting iron.

Question: Discuss the impact of waste management on environmental sustainability and the techniques used to manage waste effectively.

Answer: Effective waste management is essential for minimizing the environmental impact of waste materials. It involves strategies to reduce, reuse, and recycle waste to prevent pollution and conserve resources. Key techniques include: Reuse: Using items multiple times before discarding them. For example, reusing polythene bags reduces the need for new ones. Benefits: Reduces waste, conserves resources, and minimizes environmental impact. Reduce: Minimizing the use of unnecessary items. For instance, avoiding unnecessary antibiotics and vitamins reduces medical waste. Benefits: Decreases waste generation, conserves resources, and lowers pollution levels. Replace: Substituting harmful materials with eco-friendly alternatives. Using organic fertilizers instead of chemical ones is an example. Benefits: Reduces environmental contamination, promotes sustainable practices, and supports ecosystem health. Recycle: Converting waste materials into new products. Recycling polythene and plastic to produce fuel and using animal waste to produce biogas are examples. Benefits: Conserves resources, reduces landfill use, and minimizes

environmental impact. By implementing these waste management techniques, societies can achieve greater environmental sustainability and reduce the negative impacts of waste on ecosystems.

Question: What is the molar mass of glucose ( $C_6H_{12}O_6$ )?

Answer: The molar mass of glucose is 180 grams per mole, calculated as  $6 \times 12$  for carbon,  $12 \times 1$  for hydrogen, and  $6 \times 16$  for oxygen.

Question: What is the significance of the latent heat of vaporization in the human body's cooling mechanism?

Answer: The latent heat of vaporization is significant in the human body's cooling mechanism through sweating, where the evaporation of sweat absorbs a large amount of heat, helping to cool the body.

Question: What is haematite, and why is it important in iron extraction?

Answer: Haematite ( $Fe_2O_3$ ) is the main component of iron ore used in iron extraction. It is reduced in the blast furnace to produce liquid iron.

Question: How does solubility affect the absorption of nutrients in biological systems?

Answer: Solubility affects the absorption of nutrients by determining their availability in soluble form, facilitating their transport and uptake by cells.

Question: How do geneticists use probability to predict genetic outcomes?

Answer: Geneticists use probability to predict the likelihood of certain traits appearing in offspring, based on the known genotypes of the parents and the rules of inheritance.

Question: What observations can be made when varying the concentration of hydrochloric acid in reactions with magnesium ribbon?

Answer: Higher concentrations of hydrochloric acid lead to faster gas evolution, indicating an increased reaction rate.

Question: What is the chemical formula for sodium chloride?

Answer: The chemical formula for sodium chloride is  $NaCl$ .

Question: Explain the importance of using the appropriate cross-sectional area for connecting wires.

Answer: Using the appropriate cross-sectional area for connecting wires ensures they can safely carry the required current without overheating or causing electrical faults.

Question: What is the role of indigenous knowledge in environmental conservation?

Answer: Indigenous knowledge plays a role in environmental conservation by providing traditional practices and insights that contribute to sustainable resource management and biodiversity protection.

Question: How is the resultant force of two parallel forces acting in the same direction found?

Answer: The resultant force is found by adding the magnitudes of the two forces.

Question: How does the diaphragm in a moving coil microphone respond to sound?

Answer: The diaphragm vibrates in response to sound waves, moving the attached coil within a magnetic field and generating an alternating current.

Question: What is the acceleration of a 10 kg object when a force of 20 N is applied?

Answer: The acceleration is  $a = F/m = 20/20 = 2 \text{ m/s}^2$ .

Question: What is the significance of ionisation energy in determining the reactivity of elements?

Answer: Ionisation energy indicates how easily an atom can lose an electron, affecting its reactivity.

Question: What factors influence the efficiency of electrolysis?

Answer: Factors influencing the efficiency of electrolysis include electrolyte concentration, electrode material, current density, temperature, and the distance between electrodes.

Question: How does the position of an element in the periodic table relate to its atomic number?

Answer: The position of an element in the periodic table is directly related to its atomic number, with elements arranged in ascending order of atomic numbers.

Question: How are disaccharides formed?

Answer: Disaccharides are formed when two monosaccharides join together, releasing a water molecule.

Question: What are biodegradable and photodegradable polymers?

Answer: Biodegradable polymers decay through biological processes, while photodegradable polymers break down when exposed to sunlight.

Question: How does the structure of the small intestine aid in nutrient absorption?

Answer: The small intestine's long length, circular folds, villi, and microvilli increase the surface area for efficient nutrient absorption.

Question: Explain the process of electroforming.

Answer: Electroforming is a manufacturing process where a metal object is created by electrodepositing metal onto a mold or mandrel, which is later removed, leaving a precise and detailed metal structure used in jewelry, electronics, and aerospace.

Question: What happens during the first step of salt production in salterns?

Answer: Seawater is evaporated in large shallow tanks until calcium carbonate begins to crystallize and precipitate.

Question: What factors determine the magnitude of induced voltage in a coil?

Answer: Factors determining the magnitude of induced voltage include the number of coil turns, magnetic field strength, and speed of motion.



Question: What example is given for the resultant of two parallel forces?

Answer: An example is two people pushing a motor car with forces of 150 N and 200 N in the same direction, resulting in a total force of 350 N.

Question: What is the role of a pivot point in the formation of a force couple in practical applications?

Answer: The pivot point provides a fixed point around which the object can rotate due to the action and reaction forces according to Newton's third law, facilitating the formation of a force couple.

Question: What is the significance of glycogen storage in the liver?

Answer: The liver stores glucose as glycogen, which can be converted back to glucose and released into the blood when energy is needed.

Question: How can acids and bases be identified using litmus paper?

Answer: Acids turn blue litmus paper red, while bases turn red litmus paper blue.

Question: How does the direction of the applied force affect the velocity of an object?

Answer: The direction of the applied force determines the change in velocity. A force applied in the direction of motion increases velocity, while a force applied opposite to the direction of motion decreases velocity.

Question: What is the role of a voltmeter in an electrical circuit?

Answer: A voltmeter measures the potential difference (voltage) between two points in a circuit and is connected in parallel with the component or points to be measured.

Question: How do you calculate the power dissipated by a resistor with a known resistance and current?

Answer: The power dissipated is  $P = I^2 R$ , where  $I$  is the current and  $R$  is the resistance.

Question: Explain the concept of standard electrode potential.

Answer: The standard electrode potential is the measure of the tendency of a chemical species to gain or lose electrons under standard conditions (1 M concentration, 1 atm pressure, 25°C), relative to the standard hydrogen electrode.

Question: What is the purpose of a voltmeter in a circuit?

Answer: A voltmeter is used to measure the potential difference (voltage) between two points in a circuit.

Question: What is magnetism?

Answer: Magnetism is a force of attraction or repulsion that acts at a distance due to a magnetic field, which is caused by the motion of electric charges.

Question: How does the electrolysis of water illustrate the principles of oxidation and reduction?

Answer: The electrolysis of water illustrates oxidation and reduction by showing the reduction of  $H^+$  ions to hydrogen gas at the cathode and the

oxidation of OH<sup>-</sup> ions to oxygen gas at the anode, demonstrating the transfer of electrons in redox reactions.

Question: What is the significance of the basement membrane in epithelial tissues?

Answer: The basement membrane anchors epithelial cells, providing structural support and regulating the exchange of materials between the epithelium and underlying tissues.

Question: Describe the function of a capacitor in an electric circuit.

Answer: A capacitor stores electrical energy and releases it when needed, helping to smooth out voltage fluctuations and improve the stability of the circuit.

Question: What is the role of a catalyst in a fuel cell?

Answer: A catalyst in a fuel cell accelerates the electrochemical reactions at the electrodes, improving the efficiency and power output by lowering the activation energy required for the reactions.

Question: How does the use of renewable energy sources support environmental sustainability?

Answer: Renewable energy sources generate electricity with minimal environmental impact, reduce greenhouse gas emissions, and decrease reliance on fossil fuels. They promote sustainable energy development and environmental protection.

Question: What is the balanced chemical equation for the reaction between calcium and water?

Answer: The balanced chemical equation is:  $\text{Ca} + 2\text{H}_2\text{O} \rightarrow \text{Ca}(\text{OH})_2 + \text{H}_2$ , producing calcium hydroxide and hydrogen gas.

Question: What is the pressure exerted by a 1-meter-high column of mercury with a density of 13,600 kg/m<sup>3</sup>?

Answer: The pressure exerted is calculated using  $P = h\rho g$ . For a height of 1 m, the pressure is  $P = 1 \text{ m} \times 13,600 \text{ kg/m}^3 \times 10 \text{ m/s}^2 = 136,000 \text{ Pa}$ .

Question: Items required: three segments of nichrome wire of length 1 m having different cross-sectional areas, a copper wire segment and several segments of iron wires with the same length as the nichrome wires and having a cross-sectional area equal to the nichrome wire with the lowest cross-sectional area, two dry cells, an ammeter, a switch, a board of wood with a length of about 1 m and a breadth of about 20 cm. Connect the circuit shown in Figure 19.19 using the items above. Connect the terminal X to the end of each conductor and record the current passing through each conductor. What materials are required for the Activity ?

Answer: Three segments of nichrome wire of different cross-sectional areas, a copper wire segment, several segments of iron wire, two dry cells, an ammeter, a switch, and a wooden board.

Question: How does gas exchange occur in the alveoli?

Answer: Oxygen diffuses from the alveoli into blood capillaries, while carbon dioxide and water vapor diffuse from the blood into the alveoli to be exhaled.

Question: How is the chemical formula of calcium hydroxide written?

Answer: The chemical formula of calcium hydroxide is  $\text{Ca}(\text{OH})_2$ , indicating one calcium ion and two hydroxide ions.

Question: What is the significance of the electrochemical series in predicting the outcome of electrolysis?

Answer: The electrochemical series ranks elements based on their tendency to lose or gain electrons. It helps predict which ions will be reduced or oxidized during electrolysis.

Question: What is the pressure exerted at a depth of 2 meters in a tank with water density of  $1000 \text{ kg/m}^3$  and  $g = 10 \text{ m/s}^2$ ?

Answer: The pressure is  $20,000 \text{ Pa}$ , calculated as  $2 \text{ m} * 1000 \text{ kg/m}^3 * 10 \text{ m/s}^2$ .

Question: Why is manganese dioxide not consumed in the reaction with hydrogen peroxide?

Answer: Manganese dioxide acts as a catalyst, facilitating the reaction without undergoing any permanent chemical change.

Question: What is the deceleration of an object slowing down from  $20 \text{ m/s}$  to  $5 \text{ m/s}$  in 3 seconds?

Answer: Deceleration =  $(5 \text{ m/s} - 20 \text{ m/s}) / 3 \text{ s} = -5 \text{ m/s}^2$ .

Question: What is the role of companion cells in phloem tissue?

Answer: Companion cells are elongated cells associated with sieve tube elements. They control the activities of the sieve tube elements, which lack a nucleus.

Question: How do sound waves propagate through air?

Answer: Sound waves propagate through air as longitudinal waves, with compressions and rarefactions created by vibrating objects.

Question: What is the role of a separator in a battery?

Answer: A separator in a battery physically separates the anode and cathode while allowing the flow of ions through the electrolyte, preventing short circuits and ensuring efficient electrochemical reactions.

Question: How does the hydrated ferric oxide form during rusting?

Answer: Hydrated ferric oxide forms through further oxidation of  $\text{Fe}(\text{OH})_2$ :  
 $4\text{Fe}(\text{OH})_2 (\text{s}) + \text{O}_2 (\text{g}) \rightarrow 2(\text{Fe}_2\text{O}_3 \cdot \text{H}_2\text{O}) (\text{s}) + 2\text{H}_2\text{O} (\text{l})$ .

Question: What is neutralization?

Answer: Neutralization is the reaction between an acid and a base to form a salt and water, neutralizing the acidic and basic properties.

Question: How does the lymphatic system interact with the blood circulatory system?

Answer: The lymphatic system collects excess tissue fluid, filters it through lymph nodes, and returns it to the venous circulation via the thoracic and right lymphatic ducts.

Question: What is the role of the focal length in determining the image size in concave mirrors?

Answer: The focal length affects the distance at which rays converge, influencing the size and position of the image relative to the object.

Question: How does the release of methane (CH<sub>4</sub>) from agriculture contribute to climate change?

Answer: Methane is a potent greenhouse gas released from livestock digestion and rice paddies. It traps heat in the atmosphere, contributing significantly to global warming and climate change.

Question: How does the reaction of aluminum with hydrochloric acid demonstrate a single displacement reaction?

Answer: Aluminum displaces hydrogen from hydrochloric acid, forming aluminum chloride and hydrogen gas:  $2\text{Al} + 6\text{HCl} \rightarrow 2\text{AlCl}_3 + 3\text{H}_2$ .

Question: What is the depth of a pond with a pressure of 1,500 Pa at the bottom?

Answer: The depth of the pond can be calculated using the formula  $P = h\rho g$ . Rearranging for  $h$ , we get  $h = P / (\rho g)$ . For a pressure of 1,500 Pa,  $\rho = 1000 \text{ kg/m}^3$ , and  $g = 10 \text{ m/s}^2$ , the depth is  $h = 1,500 / (1000 * 10) = 0.15 \text{ m}$ .

Question: How does electromagnetic induction apply to credit and debit cards?

Answer: Electromagnetic induction is used in magnetic stripes on credit and debit cards, storing data that is read by inducing a current in a reader device.

Question: How does the specific heat capacity of water influence its role in the human body's temperature regulation?

Answer: Water's high specific heat capacity allows it to absorb and store large amounts of heat, helping to regulate body temperature by distributing heat throughout the body and through processes like sweating.

Question: How does the concentration of a solution change during crystallization?

Answer: The concentration increases as the solvent evaporates, causing the solute to exceed its solubility limit and crystallize.

Question: How do phloem sieve tubes transport nutrients throughout the plant?

Answer: Phloem sieve tubes, formed by end-to-end fusion of sieve tube elements with sieve plates, transport dissolved nutrients, primarily sucrose, from the leaves to other parts of the plant.

Question: What is the significance of Michael Faraday's experiments on electromagnetic induction?

Answer: Faraday's experiments established the principles of electromagnetic induction, leading to the development of electrical generators and transformers.

Question: What is the boiling point of water under one atmosphere of pressure?

Answer: The boiling point of water under one atmosphere of pressure is 100°C.

Question: How is the chemical formula of hydrogen chloride written?

Answer: The chemical formula of hydrogen chloride is HCl, indicating one hydrogen atom and one chlorine atom.

Question: What are the common salts mentioned in the document?

Answer: Common salts include sodium chloride (NaCl) and copper sulphate (CuSO<sub>4</sub>).

Question: How does an aneroid barometer measure atmospheric pressure?

Answer: An aneroid barometer measures atmospheric pressure using a sealed, air-evacuated cavity with flexible walls. Changes in pressure cause the walls to flex, moving an indicator to show the pressure on a scale.

Question: What is the valency of magnesium?

Answer: The valency of magnesium is 2.

Question: What is the electronic configuration of sodium (atomic number 11)?

Answer: The electronic configuration of sodium is 2, 8, 1.

Question: How are non-flowering seedless plants adapted to their environment?

Answer: Non-flowering seedless plants are adapted to terrestrial environments with low sunlight, shady, and wet places.

Question: What are variable resistors?

Answer: Variable resistors are resistors that allow the resistance value to be adjusted manually or by turning a screw. Examples include rheostats, pre-adjustment resistors, and volume control resistors.

Question: How does the body eliminate excess water through the kidneys?

Answer: The kidneys filter and excrete excess water in urine, maintaining fluid balance and preventing overhydration.

Question: How do you measure the current passing through a conductor using an ammeter?

Answer: Connect the ammeter in series with the conductor and read the current value displayed on the ammeter.

Question: What is the mass of a carbon (C) atom in grams?

Answer: The mass of a carbon (C) atom is  $1.993 \times 10^{-23}$  grams.

Question: How does the body respond to dehydration in terms of urine production?

Answer: During dehydration, ADH levels increase, promoting water reabsorption in the kidneys and reducing urine output to conserve water.

Question: What is the atomic number of silicon?

Answer: The atomic number of silicon is 14.

Question: How does the frequency of sound waves affect their perception by different animals?

Answer: Different animals have varying hearing ranges; for example, elephants can hear low frequencies (infra-sound), while bats can hear high frequencies (ultrasound).

Question: How does dynamic friction compare to limiting friction?

Answer: Dynamic friction is slightly less than limiting friction and acts when the objects are in relative motion.

Question: Describe the reactivity series of metals.

Answer: The reactivity series ranks metals based on their reactivity with air, water, and acids. Highly reactive metals like potassium and sodium are at the top, while less reactive metals like gold and platinum are at the bottom.

Question: What is the effect of temperature on the kinetic energy of particles in a substance?

Answer: Temperature affects the kinetic energy of particles in a substance by increasing their motion with higher temperatures and decreasing their motion with lower temperatures, influencing the substance's overall energy state.

Question: What does the slope of a displacement-time graph represent?

Answer: The slope represents the velocity of the object.

Question: How does chemical digestion differ from mechanical digestion?

Answer: Chemical digestion involves breaking down complex molecules into simpler ones through enzymatic action, making them absorbable by the body.

Question: What is the pressure exerted at a depth of 2 meters in a tank with water density of  $1000 \text{ kg/m}^3$  and  $g = 10 \text{ m/s}^2$ ?

Answer: The pressure is  $20,000 \text{ Pa}$ , calculated as  $2 \text{ m} * 1000 \text{ kg/m}^3 * 10 \text{ m/s}^2$ .

Question: What are the main features of the Domain Archaea?

Answer: The Domain Archaea includes prokaryotes that can live in extreme environments and are not sensitive to most antibiotics.

Question: How does urbanization affect the environment?

Answer: Urbanization affects the environment by increasing pollution, reducing green spaces, altering natural habitats, and contributing to climate change.

Question: Calculate the kinetic energy of a  $6 \text{ kg}$  object moving at  $4 \text{ m/s}$ .

Answer: The kinetic energy is  $48 \text{ Joules (J)}$ .

Question: What is the magnitude and direction of the resultant force if two collinear forces of  $10 \text{ N}$  and  $6 \text{ N}$  act in opposite directions?

Answer: The magnitude of the resultant force is 4 N in the direction of the 10 N force.

Question: What are the primary functions of the respiratory system's main parts?

Answer: The nasal cavity filters and moistens air, the pharynx directs air to the lungs, the larynx produces sound, the trachea conducts air, bronchi and bronchioles distribute air, and alveoli facilitate gas exchange.

Question: What are bisexual flowers?

Answer: Bisexual flowers have both male and female reproductive parts. Examples include shoe flower, passionfruit, and chilli.

Question: What is the unit of measurement for frequency?

Answer: The unit of measurement for frequency is Hertz (Hz), which represents one oscillation per second.

Question: What is the importance of using inert electrodes in electrolysis?

Answer: Inert electrodes do not participate in the electrochemical reactions, ensuring that only the desired ions are involved in the electrolysis process and preventing contamination.

Question: What is ammonification?

Answer: Ammonification is the process by which microbial activity converts nitrogenous compounds in dead organisms into ammonium compounds.

Question: Explain the concept of power and energy consumption in electric appliances, and provide examples of calculations for power and energy consumption.

Answer: Electric power and energy consumption are fundamental concepts in understanding the operation of electric appliances. Power is defined as the rate at which work is done or energy is consumed. For electric appliances, power can be calculated using the formula:

Power ( $P$ ) = Voltage ( $V$ )  $\times$  Current ( $I$ ) where power is measured in watts (W), voltage in volts (V), and current in amperes (A). Example Calculation for Power: Filament Bulb: A filament bulb connected across a 12 V power supply draws a current of 2 A. Power  $P = V \times I = 12 \times 2 = 24$  W Electric Oven: An electric oven operates under a 230 V power supply and has a power output of 2000 W. Current  $I = P/V = 2000/230 \approx 8.69$  A The energy consumed by an electric appliance over a period can be calculated using the formula: Energy ( $E$ ) = Power ( $P$ )  $\times$  Time ( $t$ ) where energy is measured in joules (J) when power is in watts and time in seconds. Example Calculation for Energy: Headlight of a Motor Car: A headlight with a power of 50 W operates for 1.5 hours. Energy  $E = P \times t = 50 \times 1.5 \times 3600 = 270,000$  J Bicycle Electric Bulb: A 6 V bicycle bulb drawing 0.6 A operates for 5 minutes. Energy  $E = V \times I \times t = 6 \times 0.6 \times 300 = 1080$  J

Question: What are the potential impacts of global warming?

Answer: Potential impacts of global warming include rising sea levels, more frequent and severe weather events, loss of biodiversity, and disruptions to agriculture and water supplies.

Question: Explain the concept of deceleration with an example.

Answer: Deceleration is negative acceleration where velocity decreases over time, such as a car slowing down from 12 m/s to 0 m/s in 4 seconds.

Question: What is the significance of the five-kingdom classification system?

Answer: The five-kingdom classification system, introduced by Robert Whittaker, helps categorize organisms into more specific groups based on their characteristics.

Question: How does a hoist used to lift vehicles work?

Answer: A hoist works by transmitting the pressure generated in the oil through a small piston to a larger piston, lifting the vehicle due to the force generated by the transmitted pressure.

Question: What are bisexual flowers?

Answer: Bisexual flowers have both male and female reproductive parts, enabling self-pollination or cross-pollination within the same flower.

Question: How do plant cells carry out photosynthesis?

Answer: Plant cells carry out photosynthesis in chloroplasts, where chlorophyll captures light energy to convert carbon dioxide and water into glucose and oxygen.

Question: What is the momentum of a 500 g object moving at 10 m/s?

Answer: The momentum is  $p = m \times v = 0.5 \times 10 = 5 \text{ kg m/s}$ .

Question: What are nucleic acids?

Answer: Nucleic acids are linear polymers made up of nucleotides.

Question: What is nuclear waste, and how is it disposed of?

Answer: Nuclear waste is radioactive and highly toxic material discarded by nuclear preparation centers and nuclear weapons. It is disposed of in deep sea or ground after being covered by thick concrete or metal casing.

Question: How can an electric current be generated using an electrochemical cell?

Answer: An electric current can be generated by setting up a reaction where electrons are transferred from one electrode (anode) to another (cathode) through an external circuit, allowing the flow of electrons.

Question: How does bile aid in lipid digestion?

Answer: Bile emulsifies lipids, breaking them into small droplets, increasing the surface area for digestive enzymes to act on them.

Question: How are fatty acids and glycerol absorbed in the small intestine?

Answer: Fatty acids and glycerol are absorbed into lacteals within the villi and transported to the lymphatic system before entering the bloodstream.

Question: What factors influence the efficiency of electrolysis?

Answer: Factors influencing efficiency include electrolyte concentration, electrode material, current density, temperature, and electrode distance.

Question: What is the principle of reversibility of light?



Answer: If the direction of a light ray is reversed, it will follow the same path backward, valid for reflections and refractions.

Question: What is the current passing through a  $6\ \Omega$  resistor connected in parallel with a 12 V power supply?

Answer: The current is  $I = V/R = 12\text{ V}/6\ \Omega = 2\text{ A}$ .

Question: How do you find the velocity of an object moving at a uniform acceleration from rest to a certain speed?

Answer: Velocity = Initial Velocity + (Acceleration \* Time)

Question: Why is it important to measure the rate of reaction under different conditions?

Answer: Measuring the rate of reaction under different conditions helps understand the factors influencing reaction kinetics and optimize industrial processes.

Question: How does the kidney filter blood and produce urine?

Answer: The kidney filters blood through nephrons, reabsorbing essential substances and excreting waste products and excess water as urine.

Question: What is the electronic configuration of magnesium?

Answer: The electronic configuration of magnesium is 2, 8, 2.

Question: How does the reduction of  $\text{H}^+$  ions at the cathode during the electrolysis of acidulated water occur?

Answer:  $\text{H}^+$  ions are reduced at the cathode by gaining electrons to form hydrogen gas:  $2\text{H}^+(\text{aq}) + 2\text{e}^- \rightarrow \text{H}_2(\text{g})$ .

Question: How does the weight of an object in water compare to its weight in air?

Answer: The weight of an object in water is less than its weight in air because the upthrust exerted by the water reduces the apparent weight of the object.

Question: What is the chemical formula of magnesium oxide?

Answer: The chemical formula of magnesium oxide is  $\text{MgO}$ , indicating one magnesium ion and one oxide ion.

Question: What is a mole in chemistry?

Answer: A mole is the amount of a substance that contains as many basic units (atoms, molecules, ions) as there are atoms in exactly 12 grams of carbon-12.

Question: How does an electrochemical gradient drive the production of ATP in chloroplasts?

Answer: In chloroplasts, an electrochemical gradient created by the transport of protons across the thylakoid membrane during photosynthesis drives the production of ATP through chemiosmosis, where protons flow back into the stroma through ATP synthase, generating ATP.

Question: How does the induced current direction change during coil rotation in a dynamo?

Answer: The induced current direction changes periodically, resulting in an alternating current as the coil rotates within the magnetic field.

Question: What is the force needed to make the resultant zero if two forces of 6 N and 4 N act in opposite directions?

Answer: A force of 10 N in the opposite direction of the combined force is needed to make the resultant zero.

Question: What is the result of connecting the positive terminals of two dry cells to a bulb?

Answer: Connecting the positive terminals of two dry cells to a bulb results in no potential difference across the bulb, and therefore, no current flow.

Question: What factors affect the resistance of a conductor?

Answer: The resistance of a conductor depends on the area of cross-section, length, and material composition of the conductor.

Question: What is the effect of inhibitors on chemical reactions?

Answer: Inhibitors slow down the reaction rate by reducing the number of effective collisions between reactant particles.

Question: How do you achieve equilibrium in an object under the action of two equal and opposite forces?

Answer: Achieve equilibrium by ensuring that the forces have equal magnitudes, act in opposite directions, and lie along the same line of action, resulting in no net force.

Question: What are atoms?

Answer: Atoms are the building units of matter, composed of subatomic particles such as protons, electrons, and neutrons.

Question: How does the induced voltage waveform look in an alternating current dynamo?

Answer: The induced voltage waveform in an alternating current dynamo is sinusoidal, alternating between positive and negative values.

Question: How do telescopes use convex lenses?

Answer: Telescopes use convex lenses to gather and focus light from distant objects, creating clear images for observation.

Question: What are electrolytes, and can you provide examples?

Answer: Electrolytes are liquids or solutions that conduct electricity. Examples include aqueous solutions of ionic compounds (e.g., sodium chloride, copper sulfate), molten ionic compounds (e.g., fused sodium chloride), and solutions of acids (e.g., hydrochloric acid, sulfuric acid).

Question: What is the chemical formula for potassium fluoride?

Answer: The chemical formula for potassium fluoride is  $\text{KF}$ .

Question: What are the safety precautions necessary when performing electrolysis?

Answer: Safety precautions for electrolysis include using appropriate personal protective equipment (PPE), ensuring proper ventilation, handling

chemicals with care, avoiding short circuits, and following correct procedures to prevent hazards like gas explosions or chemical spills.

Question: How are microwaves used in everyday life?

Answer: Microwaves are used in everyday life for cooking food in microwave ovens, as well as in communication technologies like Wi-Fi and radar.

Question: How is the chemical formula of hydrogen chloride written?

Answer: The chemical formula of hydrogen chloride is HCl, indicating one hydrogen atom and one chlorine atom.

Question: What are the observations when magnesium reacts with dilute sulfuric acid?

Answer: When magnesium reacts with dilute sulfuric acid, it dissolves and produces hydrogen gas, with the solution becoming hot:  $\text{Mg} + \text{H}_2\text{SO}_4 \rightarrow \text{MgSO}_4 + \text{H}_2$ .

Question: Materials required :- An unopened bottle of soda water (plastic), an empty bottle of the same type. Method :- Take an unopened bottle of soda water available in the market. To an identical empty bottle, add water equal in quantity to that of soda water and close the cap tightly. Now squeeze both bottles with hand and select the harder bottle. What conclusion can be drawn from Activity about the hardness of the bottles?

Answer: The harder bottle is the unopened soda water bottle, indicating that gases are dissolved under pressure, making the bottle more rigid.

Question: What is the significance of the meniscus in volumetric measurements?

Answer: The meniscus ensures accurate volume measurement by marking the correct level at the volume mark.

Question: What does it mean when the octet of electrons is complete in a molecule?

Answer: When the octet of electrons is complete, it means that the atoms in the molecule have achieved a stable configuration with eight electrons in their valence shell.

Question: How does the length of the conductor affect the force in a magnetic field?

Answer: A longer conductor increases the force in a magnetic field, as force is directly proportional to the length of the current-carrying conductor.

Question: What is the displacement of an object moving at 3 m/s for 8 seconds?

Answer: Displacement =  $3 \text{ m/s} \times 8 \text{ s} = 24 \text{ meters}$ .

Question: How is the chemical formula of phosphoric acid written?

Answer: The chemical formula of phosphoric acid is  $\text{H}_3\text{PO}_4$ , indicating three hydrogen atoms, one phosphorus atom, and four oxygen atoms.

Question: How does the polarity of water influence its role in biological systems?

Answer: The polarity of water allows it to dissolve a wide range of substances, making it an essential solvent in biological systems for transporting nutrients and waste products.

Question: What is the role of lenses in optical instruments?

Answer: Lenses in optical instruments like microscopes and telescopes magnify and focus light, enabling detailed observation of small or distant objects.

Question: How is alternating current different from direct current?

Answer: Alternating current changes direction periodically, while direct current flows in a constant direction.

Question: What is the explosive mechanism of seed dispersal?

Answer: The explosive mechanism involves the pericarp of the fruit exploding and dispersing seeds far away due to touch, moisture, or dry weather conditions.

Question: How does the induced voltage waveform look in an alternating current dynamo?

Answer: The induced voltage waveform in an alternating current dynamo is sinusoidal, alternating between positive and negative values.

Question: What are the features of vertebrates in the class Mammalia?

Answer: Vertebrates in the class Mammalia have skin covered by hair, mammary glands, sweat and sebaceous glands, ear lobes, a four-chambered heart, complete double circulation, biconcave red blood cells lacking a nucleus, and are warm-blooded with internal fertilization.

Question: What is the role of acetone in paper chromatography?

Answer: Acetone acts as the mobile phase, carrying the components of the mixture up the paper strip.

Question: What is the kinetic energy of a 7 kg object moving at 3 m/s?

Answer: The kinetic energy is 31.5 Joules (J).

Question: What is the momentum of a 10 g bullet moving at 400 m/s?

Answer: The momentum of a 10 g bullet (0.01 kg) moving at 400 m/s is  $p = 0.01 \times 400 = 4 \text{ kg m/s}$ .

Question: How does a light-emitting diode (LED) produce light?

Answer: An LED produces light through electroluminescence, where electrons recombine with holes in a semiconductor material, releasing energy in the form of photons.

Question: How is the chemical formula of calcium oxide represented?

Answer: The chemical formula of calcium oxide is  $\text{CaO}$ , indicating one calcium ion and one oxide ion.

Question: How does a function generator assist in electronic testing?

Answer: A function generator produces various waveform signals, such as sine, square, and triangle waves, used for testing, troubleshooting, and developing electronic circuits.

Question: What are the environmental concerns associated with electrochemical processes?

Answer: Environmental concerns associated with electrochemical processes include the disposal of hazardous waste, release of toxic gases, and high energy consumption. Proper waste management and energy-efficient methods are needed to mitigate these issues.

Question: What is AIDS?

Answer: AIDS, caused by the Human Immunodeficiency Virus (HIV), is a fatal disease transmitted through sexual secretions and blood. Symptoms may appear 2-15 years after infection.

Question: What elements are always present in proteins?

Answer: Carbon, Hydrogen, Oxygen, and Nitrogen are always present in proteins.

Question: What is the refractive index?

Answer: The refractive index is the ratio of the sine of the incident angle to the sine of the refracted angle for a light ray traveling between two media.

Question: What is the difference between concave and convex mirrors in terms of their reflecting surfaces?

Answer: Concave mirrors have inward-curved reflecting surfaces, while convex mirrors have outward-curved reflecting surfaces.

Question: Define natural and artificial polymers, providing examples of each, and explain the significance of biodegradable polymers.

Answer: Polymers are large molecules composed of repeating structural units called monomers. They can be classified into two main types based on their origin: natural and artificial polymers. Natural Polymers: These polymers occur naturally and are found in plants and animals. Examples include: Rubber: Derived from the latex of rubber trees. Proteins: Composed of amino acids, found in all living organisms. DNA: Carries genetic information in cells. Starch: A carbohydrate found in plants. Cellulose: A major component of plant cell walls. Artificial Polymers: These are synthetically produced through chemical processes. Examples include: Polythene (Polyethylene): Used in plastic bags and bottles. Polychloroethene (PVC): Used in pipes and vinyl flooring. Teflon (Polytetrafluoroethene): Used in non-stick cookware. Nylon: Used in textiles and ropes. Polystyrene: Used in packaging and insulation. Significance of Biodegradable Polymers: Most artificial polymers are not biodegradable, meaning they do not break down naturally in the environment, leading to pollution and waste management issues. Biodegradable polymers are designed to decompose through the action of living organisms, reducing environmental impact. Efforts are being made to develop biodegradable and photodegradable polymers that can break down more easily, addressing the environmental challenges posed by traditional plastics. The development and use of biodegradable polymers are crucial for sustainable environmental management, reducing the accumulation of plastic waste and minimizing the ecological footprint of human activities.

Question: How does the electrochemical reduction of CO<sub>2</sub> to hydrocarbons contribute to sustainable energy solutions?

Answer: The electrochemical reduction of CO<sub>2</sub> to hydrocarbons converts CO<sub>2</sub>, a greenhouse gas, into valuable fuels and chemicals using renewable electricity, contributing to sustainable energy solutions and reducing carbon emissions.

Question: What is chemical coordination, and what are its features?

Answer: Chemical coordination involves hormones secreted by endocrine glands. Hormones are organic compounds, transported through blood, produced at one site and act on another, stimulating target organs or cells.

Question: How is carbon dioxide used in fire extinguishers?

Answer: Carbon dioxide, being a non-supporter of combustion, is used in fire extinguishers to smother flames and prevent fires from spreading.

Question: What is the role of thermal radiation in heat transfer from the sun?

Answer: Thermal radiation is the primary method of heat transfer from the sun, allowing heat to travel through the vacuum of space as electromagnetic waves and warm the earth's surface.

Question: How does the diaphragm movement in a microphone relate to sound waves?

Answer: The diaphragm moves in response to sound waves, causing the attached coil to move within a magnetic field and generate an alternating current corresponding to the sound.

Question: How do plants adapt to varying environmental conditions to maintain photosynthesis?

Answer: Plants use physiological and structural adaptations, such as adjusting stomatal conductance, leaf morphology, and metabolic pathways, to maintain photosynthesis under varying environmental conditions.

Question: What are the signs and symptoms of pyelonephritis?

Answer: Symptoms of pyelonephritis include fever, chills, back or side pain, frequent urination, and blood in urine.

Question: How does the number of coil turns affect the dynamo's performance?

Answer: More coil turns increase the induced electromotive force, enhancing the dynamo's efficiency and electricity generation.

Question: What evidence can indicate a chemical reaction has occurred?

Answer: Evidence of a chemical reaction includes burning with a flame, evolution of heat, effervescence (bubbles), change in color, and precipitation (formation of a solid).

Question: What is the chemical formula for calcium oxide?

Answer: The chemical formula for calcium oxide is CaO.

Question: What is the effect of connecting two dry cells in series on the potential difference in a circuit?

Answer: Connecting two dry cells in series increases the potential difference, which can increase the current in the circuit if the resistance remains constant.

Question: Calculate the amount of sulfuric acid ( $\text{H}_2\text{SO}_4$ ) in moles in 49 grams.

Answer: The amount of sulfuric acid in 49 grams is 0.5 moles, calculated as  $49/98 = 0.5$  moles.

Question: Calculate the number of molecules in 0.2 moles of carbon dioxide ( $\text{CO}_2$ ).

Answer: The number of molecules in 0.2 moles of carbon dioxide is  $1.204 \times 10^{23}$ , calculated as  $0.2 \times 6.022 \times 10^{23}$ .

Question: Calculate the power output of a machine that does 400 J of work in 8 seconds.

Answer: The power output is 50 Watts (W).

Question: How does the speed of a rotating coil affect the generated voltage?

Answer: Faster rotation of the coil increases the rate of change of the magnetic field, generating higher voltage.

Question: How does the strength of the magnetic field affect the performance of a dynamo?

Answer: A stronger magnetic field increases the induced electromotive force, improving the dynamo's performance and electricity generation.

Question: How does solubility impact the food industry?

Answer: Solubility affects the preparation, stability, and sensory properties of food products, influencing texture, flavor, and nutritional value.

Question: What type of image is formed by a convex lens when the object is within the focal length?

Answer: A virtual, upright, and magnified image is formed.

Question: How do you calculate the amount of heat absorbed by a substance?

Answer: The amount of heat absorbed is calculated using the formula  $Q = mc\Delta T$ , where  $Q$  is the heat absorbed,  $m$  is the mass,  $c$  is the specific heat capacity, and  $\Delta T$  is the temperature change.

Question: How do inherited traits vary within a species?

Answer: Inherited traits vary within a species due to the combination of different alleles, leading to a wide range of phenotypic variations among individuals.

Question: What is the function of the plasma membrane?

Answer: The plasma membrane regulates the entry and exit of substances, maintaining the internal environment of the cell and facilitating communication with other cells.

Question: What is the velocity of a 10 kg dog if its kinetic energy is 20 J?

Answer: The velocity is 2 m/s.

Question: What is the method to observe fungi on a slice of bread?

Answer: Add a few drops of water onto a slice of bread, leave it for 2 days, obtain a small amount of the mycelium, place it on a glass slide, cover it with a coverslip, and observe it through a microscope.

Question: How does the electrolysis of copper sulfate solution demonstrate the reduction of copper ions?

Answer: The reduction of  $\text{Cu}^{2+}$  ions to copper metal at the cathode shows the electrochemical reduction process.

Question: What are electromagnetic waves?

Answer: Electromagnetic waves are waves that do not require a material medium for propagation and consist of oscillating electric and magnetic fields, such as light and radio waves.

Question: How does the mass of an object affect its weight?

Answer: The weight of an object is the force with which it is attracted towards the Earth and is calculated as  $\text{Weight} = mg$ , where  $g$  is the gravitational acceleration ( $9.8 \text{ m/s}^2$  on Earth).

Question: How do catalysts affect the activation energy of a reaction?

Answer: Catalysts lower the activation energy, making it easier for reactants to collide and form products, thus increasing the reaction rate.

Question: How much current is drawn by a 2000W electric oven operating at 230V?

Answer: The current ( $I$ ) drawn by the oven is  $I = P/V = 2000\text{W} / 230\text{V} \approx 8.69\text{A}$ .

Question: What are the adverse effects of using cosmetics excessively?

Answer: The adverse effects of using cosmetics excessively include skin irritation, allergic reactions, and the potential for long-term health issues due to harmful ingredients such as lead and mercury.

Question: What is the concept of "phenotype" in genetics?

Answer: Phenotype refers to the observable physical and physiological traits of an organism, which result from the expression of its genotype.

Question: What is the role of heat in the production of slaked lime from quicklime?

Answer: The reaction releases a significant amount of heat, indicating it is exothermic.

Question: What is the role of reforestation in environmental conservation?

Answer: Reforestation helps mitigate environmental degradation by restoring ecosystems, enhancing biodiversity, sequestering carbon, and improving soil and water quality.

Question: How do light waves differ from sound waves in terms of propagation?



Answer: Light waves are electromagnetic and can travel through a vacuum, while sound waves are mechanical and require a medium to propagate.

Question: What are the practical applications of understanding heat changes in chemical reactions?

Answer: Applications include industrial process optimization, energy production, environmental management, and scientific research.

Question: What is the displacement of an athlete who runs 200 meters on a track and finishes at the starting point?

Answer: The displacement is zero (0).

Question: How can the heat change of a neutralization reaction be experimentally determined?

Answer: By mixing known concentrations of an acid and base, measuring the temperature change, and calculating the heat change using  $Q = mc\theta$ .

Question: What are bisexual flowers?

Answer: Bisexual flowers have both male and female reproductive parts, enabling self-pollination or cross-pollination within the same flower.

Question: How are lone pairs and bond pairs represented in a Lewis structure?

Answer: In a Lewis structure, lone pairs are represented by dots, and bond pairs are represented by lines.

Question: What is the acceleration of a 6 kg object when a force of 24 N is applied?

Answer: The acceleration is  $F/m = 24/6 = 4 \text{ m/s}^2$ .

Question: How can you measure the force required to open a door using a Newton balance?

Answer: Attach a Newton balance to various points on the door and apply a perpendicular force to open it. Measure the force necessary to move the door slightly using the Newton balance.

Question: What is an individual in the context of the biosphere?

Answer: An individual is a single organism that belongs to a particular species and lives in the environment.

Question: How does a solar inverter convert energy from solar panels?

Answer: A solar inverter converts the DC electricity generated by solar panels into AC electricity, making it compatible with the power grid and household appliances.

Question: Discuss the principles and process of electrolysis, including the conventions adopted in electrolysis.

Answer: Electrolysis is a process in which electrical energy is used to drive a non-spontaneous chemical reaction. It involves the passage of an electric current through an electrolyte, causing chemical changes at the electrodes.

Principles: Electrodes: Two electrodes (anode and cathode) are immersed in an electrolyte. Electrolyte: A substance that conducts electricity by the movement of ions. Electricity Source: Provides the energy required for the

electrolysis reaction. Conventions: The electrode connected to the positive terminal of the electricity source is the anode. The electrode connected to the negative terminal is the cathode. Positive ions (cations) migrate towards the cathode and undergo reduction. Negative ions (anions) migrate towards the anode and undergo oxidation. Process: Setup: An electrolytic cell with carbon electrodes, a source of electricity, and an electrolyte (e.g., aqueous sodium chloride). Procedure: Connect the electrodes to the electricity source. Immerse the electrodes in the electrolyte. Turn on the power and observe gas bubbles at the electrodes, indicating chemical changes. Reactions: At the Cathode (Negative Electrode): Reduction:  $2\text{H}^+(\text{aq}) + 2\text{e}^- \rightarrow \text{H}_2(\text{g})$  Positive hydrogen ions gain electrons and form hydrogen gas. At the Anode (Positive Electrode): Oxidation:  $2\text{Cl}^-(\text{aq}) \rightarrow \text{Cl}_2(\text{g}) + 2\text{e}^-$  Chloride ions lose electrons and form chlorine gas. Overall Reaction:  $2\text{NaCl}(\text{aq}) + 2\text{H}_2\text{O}(\text{l}) \rightarrow \text{H}_2(\text{g}) + \text{Cl}_2(\text{g}) + 2\text{NaOH}(\text{aq})$  Applications: Electrolysis is widely used in industrial processes such as electroplating, metal refining, and the production of chemicals like chlorine and sodium hydroxide.

Question: What is the reaction of potassium bromide with chlorine gas?

Answer: Potassium bromide reacts with chlorine gas to form potassium chloride and bromine:  $2\text{KBr} + \text{Cl}_2 \rightarrow 2\text{KCl} + \text{Br}_2$ .

Question: What observations can be made when varying the concentration of hydrochloric acid in reactions with magnesium ribbon?

Answer: Higher concentrations of hydrochloric acid lead to faster gas evolution, indicating an increased reaction rate.

Question: What are the components of the extracellular matrix, and what are their functions?

Answer: The extracellular matrix is composed of proteins like collagen and elastin, and polysaccharides, providing structural support, facilitating cell adhesion, and mediating cell signaling.

Question: Calculate the power of a 12V electric bulb drawing a current of 1.5A.

Answer: The power (P) of the bulb is  $P = VI = 12\text{V} \times 1.5\text{A} = 18\text{W}$ .

Question: What is the molecular formula and structure of ethene?

Answer: The molecular formula of ethene is  $\text{C}_2\text{H}_4$ , with a structure containing a double bond between two carbon atoms, each bonded to two hydrogen atoms.

Question: What is a biomass pyramid?

Answer: A biomass pyramid is a graphical representation showing the total amount of organic matter present in different trophic levels, expressed as grams per square meter per year.

Question: What does the formula  $Q = mc\theta$  represent?

Answer: Q represents the heat change, m represents the mass of the substance, c represents the specific heat capacity, and  $\theta$  represents the temperature change.

Question: What is the purpose of a signal booster in communication systems?

Answer: A signal booster amplifies weak signals in communication systems, extending the range and improving the quality of transmissions for better reception.

Question: How is the pressure in a tire measured and why is it important?

Answer: Tire pressure is measured using a tire gauge. Proper tire pressure is important for vehicle safety, fuel efficiency, and tire longevity.

Question: How do the shapes of bacteria vary?

Answer: Bacteria can be spherical (coccus), rod-shaped (bacillus), spiral (spirillum), or comma-shaped (vibrio).

Question: What is the concentration of a solution containing 18g of glucose in 250 cm<sup>3</sup> of water?

Answer: The concentration is 0.4 mol/dm<sup>3</sup>.

Question: What are the benefits of using electrochemical methods for hydrogen production?

Answer: Electrochemical methods for hydrogen production, such as water electrolysis, offer benefits like high purity hydrogen, scalability, and the potential for integration with renewable energy sources, providing a clean and sustainable energy carrier.

Question: What are the effects of climate change on polar bear populations?

Answer: Climate change reduces sea ice habitat, affects prey availability, and increases the risk of starvation and reproductive failure for polar bears. It threatens their survival and population stability.

Question: How does the specific heat capacity of water influence its use in climate control systems?

Answer: Water's high specific heat capacity allows it to absorb and release large amounts of heat with minimal temperature change, making it effective for climate control systems in buildings and industrial processes.

Question: What are the ethical considerations of using genetic information for insurance and employment?

Answer: Ethical considerations include concerns about genetic discrimination, privacy, and the potential misuse of genetic information to deny insurance coverage or employment opportunities based on an individual's genetic risk for certain diseases.

Question: What is the function of brushing rings in an alternating current dynamo?

Answer: Brushing rings connect the rotating coil to the external circuit, allowing current to flow continuously despite the coil's rotation.

Question: What is the first ionisation energy of sodium?

Answer: The first ionisation energy of sodium is 495 kJ/mol.

Question: What is the significance of the overall electrolytic reaction for sodium chloride?

Answer: The overall electrolytic reaction for sodium chloride highlights the production of hydrogen and chlorine gases and the remaining sodium hydroxide in the solution.

Question: What is the acceleration of a 6 kg body when a force of 12 N is applied?

Answer: The acceleration is  $a = F/m = 2 \text{ m/s}^2$ .

Question: What is a mixture?

Answer: A mixture is formed by mixing two or more substances without any chemical changes, retaining their physical and chemical properties.

Question: How do you determine the equilibrium of an object under the action of two forces using a spring balance and a ring?

Answer: Attach the spring balance to the ring and pull in opposite directions with varying forces. The object remains in equilibrium when the forces are equal in magnitude and opposite in direction, resulting in no net movement.

Question: What is the function of the cerebrum?

Answer: It is responsible for perception, sensory information processing, high mental activities like learning and thinking, and voluntary muscle control.

Question: What are the potential impacts of deforestation on indigenous communities?

Answer: Deforestation threatens the livelihoods, culture, and traditional knowledge of indigenous communities. It reduces access to natural resources and disrupts their way of life.

Question: What is the critical angle for water?

Answer: The critical angle for water is 49 degrees.

Question: How is the heat of reaction calculated for 1 mol of NaOH reacting with 1 mol of HCl?

Answer: By calculating the heat change for 0.1 mol of NaOH reacting with 0.1 mol of HCl and then scaling up to 1 mol, resulting in  $42 \text{ kJ mol}^{-1}$ .

Question: How is carbon dioxide used in the production of fizzy drinks?

Answer: Carbon dioxide dissolves in water to form carbonic acid, giving fizzy drinks their characteristic effervescence and taste.

Question: What are the deficiency symptoms of iron?

Answer: Deficiency symptoms of iron include anemia, sleepiness, and hypoactive nature.

Question: How do lenses help in vision correction for farsightedness?

Answer: Lenses for farsightedness use convex lenses to converge light rays before they enter the eye, aiding in clear vision of close objects.

Question: How is the relative atomic mass of an element defined?

Answer: The relative atomic mass of an element is defined as the weighted average mass of the atoms in a naturally occurring sample of the element, compared to  $1/12$  of the mass of a carbon-12 atom.

Question: How is the chyme formed in the stomach?

Answer: Chyme is formed by the mixing and breaking down of food with gastric juice, resulting in a semi-liquid mixture that moves to the small intestine.

Question: What substances are contained in gastric juice, and what are their functions?

Answer: Gastric juice contains hydrochloric acid (HCl), which activates pepsin for protein digestion, and the enzyme pepsin, which breaks down proteins into polypeptides.

Question: What is the boiling point of ethanol?

Answer: The boiling point of ethanol is  $78^{\circ}\text{C}$ .

Question: What is the resultant force if two forces of 10 N and 6 N act in the same direction?

Answer: The resultant force is 16 N in the same direction.

Question: How does mass affect gravitational potential energy?

Answer: Mass affects gravitational potential energy directly; increasing the mass increases the potential energy proportionally.

Question: What does an increase in temperature indicate in a chemical reaction?

Answer: An increase in temperature indicates an exothermic reaction where heat is released.

Question: What is the role of chloroplasts in plant cells?

Answer: Chloroplasts contain chlorophyll and other pigments that capture light energy, facilitating the process of photosynthesis in plant cells.

Question: How does the release of sulfur dioxide ( $\text{SO}_2$ ) contribute to the formation of acid rain?

Answer: The release of sulfur dioxide ( $\text{SO}_2$ ) contributes to the formation of acid rain by reacting with water vapor in the atmosphere to form sulfuric acid, which then falls to the ground as acid rain.

Question: What are the features of smooth muscle tissue?

Answer: Smooth muscle tissue is composed of spindle-shaped, unbranched cells with a single central nucleus, lacks striations, does not fatigue quickly, and is controlled involuntarily.

Question: How are waves used in medical treatments?

Answer: Waves, such as ultrasound and X-rays, are used in medical imaging and treatments to diagnose and treat various conditions.

Question: What is the nature of the image when the object distance is greater than twice the focal length?

Answer: The image is diminished, real, and inverted, formed between the focal length and twice the focal length on the opposite side.

Question: What is the importance of green spaces in urban areas?

Answer: Green spaces in urban areas are important for providing recreational opportunities, improving air quality, supporting biodiversity, and enhancing mental and physical well-being.

Question: What is the displacement of a body moving at a constant velocity of 6 m/s for 8 seconds?

Answer: The displacement is calculated using the formula: Displacement = Velocity  $\times$  Time. Therefore, Displacement = 6 m/s  $\times$  8 s = 48 meters.

Question: How do gamma rays differ from other electromagnetic waves in terms of energy?

Answer: Gamma rays have the highest energy and frequency among electromagnetic waves, making them highly penetrating and useful in medical treatments and nuclear physics.

Question: What are free electrons?

Answer: Free electrons are electrons in the outermost shell of metallic atoms that can easily detach from the atom and move freely.

Question: What is an electric current?

Answer: An electric current is the flow of electric charges through a conductor.

Question: How does the smooth endoplasmic reticulum contribute to detoxification?

Answer: The smooth endoplasmic reticulum contains enzymes that detoxify harmful substances, such as drugs and alcohol, by converting them into less toxic compounds.

Question: What is the resultant force?

Answer: The resultant force is the single force that gives the same result as that of all the contributing forces.

Question: What are the functions of epithelial tissue?

Answer: Epithelial tissue functions include lining free surfaces for protection, absorption of nutrients, perception of stimuli, secretion of mucus, and filtration of blood.

Question: How does a solar charge controller protect batteries in solar power systems?

Answer: A solar charge controller regulates the charging and discharging of batteries in solar power systems, preventing overcharging, deep discharge, and extending battery life.

Question: What are the environmental impacts of using fossil fuels for energy?

Answer: The environmental impacts of using fossil fuels for energy include greenhouse gas emissions, air and water pollution, habitat destruction, and contribution to climate change.

Question: What is the chemical formula for magnesium sulfide?

Answer: The chemical formula for magnesium sulfide is  $\text{MgS}$ .

Question: Calculate the amount of oxygen in moles in 32 grams of oxygen ( $\text{O}_2$ )?

Answer: The amount of oxygen in 32 grams is 1 mole, calculated as  $32/32 = 1$  mole.

Question: How do lubricants reduce friction?

Answer: Lubricants reduce friction by forming a thin layer between contact surfaces, minimizing direct contact and thus reducing the frictional force.

Question: How does the thermal conductivity of a material influence its use in cooking utensils?

Answer: Materials with high thermal conductivity, like metals, are used in cooking utensils because they transfer heat efficiently, ensuring even cooking and quick heating.

Question: How are essential oils extracted by steam distillation?

Answer: Steam passes through plant parts, vaporizing the essential oils, which are then condensed and separated from water due to immiscibility.

Question: Describe the motion of an object traveling at a uniform speed of 4 m/s for 10 seconds.

Answer: The object travels a distance of 40 m.

Question: What is the significance of a virus in biological studies?

Answer: Viruses are significant because they demonstrate characteristics of both living and non-living entities. They can only replicate within a host cell, making them unique subjects for studying life processes.

Question: What is the significance of the temperature change in a chemical reaction?

Answer: It indicates the amount of heat evolved or absorbed, helping classify the reaction as exothermic or endothermic.

Question: Why does an object placed on a table not fall down despite the gravitational force acting on it?

Answer: An object placed on a table does not fall down because the gravitational force (weight) acting downwards is balanced by the perpendicular reaction force exerted upwards by the table, resulting in equilibrium.

Question: What is the resultant force when two forces of 10 N and 6 N act in the same direction?

Answer: The resultant force is 16 N in the same direction.

Question: What is the significance of the absence of chloroplasts in meristematic cells?

Answer: The absence of chloroplasts in meristematic cells allows them to focus on active cell division and growth rather than energy production through photosynthesis.

Question: Who formulated the three laws of motion?

Answer: Sir Isaac Newton formulated the three laws of motion based on his studies.

Question: How do viruses infect plants?

Answer: Viruses infect plants by entering through wounds or being transmitted by vectors such as insects, then replicating within plant cells and causing symptoms such as mosaic patterns, stunted growth, and wilting.

Question: How can mixtures be classified based on the uniformity of their components?

Answer: Mixtures can be classified as homogeneous mixtures, where the composition is uniform throughout, and heterogeneous mixtures, where the composition is not uniform.

Question: What factors affect the heat capacity of an object?

Answer: The heat capacity of an object depends on the substance it is made of and its mass.

Question: What are the standards of binomial nomenclature?

Answer: The standards include using Latin or Greek for names, capitalizing the first letter of the generic name, underlining handwritten names, and italicizing printed names.

Question: How do you apply a couple of forces to rotate a rod without causing linear motion?

Answer: Apply a couple of forces by exerting equal and opposite forces along the same plane at different points on the rod, resulting in rotation around a point between the forces without causing linear motion.

Question: How does the number of coil turns affect the dynamo's performance?

Answer: More coil turns increase the induced electromotive force, enhancing the dynamo's efficiency and electricity generation.

Question: How do concave lenses form images?

Answer: Concave lenses diverge light rays, creating virtual, upright, and smaller images of objects.

Question: Explain the operation of a light sensor in automatic lighting systems.

Answer: A light sensor detects ambient light levels and controls lighting systems to turn on or off based on the detected light, providing energy-efficient and automatic lighting control.

Question: What is the significance of the nuclear envelope in gene regulation?

Answer: The nuclear envelope controls the exchange of materials between the nucleus and cytoplasm, regulating the accessibility of transcription factors and RNA molecules, influencing gene expression.



Question: What is the main way to identify different species in the biosphere?

Answer: Different species can be identified by observing their external features, which are inherited and passed down from generation to generation.

Question: How is the Celsius scale defined?

Answer: The Celsius scale is defined by taking the temperature at which pure ice melts into liquid water under one atmosphere as  $0^{\circ}\text{C}$  and the temperature at which water vaporizes into steam under the same pressure as  $100^{\circ}\text{C}$ .

Question: What is the role of carbon dioxide in photosynthesis?

Answer: Carbon dioxide acts as a raw material for photosynthesis, enabling plants to produce food and supporting the food chain for all living beings.

Question: How does the release of greenhouse gases contribute to the greenhouse effect?

Answer: The release of greenhouse gases contributes to the greenhouse effect by trapping heat in the Earth's atmosphere, leading to an increase in global temperatures and climate change.

Question: What is an ecosystem?

Answer: An ecosystem is all the communities and the non-living components with which they interact in a particular area.

Question: What is the function of the corpus luteum in the menstrual cycle?

Answer: The corpus luteum forms from the remains of the graafian follicle after ovulation and secretes progesterone to maintain the uterine lining for potential pregnancy.

Question: How do magnesium and sulfur atoms achieve a stable electronic configuration in magnesium sulfide?

Answer: Magnesium atoms lose electrons to form  $\text{Mg}^{2+}$  ions, and sulfur atoms gain electrons to form  $\text{S}^{2-}$  ions. The electrostatic attraction between these ions forms magnesium sulfide ( $\text{MgS}$ ).

Question: What is the function of a moving coil magnetic microphone?

Answer: A moving coil magnetic microphone converts sound waves into electrical signals by vibrating a coil in a magnetic field, inducing an alternating current.

Question: What is the taste of acids, and why should laboratory acids not be tasted?

Answer: Acids have a sour taste, but laboratory acids should not be tasted because they can be corrosive and harmful.

Question: What is the importance of catalysts in everyday life?

Answer: Catalysts play a crucial role in various processes, such as food digestion, pollution control, and manufacturing of chemicals.

Question: What is the chemical formula for sodium nitrate?

Answer: The chemical formula for sodium nitrate is  $\text{NaNO}_3$ , indicating one sodium ion and one nitrate ion.

Question: How is electrochemical impedance spectroscopy used to study electrochemical systems?

Answer: Electrochemical impedance spectroscopy (EIS) measures the impedance of an electrochemical system over a range of frequencies, providing information on reaction kinetics, charge transfer resistance, and diffusion processes, useful for characterizing batteries, fuel cells, and corrosion.

Question: What are the three types of meristematic tissues?

Answer: The three types of meristematic tissues are apical meristems, intercalary meristems, and lateral meristems.

Question: What is the resultant force when two forces of 4 N and 6 N act in opposite directions?

Answer: The resultant force is 2 N in the direction of the 6 N force.

Question: What are the observations when burning a piece of cleaned magnesium ribbon?

Answer: When a piece of cleaned magnesium ribbon is burned, it burns with a bright white flame, leaving behind a white powder, which is magnesium oxide.

Question: Describe the working principle of a transformer.

Answer: A transformer transfers electrical energy between two or more circuits through electromagnetic induction, with primary and secondary windings that can step up or step down voltage levels.

Question: What adaptations do fruits dispersed by water have?

Answer: Fruits dispersed by water have porous or fibrous pericarps, floatation-suited pericarps, and air-filled shells.

Question: What is the significance of the renal pelvis in the kidney?

Answer: The renal pelvis collects urine from the nephrons and funnels it into the ureters for transport to the bladder.

Question: What is the valency of silicon?

Answer: The valency of silicon is 4.

Question: How does the rate of change of the magnetic field affect the induced voltage?

Answer: A faster rate of change of the magnetic field induces a higher voltage, as the induced electromotive force is directly proportional to the rate of change.

Question: What observations indicate that chlorine gas is produced during the electrolysis of sodium chloride solution?

Answer: The production of chlorine gas is indicated by the formation of gas bubbles at the anode and the characteristic greenish-yellow color and strong odor of chlorine.

Question: What does the formula  $Q = mc\theta$  represent?

Answer:  $Q$  represents the heat change,  $m$  represents the mass of the substance,  $c$  represents the specific heat capacity, and  $\theta$  represents the temperature change.

Question: What is the purpose of a digital-to-analog converter (DAC) in electronic systems?

Answer: A DAC converts digital signals into corresponding analog voltages, enabling digital devices to interface with analog systems and control real-world analog processes.

Question: What is the importance of understanding electromagnetism in technology development?

Answer: Understanding electromagnetism is crucial for designing and operating various devices, including motors, generators, transformers, and medical equipment.

Question: What is the role of the electrolyte in an electrolytic cell?

Answer: The electrolyte in an electrolytic cell conducts electricity by allowing ions to move between electrodes, enabling the chemical reactions necessary for electrolysis.

Question: What is the importance of the circulatory system in the human body?

Answer: The circulatory system transports oxygen, nutrients, hormones, and waste products throughout the body, maintaining homeostasis.

Question: What is the reaction between zinc and sulfuric acid?

Answer: Zinc reacts with sulfuric acid to form zinc sulfate and hydrogen gas:  $\text{Zn} + \text{H}_2\text{SO}_4 \rightarrow \text{ZnSO}_4 + \text{H}_2$ .

Question: How does the body manage glucose levels through kidney function?

Answer: The kidneys filter glucose from the blood, reabsorbing it in the proximal tubules to prevent glucose loss in urine.

Question: What occurs when zinc reacts with copper sulfate solution?

Answer: Zinc displaces copper from copper sulfate, forming zinc sulfate and copper:  $\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$ .

Question: How does the surface area of a reactant influence the rate of a chemical reaction?

Answer: A larger surface area provides more collision sites for reactants, increasing the rate of reaction.

Question: Describe the equilibrium of a child sitting on a swing in terms of forces.

Answer: The child remains in equilibrium because the forces exerted by the two ropes balance the weight of the child. These forces are coplanar and parallel, and their magnitudes add up to equal the weight of the child.

Question: How do ultrasound waves help in examining the heart?

Answer: Ultrasound waves are used to visualize the heart's internal structures, measure blood flow, and assess the heart's size and function.

Question: How does a forward-biased p-n junction behave?

Answer: A forward-biased p-n junction allows current to flow across the junction by thinning down the depletion region when the external potential difference is sufficiently large.

Question: How do muscles generate movement?

Answer: Muscles generate movement by contracting, pulling on tendons attached to bones, and creating motion at joints.

Question: What is an example that illustrates Newton's third law of motion?

Answer: An example is a balloon releasing air and moving in the opposite direction due to the reaction force exerted by the escaping air.

Question: What is the role of manganese dioxide in the decomposition of hydrogen peroxide?

Answer: Manganese dioxide acts as a catalyst, increasing the rate of decomposition without being consumed in the reaction.

Question: What is the unit for measuring velocity?

Answer: The unit for measuring velocity is meters per second (m/s).

Question: How does increasing the roughness of sandpaper affect the limiting frictional force?

Answer: Increasing the roughness of sandpaper increases the limiting frictional force, as rougher surfaces provide more resistance to motion.

Question: How does the specific heat capacity of water influence its use in climate control systems?

Answer: Water's high specific heat capacity allows it to absorb and release large amounts of heat with minimal temperature change, making it effective for climate control systems in buildings and industrial processes.

Question: How is glucose produced during photosynthesis stored in plants?

Answer: Glucose produced during photosynthesis is temporarily stored as starch in leaves and later converted to sucrose for transport to other tissues.

Question: What is the role of genetic counseling in managing inherited disorders?

Answer: Genetic counseling provides individuals and families with information about the risks, inheritance patterns, and implications of genetic disorders, helping them make informed decisions about their health and reproduction.

Question: What is the significance of the nuclear envelope in gene regulation?

Answer: The nuclear envelope controls the exchange of materials between the nucleus and cytoplasm, regulating the accessibility of transcription factors and RNA molecules, influencing gene expression.

Question: How does electroplating contribute to the manufacturing of decorative items?

Answer: Electroplating applies a thin metallic layer with desirable properties, such as luster and resistance to tarnishing, onto decorative items.

Question: How does the electrolysis of acidulated water produce hydrogen gas?

Answer: Hydrogen gas is produced at the cathode by the reduction of H<sup>+</sup> ions:  $2\text{H}^+ (\text{aq}) + 2\text{e}^- \rightarrow \text{H}_2 (\text{g})$ .

Question: How does a compressed gas exert pressure?

Answer: A compressed gas exerts pressure due to the force of the gas molecules colliding with the walls of the container. The more the gas is compressed, the higher the pressure.

Question: What is the role of manganese dioxide in the decomposition of hydrogen peroxide?

Answer: Manganese dioxide acts as a catalyst, increasing the rate of decomposition without being consumed in the reaction.

Question: What is the stable electronic configuration of neon?

Answer: The stable electronic configuration of neon is 2, 8.

Question: What components are essential for the operation of a bicycle dynamo?

Answer: Essential components of a bicycle dynamo include the rotating coil, magnetic field, mechanical connection to the tire, and electrical circuit.

Question: How does the boiling point of a mixture affect its separation by distillation?

Answer: Components with lower boiling points vaporize first, allowing for their separation from those with higher boiling points.

Question: How can animal and plant cells be studied in a lab?

Answer: Animal cells can be studied by observing cheek cells, and plant cells can be studied by observing onion epidermal cells under a light microscope.

Question: What is the function of the commutator in maintaining motor efficiency?

Answer: The commutator alternates the current direction, preventing reverse motion and ensuring continuous, efficient rotation.

Question: Explain the concept of a concentration cell.

Answer: A concentration cell is an electrochemical cell where the electrodes are made of the same material, but the electrolyte concentrations differ. The cell generates a potential difference due to the concentration gradient, driving the flow of ions from high to low concentration.

Question: What are the uses of Sodium chloride?

Answer: Sodium chloride is used to flavor food, preserve food, produce chemicals like chlorine and hydrochloric acid, make sodium hydroxide, and glaze earthenware.

Question: How did Mendel's experiments demonstrate the concept of dominant and recessive traits?

Answer: Mendel's experiments demonstrated that dominant traits mask recessive traits in the F1 generation, but recessive traits reappear in the F2 generation, showing the principles of dominance and recessiveness.

Question: What are the differences between monocots and dicots in terms of flower structure?

Answer: Monocot flowers are trimerous (parts in threes), while dicot flowers are tetra- or pentamerous (parts in fours or fives).

Question: How do sound waves interact with solid objects?

Answer: Sound waves can cause solid objects to vibrate, transferring energy through the material and potentially amplifying the sound.

Question: What is the role of tracheids in xylem tissue?

Answer: Tracheids are elongated, spindle-shaped cells that help in the transportation of water and also provide structural support.

Question: How does a Hall effect sensor detect magnetic fields?

Answer: A Hall effect sensor detects magnetic fields by generating a voltage proportional to the magnetic field strength, used in position sensing, speed detection, and current measurement applications.

Question: How do geneticists use linkage analysis to identify disease genes?

Answer: Geneticists use linkage analysis to identify disease genes by studying families with a history of a genetic disorder, tracking the inheritance of genetic markers linked to the disease, and narrowing down the chromosomal region where the disease gene is located.

Question: What happens during the menstrual phase of the uterine cycle?

Answer: During the menstrual phase, the uterine lining degrades and is expelled from the body as menstrual flow, typically lasting about four days.

Question: How does kidney function influence the body's fluid balance?

Answer: The kidneys regulate fluid balance by adjusting urine production, influenced by hormones like ADH and aldosterone.

Question: What is the role of a potentiostat in conducting electrochemical experiments?

Answer: A potentiostat controls the potential of the working electrode relative to a reference electrode while measuring the current flow, allowing precise control and analysis of electrochemical reactions, kinetics, and mechanisms.

Question: Calculate the power output of a machine that does 150 J of work in 3 seconds.

Answer: The power output is 50 Watts (W).

Question: How does temperature affect the solubility of solids in liquids?

Answer: The solubility of solids in liquids generally increases with an increase in temperature.

Question: What adaptations do alveoli have for efficient gas exchange?

Answer: Alveoli have thin walls, moist surfaces, a rich blood supply, and a large number of sacs to maximize the surface area for gas exchange.

Question: What is binomial nomenclature?

Answer: Binomial nomenclature is a system of naming organisms using two epithets (a generic name and a specific epithet) introduced by Carolus Linnaeus in 1753. It is regulated by the International Commission on Botanical Nomenclature (ICBN) and the International Commission on Zoological Nomenclature (ICZN).

Question: What is the chemical formula for calcium sulfate?

Answer: The chemical formula for calcium sulfate is  $\text{CaSO}_4$ .

Question: What are the methods of dispersal of fruits and seeds?

Answer: The four principal methods of dispersal are by animals, water, wind, and explosive mechanisms.

Question: Describe the reaction between aluminum and copper sulfate solution.

Answer: Aluminum displaces copper from copper sulfate, forming aluminum sulfate and copper:  $2\text{Al} + 3\text{CuSO}_4 \rightarrow \text{Al}_2(\text{SO}_4)_3 + 3\text{Cu}$ .

Question: How does deforestation affect the water cycle?

Answer: Deforestation affects the water cycle by reducing transpiration, altering precipitation patterns, increasing runoff and soil erosion, and reducing the ability of forests to regulate water flow.

Question: How does the diaphragm movement in a microphone relate to sound waves?

Answer: The diaphragm moves in response to sound waves, causing the attached coil to move within a magnetic field and generate an alternating current corresponding to the sound.

Question: What is the chemical formula for magnesium chloride?

Answer: The chemical formula for magnesium chloride is  $\text{MgCl}_2$ .

Question: How is the displacement of a body moving at a uniform acceleration found using the shaded area under the velocity-time graph?

Answer: The displacement is found by calculating the area of the shaded region under the velocity-time graph, which represents the total displacement.

Question: What is the function of mitochondria in cellular respiration?

Answer: Mitochondria generate ATP through cellular respiration, converting glucose and oxygen into energy, carbon dioxide, and water, powering cellular activities.

Question: What are the features of invertebrates in the phylum Mollusca?

Answer: Invertebrates in the phylum Mollusca are triploblastic, soft-bodied animals with a body divided into head, visceral mass, and muscular foot, and some have internal and external shells made of  $\text{CaCO}_3$ .

Question: How does electromagnetic induction enable the operation of a moving coil microphone?

Answer: Electromagnetic induction enables the microphone to convert sound waves into electrical signals by inducing a current in the vibrating coil.

Question: What are the typical capacitance values used for smoothing in rectification circuits?

Answer: Typical capacitance values used for smoothing in rectification circuits range from  $1000\ \mu\text{F}$  to  $2000\ \mu\text{F}$ , depending on the required smoothness and load.

Question: What are the features of vertebrates in the class Mammalia?

Answer: Vertebrates in the class Mammalia have skin covered by hair, mammary glands, sweat and sebaceous glands, ear lobes, a four-chambered heart, complete double circulation, biconcave red blood cells lacking a nucleus, and are warm-blooded with internal fertilization.

Question: How does the depth of water in a container affect the pressure at the bottom?

Answer: The pressure at the bottom of a water container increases with depth, as it is proportional to the height of the water column above the bottom.

Question: What is the quality of sound?

Answer: Quality of sound, or timbre, allows us to distinguish different sounds with the same pitch and loudness, such as the difference between a piano and a violin.

Question: What is a tertiary consumer?

Answer: A tertiary consumer is a carnivore that feeds on secondary consumers.

Question: How do geneticists study the function of non-coding DNA?

Answer: Geneticists study the function of non-coding DNA by analyzing its role in regulating gene expression, investigating its involvement in chromatin structure, and identifying non-coding RNAs that play crucial roles in cellular processes.

Question: Explain the equilibrium of a child sitting on a swing in terms of forces.

Answer: A child sitting on a swing remains in equilibrium because the sum of the forces exerted by the two ropes ( $F_1$  and  $F_2$ ) is equal to the weight of the child. These forces balance each other, keeping the child at rest.

Question: What are the repeating units in polythene?

Answer: The repeating units in polythene are  $-\text{CH}_2-\text{CH}_2-$ .



Question: What are the two groups of non-flowering plants?

Answer: Non-flowering plants are divided into non-flowering seedless plants and non-flowering seed plants.

Question: Where is starch found?

Answer: Starch is found in grains, yams, jak, bread, and fruits.

Question: Describe the role of an electricity meter in monitoring energy consumption.

Answer: An electricity meter monitors energy consumption by recording the total kilowatt hours (kWh) of electricity used by the household, providing data for billing and energy management.

Question: What is the significance of the color change in pH papers?

Answer: The color change in pH papers indicates the pH value of a solution, helping to determine its acidic or basic nature.

Question: How do infrared rays contribute to heat transfer?

Answer: Infrared rays are a form of heat radiation that transfers energy from warm objects to cooler surroundings, contributing to thermal energy transfer.

Question: What is the process of catabolism?

Answer: Catabolism is the process of breaking down complex compounds into simple compounds within the body, releasing energy.

Question: What is aerial layering?

Answer: Aerial layering is used for twigs high above the ground. A ring of bark is removed, and a mixture of compost and coir dust is placed around the area and tied with a strip of polythene. After a few weeks, roots develop, and the twig is separated from the mother plant.

Question: How do you determine the number of moles in a given mass of a compound?

Answer: The number of moles in a given mass of a compound is determined by dividing the mass by the molar mass of the compound,  $n = m/M$ .

Question: What is the reaction between aluminum and copper sulfate solution?

Answer: Aluminum displaces copper from copper sulfate, forming aluminum sulfate and copper:  $2\text{Al} + 3\text{CuSO}_4 \rightarrow \text{Al}_2(\text{SO}_4)_3 + 3\text{Cu}$ .

Question: What is the significance of the perpendicular distance in the moment of a couple of forces?

Answer: The perpendicular distance in the moment of a couple of forces determines the magnitude of the moment. A greater distance results in a larger moment for the same force, enhancing the rotational effect.

Question: Explain the principle of operation of an electric motor.

Answer: An electric motor converts electrical energy into mechanical energy through the interaction of magnetic fields in the rotor and stator, causing the rotor to rotate.

Question: How do bacteria reproduce?

Answer: Bacteria reproduce asexually through binary fission, and cyanobacteria can reproduce by fragmentation and budding.

Question: How are bladder stones treated using ultrasound waves?

Answer: Bladder stones are blasted using high-frequency ultrasound waves in a process known as lithotripsy.

Question: What are minerals and their importance?

Answer: Minerals are important nutrient constituents for life processes in organisms, absorbed as trace or macro elements.

Question: What are some uses of sodium?

Answer: Sodium is used in the production of sodium cyanide for extracting gold and silver, making sodium amalgam as a reducing agent in organic chemistry, extracting metals like titanium and zirconium, producing indigo dye, and manufacturing street lamps with a yellow glow.

Question: What is the relationship between mass and heat capacity?

Answer: The heat capacity of an object is directly proportional to its mass. Larger masses have higher heat capacities if they are made of the same substance.

Question: What is the result of increasing the weight of an object on the limiting frictional force?

Answer: Increasing the weight of an object increases the limiting frictional force because the normal reaction force increases.

Question: How does the high specific heat capacity of water influence its use in cooling systems?

Answer: The high specific heat capacity of water allows it to absorb and store large amounts of heat energy, making it effective for use in cooling systems.

Question: What are the different types of muscle tissue?

Answer: There are three types of muscle tissue: skeletal (voluntary movement), cardiac (heart contractions), and smooth (involuntary movements in organs).

Question: How do gamma rays differ from radio waves in terms of frequency and energy?

Answer: Gamma rays have much higher frequencies and energy compared to radio waves, making them more penetrating and energetic.

Question: What are some uses of Sodium hydroxide?

Answer: Sodium hydroxide is used in the production of soap, paper, artificial silk, and paints, and in petroleum refining.

Question: How do telescopes use convex lenses?

Answer: Telescopes use convex lenses to gather and focus light from distant objects, creating clear images for observation.

Question: What are the by-products of the industrial production of sodium metal using the Downs cell?

Answer: The by-products include chlorine gas, which can be used in producing hydrochloric acid and disinfectants.

Question: How can water conservation help address water scarcity?

Answer: Water conservation helps address water scarcity by reducing water waste, improving water use efficiency, and promoting sustainable water management practices.

Question: What is the unit of acceleration?

Answer: The unit of acceleration is meters per second squared ( $\text{m/s}^2$ ).

Question: How do bacteria acquire genetic diversity?

Answer: Bacteria acquire genetic diversity through mechanisms such as mutation, horizontal gene transfer (conjugation, transformation, and transduction), and recombination.

Question: What is the valency of calcium?

Answer: The valency of calcium is 2.

Question: How does habitat destruction impact wildlife populations?

Answer: Habitat destruction reduces available resources, fragments populations, decreases genetic diversity, and increases vulnerability to environmental changes and human activities. It leads to declines in wildlife populations.

Question: How do geneticists study the inheritance of traits in humans?

Answer: Geneticists study the inheritance of traits in humans by analyzing family pedigrees, conducting genetic tests, and studying the genotypes and phenotypes of individuals.

Question: How is the resultant force of two forces acting along the same direction demonstrated in the Activity to demonstrate collinear forces?

Answer: It is demonstrated by using Newton balances to show that the sum of the forces from two balances is equal to the force measured by a third balance.

Question: How does pressure affect the rate of reaction in gases, as shown in Fig. 17.1?

Answer: Higher pressure increases the number of collisions per unit time, resulting in a higher rate of reaction.

Question: What is the chemical formula for lithium oxide?

Answer: The chemical formula for lithium oxide is  $\text{Li}_2\text{O}$ .

Question: How does particle size influence the rate of reaction?

Answer: Smaller particle size increases the surface area, leading to more collision sites and a faster rate of reaction.

Question: What is the significance of atmospheric pressure in weather prediction?

Answer: Atmospheric pressure is a key factor in weather prediction as it influences wind patterns, precipitation, and temperature changes. High pressure typically brings clear weather, while low pressure can indicate stormy conditions.

Question: How do geneticists study the genetic basis of behavior?

Answer: Geneticists study the genetic basis of behavior by analyzing genetic differences between individuals, using animal models, and conducting twin and family studies to understand the heritability of behavioral traits.

Question: What forms of energy conversion occur in an induction cooker and a microwave oven?

Answer: In an induction cooker, electric energy is converted into heat. In a microwave oven, electric energy is converted into heat to cook food.

Question: What is the principle behind the operation of a bicycle dynamo?

Answer: The principle behind a bicycle dynamo is electromagnetic induction, where mechanical rotation induces an electromotive force in the coil.

Question: What are the stages of the menstrual cycle in the uterus?

Answer: The stages of the menstrual cycle in the uterus are the menstrual phase (degradation and expulsion of the uterine wall), proliferation phase (rebuilding of the uterine wall), and secretory phase (thickening and increased blood supply of the uterine wall).

Question: How many focal points does a lens have, and why?

Answer: A lens has two focal points, one on each side, because light can enter from either side of the lens.

Question: What elements are present in lipids?

Answer: Lipids contain Carbon, Hydrogen, and Oxygen.

Question: What are the benefits of sustainable agricultural practices?

Answer: Sustainable agricultural practices enhance soil health, reduce chemical inputs, promote biodiversity, and support long-term productivity. They contribute to environmental sustainability and food security.

Question: What is the role of phospholipids in cell membranes?

Answer: Phospholipids are a major component of cell membranes, forming a bilayer that provides structure and regulates the movement of substances in and out of the cell.

Question: What is asexual reproduction?

Answer: Asexual reproduction occurs by spores or vegetative parts from a matured organism, resulting in offspring that are more or less like the maternal organism. No gametes are produced in this process.

Question: What are the ethical considerations of germline gene editing?

Answer: Ethical considerations of germline gene editing include concerns about the long-term effects on future generations, the potential for unintended consequences, and the moral implications of altering the

human genome.

Question: What happens to the induced current when the coil in a dynamo is vertical?

Answer: When the coil is vertical, the induced current becomes zero as the conductors do not intersect the magnetic field lines.

Question: How do you achieve equilibrium in a system of forces acting on an object suspended by multiple strings?

Answer: Achieve equilibrium by ensuring that the forces exerted by the strings balance the weight of the object. The tensions in the strings must be equal and opposite to the weight, and their lines of action must intersect at a common point.

Question: What is the significance of the Kelvin scale in measuring temperature?

Answer: The Kelvin scale is significant for scientific measurements because it starts at absolute zero, providing a direct relationship between temperature and thermal energy.

Question: What precautions should be taken when preparing a solution of a specific concentration?

Answer: Ensure cleanliness, accurate weighing, proper mixing, and prevent contamination.

Question: What is the significance of the lattice structure in determining the properties of ionic compounds?

Answer: The lattice structure in ionic compounds provides stability, high melting and boiling points, and electrical conductivity in the molten and aqueous states due to the strong electrostatic forces between ions.

Question: How does the speed of a rotating coil influence the dynamo's output?

Answer: A faster rotating coil increases the rate of change of the magnetic field, generating higher voltage and more electrical power.

Question: How does the specific heat capacity of concrete compare to other building materials?

Answer: Concrete has a higher specific heat capacity compared to many other building materials, meaning it can absorb and store more heat energy, making it useful for thermal mass in buildings.

Question: Describe the acceleration of an object moving in a straight line from 0 m/s to 12 m/s in 6 seconds.

Answer: The acceleration is  $2 \text{ m/s}^2$ .

Question: What is atmospheric pressure and how is it created?

Answer: Atmospheric pressure is the pressure exerted by the weight of the air above a point on Earth's surface. It is created by the gravitational force acting on the air molecules.

Question: What is the function of the gynoecium?

Answer: The gynoecium, the female reproductive structure, contains ovules in the ovary, which are the female gamete cells of the flower.

Question: How do you calculate the relative atomic mass of an element?

Answer: The relative atomic mass of an element is calculated by comparing the mass of an atom of the element to 1/12 the mass of a carbon-12 ( $^{12}\text{C}$ ) isotope.

Question: How are animals in the Kingdom Animalia divided based on the presence or absence of a vertebral column?

Answer: Animals in the Kingdom Animalia are divided into two groups: Invertebrates (without a vertebral column) and Vertebrates (with a vertebral column).

Question: What is the Golgi complex, and what are its functions?

Answer: The Golgi complex is a stack of membrane-bound sacs that produce secretory substances, package them, and facilitate their secretion.

Question: What are the potential risks of genetic engineering?

Answer: Potential risks include unintended environmental impacts, such as gene flow to wild relatives, the development of resistance in pests, and ethical concerns about altering the genetic makeup of organisms.

Question: How does a switch control the flow of current in a circuit?

Answer: A switch controls the flow of current by opening or closing the circuit. When the switch is open, the circuit is incomplete, and no current flows. When the switch is closed, the circuit is complete, and current flows.

Question: How do you calculate the potential difference across each resistor in a series circuit with a known total voltage?

Answer: Calculate the voltage drop across each resistor using Ohm's Law:  $V = I \cdot R$ , where  $I$  is the total current and  $R$  is the resistance of each resistor.

Question: What are the advantages of sexual reproduction in plants?

Answer: Sexual reproduction produces genetic variation, leading to offspring with mixed characteristics of both parents, and enables the evolution of new plant varieties.

Question: What is the role of nitrifying bacteria in the nitrogen cycle?

Answer: Nitrifying bacteria convert ammonia into nitrites and then into nitrates, which plants can absorb.

Question: Describe the equilibrium of a child sitting on a swing in terms of forces.

Answer: The child remains in equilibrium because the forces exerted by the two ropes balance the weight of the child. These forces are coplanar and parallel, and their magnitudes add up to equal the weight of the child.

Question: What is the significance of electron sharing in the formation of homoatomic and heteroatomic molecules?

Answer: Electron sharing is significant in the formation of homoatomic molecules (same element) and heteroatomic molecules (different elements), enabling the creation of various chemical compounds.

Question: How does the number of energy levels in an atom determine the period to which an element belongs?

Answer: The number of energy levels carrying electrons in an atom determines the period to which an element belongs.

Question: How is sugar produced using crystallization?

Answer: Sugar is produced by concentrating purified sugarcane juice through vaporization, leading to the crystallization of sugar from the solution.

Question: What causes syphilis, and what are its symptoms?

Answer: Syphilis is caused by the bacterium *Treponema pallidum* and presents with painless blisters, fever, and throat pain. It can spread to other organs if untreated.

Question: How does the process of peristalsis aid in food digestion?

Answer: Peristalsis involves contractions and relaxations of the esophageal muscles, creating waves that propel the food bolus forward through the digestive tract.

Question: What is the significance of the turning effect of a force in practical applications?

Answer: The turning effect of a force is significant in practical applications such as opening doors, using wrenches, and rotating objects, where the ease of rotation depends on the applied moment.

Question: How does the body protect against oxidative stress?

Answer: The body uses antioxidants, such as vitamins C and E, and enzymes like superoxide dismutase, to neutralize free radicals and prevent cellular damage.

Question: How do polar covalent bonds differ from ionic bonds?

Answer: Polar covalent bonds involve the unequal sharing of electrons between atoms with different electronegativities, resulting in partial charges, while ionic bonds involve the complete transfer of electrons from one atom to another, resulting in full positive and negative charges.

Question: How is the chemical formula of sodium nitrate represented?

Answer: The chemical formula of sodium nitrate is  $\text{NaNO}_3$ , indicating one sodium ion and one nitrate ion.

Question: How does a battery management system (BMS) protect lithium-ion batteries?

Answer: A BMS monitors and controls the charging and discharging of lithium-ion batteries, ensuring safe operation, preventing overcharging, and extending battery life.

Question: What is the significance of the electronic configuration in determining the reactivity of an element?

Answer: The electronic configuration determines the stability of an element's valence shell, influencing its tendency to gain, lose, or share electrons, and thus its chemical reactivity.

Question: What are the key components of a simple electrical circuit?

Answer: The key components of a simple electrical circuit include a power source, conductors (wires), a load (e.g., a bulb or resistor), and a switch.

Question: Describe the function of a stepper motor in automation.

Answer: A stepper motor moves in discrete steps, controlled by digital pulses, providing precise positioning and speed control in automation and robotics applications.

Question: What happens when the forces acting on an object are not aligned along the same line?

Answer: When the forces acting on an object are not aligned along the same line, the object will experience a net moment, causing it to rotate or move, indicating that it is not in equilibrium.

Question: What is the significance of a constant ratio of voltage to current in a conductor?

Answer: A constant ratio of voltage to current indicates that the conductor follows Ohm's Law, with a fixed resistance at constant temperature.

Question: How do cataracts develop?

Answer: Cataracts develop due to changes in the nature of proteins in the lens of the eye, causing the lens to lose its transparency. Harmful gases emitted from factories and exposure to ultraviolet rays due to ozone layer depletion contribute to this condition.

Question: How does the electrolysis of sodium chloride solution demonstrate the production of sodium hydroxide?

Answer: The electrolysis of sodium chloride solution produces hydrogen and chlorine gases, leaving behind  $\text{Na}^+$  and  $\text{OH}^-$  ions in the solution, which combine to form sodium hydroxide.

Question: What is the role of an inductor in electronic circuits?

Answer: An inductor stores energy in a magnetic field when current flows through it, and it opposes changes in current, making it useful in filtering and energy storage applications.

Question: How does the strength of the magnetic field affect the performance of a dynamo?

Answer: A stronger magnetic field increases the induced electromotive force, improving the dynamo's performance and electricity generation.

Question: What is the chemical formula for sulfur dioxide?

Answer: The chemical formula for sulfur dioxide is  $\text{SO}_2$ .

Question: What are the applications of electrochemical cells in medical devices?

Answer: Electrochemical cells are used in medical devices for applications like powering pacemakers, drug delivery systems, biosensors for glucose monitoring, and diagnostic equipment, providing reliable and efficient energy solutions for healthcare.



Question: What factors determine the magnitude of induced voltage in a coil?

Answer: Factors determining the magnitude of induced voltage include the number of coil turns, magnetic field strength, and speed of motion.

Question: How is the group of an element determined?

Answer: The group of an element is determined by the number of electrons in its outermost energy level.

Question: What are the steps involved in tissue culture?

Answer: The steps include introducing vegetative tissue into the culture medium, developing callus, separating plantlets, and adapting them to natural conditions.

Question: How do scientists study the genetic basis of inherited traits?

Answer: Scientists study the genetic basis of inherited traits through experiments, genetic crosses, and analysis of DNA sequences to understand how traits are passed down from one generation to the next.

Question: What are the effects of habitat loss on species survival?

Answer: Habitat loss reduces available resources, fragments populations, and increases vulnerability to environmental changes and human activities. It leads to declines in species survival and biodiversity.

Question: Describe the significance of impedance matching in RF circuits.

Answer: Impedance matching ensures maximum power transfer and minimizes signal reflection in RF circuits by matching the impedance of the source and load, optimizing performance.

Question: How does the atmospheric pressure change with weather conditions?

Answer: Atmospheric pressure can vary with weather conditions. It generally decreases with stormy weather and increases with clear weather due to changes in air density and temperature.

Question: How are the kingdoms in the Domain Eukarya divided?

Answer: The kingdoms in the Domain Eukarya are divided into Protista, Fungi, Plantae, and Animalia.

Question: What is the principle behind the operation of a hydraulic press?

Answer: The principle behind a hydraulic press is that pressure applied to a confined fluid is transmitted undiminished in all directions, allowing a small force applied to a small piston to generate a larger force on a larger piston.

Question: What is the chemical formula for copper sulfate?

Answer: The chemical formula for copper sulfate is  $\text{CuSO}_4$ .

Question: What factors influence the efficiency of electromagnetic induction?

Answer: Factors influencing efficiency include the number of coil turns, the strength of the magnetic field, and the speed of relative motion between the coil and magnet.

Question: Describe the function of a main switch in a domestic electric circuit.

Answer: The main switch allows the entire household circuit to be disconnected from the power supply for safety and maintenance purposes.

Question: How does the speed of a rotating coil influence the dynamo's output?

Answer: A faster rotating coil increases the rate of change of the magnetic field, generating higher voltage and more electrical power.

Question: What is the role of a phase comparator in phase-locked loops (PLLs)?

Answer: A phase comparator in PLLs compares the phase of an input signal with a reference signal, generating an error signal to adjust the frequency of the output signal for synchronization.

Question: How is electroplating used to improve the properties of metal objects?

Answer: Electroplating enhances properties like corrosion resistance, appearance, and durability by applying a thin layer of a less reactive metal.

Question: What is the relationship between the speed of coil rotation and the output voltage of a dynamo?

Answer: The output voltage of a dynamo increases with the speed of coil rotation, as a higher speed induces a greater electromotive force.

Question: What are the main parts of a flower involved in sexual reproduction?

Answer: The main parts of a flower involved in sexual reproduction are the calyx, corolla, androecium, and gynoecium.

Question: What is nephritis, and how does it affect kidney function?

Answer: Nephritis is the swelling of the kidneys due to infection or toxins, affecting glomerulus and uriniferous tubules, leading to reduced urine formation and accumulation of waste in the body.

Question: How do proteins act as enzymes?

Answer: Proteins act as enzymes that catalyze all biochemical reactions in organisms.

Question: Explain the concept of electrode potential and its importance in electrochemical reactions.

Answer: Electrode potential is the measure of the ability of an electrode to gain or lose electrons relative to a reference electrode. It is important in electrochemical reactions as it determines the direction and feasibility of redox reactions.

Question: How are vitamins classified based on solubility?

Answer: Vitamins are classified into water-soluble (B and C) and fat-soluble (A, D, E, and K) based on their solubility.

Question: How does a solar inverter convert energy from solar panels?

Answer: A solar inverter converts the DC electricity generated by solar panels into AC electricity, making it compatible with the power grid and household appliances.

Question: What is the purpose of a barometer in meteorological observations?

Answer: A barometer is used in meteorological observations to measure atmospheric pressure, providing data for weather forecasting and understanding atmospheric conditions.

Question: How can the pain from a bee sting be relieved using neutralization?

Answer: Applying a weak basic substance like baking soda or calcium carbonate neutralizes the acidic poison from a bee sting.

Question: How does the movement of an object differ on a smoother surface compared to a rougher one?

Answer: An object moves a longer distance on a smoother surface before coming to rest because the frictional force is less compared to a rougher surface.

Question: What is the principle behind the operation of a thermos flask?

Answer: A thermos flask operates on the principle of insulation and reflection. It has a vacuum layer to prevent heat transfer by conduction and convection, and reflective surfaces to reduce heat transfer by radiation, maintaining the temperature of its contents.

Question: What are the key points summarized about heat changes in chemical reactions?

Answer: Every chemical reaction involves a heat change, exothermic reactions release heat, endothermic reactions absorb heat, and the amount of heat can be calculated using  $Q = mc\theta$ .

Question: Describe the function of alveoli in the lungs.

Answer: Alveoli are tiny air sacs where gas exchange occurs, with oxygen diffusing into blood capillaries and carbon dioxide diffusing out to be exhaled.

Question: What are some common examples of covalent compounds with low melting and boiling points?

Answer: Common examples of covalent compounds with low melting and boiling points include water ( $H_2O$ ), ammonia ( $NH_3$ ), oxygen ( $O_2$ ), and ethyl alcohol ( $C_2H_5OH$ ).

Question: How is the chemical formula of aluminium oxide written?

Answer: The chemical formula of aluminium oxide is  $Al_2O_3$ , indicating two aluminium ions and three oxide ions.

Question: What is the valency of oxygen?

Answer: The valency of oxygen is 2.

Question: What is the acceleration of a 4 kg object when a force of 16 N is applied?

Answer: The acceleration is  $a=F/m=4 \text{ m/s}^2$ .

Question: How do concave mirrors produce magnified images?

Answer: Concave mirrors produce magnified images when the object is placed between the focal point and the mirror, resulting in a virtual, upright, and enlarged image.

Question: What is the valency of silicon?

Answer: The valency of silicon is 4.

Question: What is the purpose of the galvanometer in demonstrating electromagnetic induction?

Answer: The galvanometer measures the induced current, indicating the presence and magnitude of electromagnetic induction in a circuit.

Question: How do Punnett squares help geneticists visualize genetic crosses?

Answer: Punnett squares help geneticists visualize genetic crosses by showing all possible combinations of alleles from two parents, allowing predictions of genotypes and phenotypes in offspring.

Question: What are the uses of Hydrochloric acid?

Answer: It is used for rust removal in steel objects, making gelatin from bony materials in food technology, and making aqua regia for dissolving metals like gold and platinum.

Question: What is the resultant force if one child pushes an object with 5 N and another child pulls it with 7 N in the same direction?

Answer: The resultant force is 12 N in the same direction.

Question: What is the significance of the Human Genome Project?

Answer: The Human Genome Project aimed to map the entire human genome, identifying all genes and their functions. This project has provided valuable insights into genetic disorders, human evolution, and personalized medicine.

Question: How do whales use sound waves for communication?

Answer: Whales use sound waves to communicate through water, where sound travels faster than in air.

Question: What are meristematic tissues, and where are they located?

Answer: Meristematic tissues are tissues with cells that actively divide by mitosis to produce new cells. They are located in specific areas of the plant such as the shoot apex, root apex, and axillary buds.

Question: How do you calculate the current passing through each resistor in a parallel circuit?

Answer: The current passing through each resistor in a parallel circuit is calculated using Ohm's Law for each resistor:  $I_i = V / R_i$ , where  $V$  is the voltage across the parallel combination and  $R_i$  is the resistance of each resistor.

Question: How does a capacitor store electrical energy?

Answer: A capacitor stores electrical energy by accumulating charge on its plates when a voltage is applied, creating an electric field between the plates.

Question: How do coir ropes utilize friction?

Answer: Coir ropes utilize friction among the coir fibers to maintain their strength and prevent the fibers from separating, even under large forces.

Question: What is the operation of a triac in AC power control?

Answer: A triac is a bidirectional semiconductor switch that controls AC power by allowing current to flow in both directions when triggered, used in light dimmers and motor speed controls.

Question: How is mean speed calculated for an object traveling different distances in equal time intervals?

Answer: Mean speed is calculated by dividing the total distance traveled by the total time interval.

Question: What role does water play in seed germination?

Answer: Water activates enzymes in the cotyledons, leading to the digestion of stored complex food into simple nutrients, which help develop the radicle and plumule.

Question: What is the maximum number of electrons in the K shell?

Answer: The maximum number of electrons in the K shell is 2.

Question: How do organisms maintain homeostasis?

Answer: Organisms maintain homeostasis by regulating internal conditions such as temperature, pH, and water balance through feedback mechanisms and physiological processes.

Question: Explain the process of rusting of iron, including the conditions required and the chemical reactions involved.

Answer: Rusting of iron is an electrochemical process that occurs when iron is exposed to oxygen and moisture. This process leads to the formation of iron oxides, commonly known as rust. Conditions Required: Presence of Oxygen: Oxygen from the air reacts with iron. Presence of Water: Water facilitates the movement of ions, accelerating the rusting process.

Experiment to Demonstrate the Role of Air in Rusting: Materials Required: Two boiling tubes, ordinary cold water, coconut oil, two iron nails, burner, dilute hydrochloric acid. Method: Remove the zinc coating from the iron nails by immersing them in dilute hydrochloric acid. Place the nails in two boiling tubes, one with boiled water and a layer of coconut oil to prevent air contact, and the other with cold water exposed to air. Observe the nails after a few days. Observations: The nail in the tube with cold water (exposed to air) rusts. The nail in the tube with boiled water and coconut oil (preventing air contact) does not rust. Chemical Reactions: At the Anode: Iron is oxidized to iron ions. Reaction:  $\text{Fe(s)} \rightarrow \text{Fe}^{2+}(\text{aq}) + 2\text{e}^-$  At the Cathode: Oxygen is reduced in the presence of water. Reaction:  $\text{O}_2(\text{g}) + 4\text{H}^+(\text{aq}) + 4\text{e}^- \rightarrow 2\text{H}_2\text{O(l)}$  Overall Reaction: Iron reacts with oxygen and water to form hydrated iron(III) oxide. Reaction:  $4\text{Fe(s)} + 3\text{O}_2(\text{g}) + 6\text{H}_2\text{O(l)} \rightarrow 4\text{Fe(OH)}_3(\text{s})$  On drying, iron(III) hydroxide dehydrates to form rust:  $\text{Fe(OH)}_3(\text{s}) \rightarrow \text{Fe}_2\text{O}_3 \cdot \text{H}_2\text{O(s)}$  Conclusion: Rusting of iron requires both oxygen

and water. It is an electrochemical process involving the oxidation of iron and the reduction of oxygen, leading to the formation of rust. Preventive measures, such as coating iron with paint or other protective layers, can inhibit rusting by blocking exposure to air and moisture.

Question: How does the electrolysis of acidulated water produce oxygen gas?

Answer: Oxygen gas is produced at the anode by the oxidation of OH<sup>-</sup> ions:  
 $4\text{OH}^- (\text{aq}) \rightarrow \text{O}_2 (\text{g}) + 2\text{H}_2\text{O} (\text{l}) + 4\text{e}^-$ .

Question: What is the formula for the moment of a force applied to a rod pivoted at a certain point?

Answer: The moment of a force applied to a rod pivoted at a certain point is calculated as the product of the force and the perpendicular distance from the pivot point to the line of action of the force.

Question: Explain the process of anodization and its applications.

Answer: Anodization is an electrochemical process that forms a protective oxide layer on the surface of metals like aluminum. It enhances corrosion resistance, wear resistance, and aesthetic appearance, used in aerospace, automotive, and consumer products.

Question: What is the process of lowering the concentration of a solution by adding more solvent called?

Answer: The process is called dilution.

Question: How do plant cells utilize the central vacuole for storage?

Answer: The central vacuole stores water, nutrients, waste products, and pigments, maintaining turgor pressure, and contributing to cell growth and structural integrity.

Question: How does the reactivity of metals compare to non-metals in terms of electronegativity?

Answer: Metals generally have lower electronegativity and are more likely to lose electrons, while non-metals have higher electronegativity and are more likely to gain electrons.

Question: How is the chemical formula of hydrogen sulphide written?

Answer: The chemical formula of hydrogen sulphide is H<sub>2</sub>S, indicating two hydrogen atoms and one sulphur atom.

Question: What is the frequency range of visible light in the electromagnetic spectrum?

Answer: The frequency range of visible light is approximately  $4.28 \times 10^{14}$  Hz to  $7.69 \times 10^{14}$  Hz.

Question: How does nitrogen behave chemically?

Answer: Nitrogen is a non-supporter of combustion and is a gas of very low reactivity. However, at high temperatures, nitrogen gas reacts with non-metals like oxygen, hydrogen, carbon, and silicon as well as with metals like magnesium and aluminium.

Question: How is the resultant force of two forces acting along the same direction demonstrated in Activity to demonstrate collinear forces?

Answer: It is demonstrated by using Newton balances to show that the sum of the forces from two balances is equal to the force measured by a third balance.

Question: Describe the experimental procedure to investigate the effect of salt on rusting of iron, including observations and conclusions.

Answer: The presence of salt accelerates the rusting of iron. This can be demonstrated through a simple experiment. Materials Required: Cleaned iron nails, boiling tubes, solid sodium chloride, water. Method: Place a clean iron nail in each of two boiling tubes. Add ordinary water to one tube and water mixed with sodium chloride to the other. Allow them to stand for about a day and observe. Observations: The nail in the tube with sodium chloride solution rusts more than the nail in ordinary water. Conclusion: Sodium chloride accelerates the rusting of iron. This is because salt increases the conductivity of water, facilitating the electrochemical reactions involved in rusting. This effect is particularly pronounced in coastal areas where salt concentration in the air is higher, leading to faster corrosion of iron objects.

Question: What are some examples of substances separated using mechanical methods in daily life?

Answer: Examples include winnowing to remove chaff from rice, sieving to remove gravel from sand, and using magnets to separate iron filings from a mixture.

Question: How does a power inverter convert DC to AC?

Answer: A power inverter converts DC to AC by using electronic circuits to switch the DC input in a way that generates an AC output, allowing DC sources like batteries to power AC devices.

Question: How does a membrane electrode assembly (MEA) function in a fuel cell?

Answer: A membrane electrode assembly (MEA) in a fuel cell consists of a proton-conducting membrane sandwiched between two electrodes (anode and cathode). It facilitates the electrochemical reactions, allowing protons to pass through the membrane while electrons flow through an external circuit, generating electricity.

Question: How do you apply a couple of forces to rotate a steering wheel?

Answer: Apply a couple of forces by using both hands to exert equal and opposite forces on opposite sides of the steering wheel, creating a moment that rotates the wheel.

Question: What happens to the lustre of sodium metal when it is taken out of paraffin oil?

Answer: When sodium metal is taken out of paraffin oil, its silvery lustre disappears and it gets tarnished after some time due to oxidation.

Question: Why is it important to use weatherproof enclosures for outdoor electrical installations?

Answer: Weatherproof enclosures protect electrical components from moisture, dust, and other environmental factors, ensuring safe and reliable operation in outdoor settings.

Question: What is the impact of acidic rain on the environment?

Answer: Acidic rain can harm plants, aquatic life, and infrastructure by lowering the pH of soil and water bodies and corroding buildings and monuments.

Question: How do sound waves create the sensation of hearing?

Answer: Sound waves cause the eardrum and inner ear structures to vibrate, converting mechanical energy into electrical signals perceived as sound.

Question: How does the dielectric constant of a solvent affect solubility?

Answer: A higher dielectric constant indicates a solvent's ability to stabilize charged particles, enhancing the solubility of ionic and polar solutes.

Question: What is the importance of the lymphatic system in the human body?

Answer: The lymphatic system collects excess tissue fluid, filters it through lymph nodes to destroy pathogens, and returns it to the bloodstream, aiding in immune defense.

Question: What is the resultant force if an object held by a Newton balance reads 80 N and another object of 500 g is attached?

Answer: The resultant force is approximately 85 N (considering the additional 5 N from the 500 g mass).

Question: What is the function of a step-down transformer?

Answer: A step-down transformer decreases the output voltage, making it lower than the input voltage.

Question: Why does the rate of reaction increase with the concentration of reactants?

Answer: The number of particles of reactants in a unit volume increases, leading to more collisions per unit time and a faster reaction rate.

Question: Describe the factors affecting population density and the phases of population growth.

Answer: Population density is the number of organisms of a species living in a unit area of a selected habitat. For instance, the human population density of Sri Lanka in 2014 was 329.12 individuals per square kilometer. The size of a natural population varies over time due to four main factors: Births: The number of new organisms added to the population. Deaths: The number of organisms dying in the population. Immigration: The number of organisms added to the population from outside. Emigration: The number of organisms leaving the population. These factors create a dynamic population density, depicted in a typical growth curve of population (Figure 15.4), which includes four phases: Slow Growth Phase (Lag Phase): Initial slow growth due to a shortage of reproducing individuals. High Growth Phase (Exponential Phase/Log Phase): Maximum growth rate as organisms adapt to the environment, with a high birth rate exceeding the death rate.



Deceleration Phase: Growth rate decreases due to resource competition, food shortage, disease spread, predation, and parasitism. Stationary Phase/Stabilizing Phase: Population reaches carrying capacity, achieving dynamic equilibrium where birth and death rates balance, resulting in zero growth. Human population growth, however, differs from natural populations. The growth curve for humans is J-shaped, indicating exponential growth due to increased birth rates and decreased death rates, driven by technological advancements, medical progress, and higher food production rates

Question: How does the reactivity of metals with water differ among sodium, magnesium, and zinc?

Answer: Sodium reacts vigorously with cold water, magnesium reacts with hot water, and zinc reacts only with steam, showing varying reactivity levels with water.

Question: What happens to the charges on an object when electrons are removed?

Answer: When electrons are removed from an object, it becomes positively charged.

Question: How does a spectrum analyzer measure signal frequencies?

Answer: A spectrum analyzer displays the amplitude of signal frequencies over a range, allowing the analysis of signal components and their respective power levels.

Question: What is the blast furnace used for?

Answer: The blast furnace is used to extract iron from iron ore. It involves feeding raw materials from the top and blowing hot air from the bottom to produce liquid iron through several reactions.

Question: How do calcium and chlorine atoms achieve a stable electronic configuration in calcium chloride?

Answer: Calcium atoms lose electrons to form  $\text{Ca}^{2+}$  ions, and chlorine atoms gain electrons to form  $\text{Cl}^-$  ions. The electrostatic attraction between these ions forms calcium chloride ( $\text{CaCl}_2$ ).

Question: Calculate the power required to do 100 J of work in 5 seconds.

Answer: The power required is 20 Watts (W).

Question: What is the principle behind the operation of a thermos flask?

Answer: A thermos flask operates on the principle of insulation and reflection. It has a vacuum layer to prevent heat transfer by conduction and convection, and reflective surfaces to reduce heat transfer by radiation, maintaining the temperature of its contents.

Question: Describe the equilibrium of a framed picture hanging on the wall.

Answer: The framed picture is in equilibrium because the tensions in the two strings balance the weight of the picture. The three forces are coplanar, and their lines of action intersect at a common point.

Question: What is the role of selective breeding in agriculture?

Answer: Selective breeding involves choosing plants or animals with desirable traits to produce offspring with improved qualities, such as higher yield, disease resistance, or better nutritional value.

Question: What is the volume fraction of ethyl alcohol in a solution made by adding 25 cm<sup>3</sup> of ethyl alcohol to 250 cm<sup>3</sup> of water?

Answer: The volume fraction of ethyl alcohol is 0.1 or 10%.

Question: What is the importance of maintaining proper hydration for kidney function?

Answer: Proper hydration ensures adequate urine production, preventing kidney stones and other urinary disorders while aiding in the efficient removal of waste.

Question: How can the normal reaction be increased to investigate its effect on friction?

Answer: The normal reaction can be increased by placing additional weights on the object and measuring the resulting limiting frictional force.

Question: How does the amount of heat required to increase the temperature of different substances compare?

Answer: Different substances require different amounts of heat to increase their temperature due to their specific heat capacities. For the same mass and temperature change, substances with higher specific heat capacities require more heat.

Question: What is the specific heat capacity of mercury?

Answer: The specific heat capacity of mercury is 140 J kg<sup>-1</sup> K<sup>-1</sup>.

Question: What are electrochemical cells, and how are they used in everyday life?

Answer: Electrochemical cells are devices that convert chemical energy into electrical energy. They are commonly used to power everyday equipment such as toy cars, electric torches, calculators, computers, and mobile phones.

Question: Materials required :- Two beakers, a glass rod, a funnel, a filter paper, hand lens. Method :- Transfer the mixture made in activity 3.1.1 above into a small 100 ml beaker, add about 50 ml of water to it and stir well. Then, place a filter paper in a glass funnel and filter this solution into another beaker. Allow the residue on the filter paper to dry and observe with a hand lens. Observe the filtrate as well. What does the residue and filtrate indicate in this Activity ?

Answer: The residue on the filter paper is naphthalene powder, and the blue filtrate indicates that copper sulphate has dissolved in water.

Question: What is the unit of velocity?

Answer: The unit of velocity is meters per second (m/s).

Question: What is the reaction between calcium carbonate and hydrochloric acid?

Answer: Calcium carbonate reacts with hydrochloric acid to form calcium chloride, water, and carbon dioxide:  $\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$ .

Question: What are the three stages of respiration in humans?

Answer: The three stages are gas exchange between the external environment and lungs, gas exchange in alveoli, and cellular respiration.

Question: How does the reaction of iron with hydrochloric acid differ from that of copper?

Answer: Iron reacts with hydrochloric acid to form iron chloride and hydrogen gas, while copper does not react with hydrochloric acid under normal conditions:  $\text{Fe} + 2\text{HCl} \rightarrow \text{FeCl}_2 + \text{H}_2$ ;  $\text{Cu} + \text{HCl} \rightarrow \text{No reaction}$ .

Question: What is the reaction between zinc and sulfuric acid?

Answer: Zinc reacts with sulfuric acid to form zinc sulfate and hydrogen gas:  $\text{Zn} + \text{H}_2\text{SO}_4 \rightarrow \text{ZnSO}_4 + \text{H}_2$ .

Question: Calculate the power required to do 500 J of work in 20 seconds.

Answer: The power required is 25 Watts (W).

Question: How does a photovoltaic (PV) cell generate electricity?

Answer: A PV cell generates electricity by converting sunlight into electrical energy through the photovoltaic effect, where light photons excite electrons, creating an electric current.

Question: Who introduced the five-kingdom classification system?

Answer: Robert Whittaker introduced the five-kingdom classification system in 1969.

Question: What is the result of the reaction between sulphuric acid and sodium hydroxide?

Answer: Sulphuric acid reacts with sodium hydroxide to form sodium sulphate and water ( $\text{H}_2\text{SO}_4 + 2\text{NaOH} \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$ ).

Question: How does the body respond to dehydration?

Answer: The body increases ADH secretion, reduces urine output, and triggers thirst to maintain water balance.

Question: How do wind instruments produce sound by vibrating air columns?

Answer: Wind instruments produce sound when air is blown into them, causing the air column inside to vibrate and generate sound waves.

Question: Explain the function of a load cell in weighing systems.

Answer: A load cell measures force or weight by converting mechanical stress into an electrical signal, providing accurate weight measurement in scales and industrial applications.

Question: What is the specific heat capacity of water, and why is it significant?

Answer: The specific heat capacity of water is  $4200 \text{ J kg}^{-1} \text{ K}^{-1}$ . It is significant because it allows water to absorb and store large amounts of heat, moderating temperature changes and making it useful in various applications.

Question: How does temperature affect the rate of reaction?

Answer: Increasing the temperature generally increases the rate of reaction by providing more energy for collisions between reactants.

Question: What is the role of the placenta in fetal development?

Answer: The placenta facilitates the exchange of nutrients, oxygen, and waste products between the mother and fetus through the umbilical cord.

Question: How does the conductivity of an electrolyte influence the performance of an electrochemical cell?

Answer: The conductivity of an electrolyte influences the performance of an electrochemical cell by affecting ion transport and reaction rates. High conductivity ensures efficient ion migration, reducing internal resistance and improving cell efficiency and power output.

Question: What is the displacement of an object moving with a uniform velocity of 8 m/s for 12 seconds?

Answer: Displacement =  $8 \text{ m/s} \times 12 \text{ s} = 96 \text{ meters}$ .

Question: What are the properties of water that make it essential for life?

Answer: The properties of water that make it essential for life include its high specific heat capacity, high boiling point, solvent capabilities, and density characteristics that allow ice to float.

Question: What is the purpose of using a capillary tube in chromatography?

Answer: The capillary tube helps in applying a precise and small amount of the extract to the paper strip for separation.

Question: What are the deficiency symptoms of nitrogen in plants?

Answer: Deficiency symptoms of nitrogen in plants include chlorosis in mature leaves and retardation in growth.

Question: How do you convert a temperature from Celsius to Kelvin?

Answer: To convert a temperature from Celsius to Kelvin, add 273 to the Celsius temperature.

Question: What is the relationship between valence electrons and chemical bonding?

Answer: Valence electrons are crucial in chemical bonding as they are involved in forming bonds between atoms.

Question: How does the plasma membrane control the movement of substances?

Answer: The plasma membrane controls the movement of substances through selective permeability, allowing certain molecules to pass while restricting others, maintaining cellular homeostasis.

Question: What is the principle of a simple microscope?

Answer: A simple microscope uses a single convex lens to magnify small objects by converging light rays to a focal point.

Question: How does chronic inflammation affect kidney health?

Answer: Chronic inflammation can lead to kidney damage by promoting fibrosis, scarring, and reduced kidney function over time.

Question: What is the androecium?

Answer: The androecium is the male reproductive structure of a flower, consisting of a filament and an anther. The anther contains pollen sacs where pollen is produced.

Question: What are some examples of organisms in the Domain Archaea?

Answer: Examples include Methanogens and Halophiles.

Question: What are the potential risks of genetic engineering?

Answer: Potential risks include unintended environmental impacts, such as gene flow to wild relatives, the development of resistance in pests, and ethical concerns about altering the genetic makeup of living organisms.

Question: What role does the magnetic field play in the operation of a bicycle dynamo?

Answer: The magnetic field interacts with the rotating coil, inducing an electromotive force that generates electrical power for the bicycle's lights.

Question: What is the valency of calcium?

Answer: The valency of calcium is 2.

Question: What is the principle of electromagnetic induction?

Answer: Electromagnetic induction is the process of generating an electromotive force in a conductor due to a changing magnetic field.

Question: What is the time taken by an object projected vertically upwards at 30 m/s to reach its maximum height?

Answer:  $\text{Time} = \text{Initial velocity} / \text{Gravitational acceleration} = 30 \text{ m/s} / 10 \text{ m/s}^2 = 3 \text{ seconds}.$

Question: What are the conditions for equilibrium in an object under the action of three non-parallel coplanar forces?

Answer: The three forces must be coplanar, their lines of action must intersect at a common point, and the resultant of any two forces must be equal in magnitude and opposite in direction to the third force.

Question: How does an electric meter measure energy consumption in a household?

Answer: An electric meter measures energy consumption by recording the total kilowatt hours (kWh) of electricity used by the household, based on the power drawn and the duration of use.

Question: What are the primary causes of heart diseases?

Answer: The primary causes of heart diseases include narrowed or blocked blood vessels, improper functioning of heart muscles, valves, or rhythm, and lifestyle changes such as lack of physical exercise, rest, and increased mental stress due to industrialization.

Question: What is the significance of the specific heat capacity in thermal applications?

Answer: The specific heat capacity is significant in thermal applications because it determines how much heat is needed to change the temperature of a substance, influencing heating and cooling processes in various applications.

Question: What are the threats to biodiversity?

Answer: Threats to biodiversity include habitat destruction, climate change, pollution, overexploitation, and the introduction of invasive species.

Question: How do stomata function in gas exchange for photosynthesis?

Answer: Stomata are small openings on the leaf surface that allow CO<sub>2</sub> to diffuse into the leaf and O<sub>2</sub> to diffuse out, facilitating gas exchange for photosynthesis.

Question: What is the relationship between current and potential difference in a conductor?

Answer: According to Ohm's Law, the current (I) passing through a conductor is directly proportional to the potential difference (V) across it, provided the temperature remains constant.

Question: What is the purpose of an energy meter in households?

Answer: An energy meter measures the amount of electrical energy consumed by household appliances, providing data for billing and energy management.

Question: What is the formula to calculate acceleration from a velocity-time graph?

Answer:  $\text{Acceleration} = (\text{Velocity difference}) / (\text{Time interval})$

Question: How is the chemical formula of carbon dioxide written?

Answer: The chemical formula of carbon dioxide is CO<sub>2</sub>, indicating one carbon atom and two oxygen atoms.

Question: Describe the benefits of using energy-efficient cookers.

Answer: Energy-efficient cookers reduce energy consumption, cook food faster, and generate less heat waste, leading to cost savings and a reduced environmental impact.

Question: What are the applications of electrochemical cells in medical devices?

Answer: Electrochemical cells are used in medical devices for applications like powering pacemakers, drug delivery systems, biosensors for glucose monitoring, and diagnostic equipment, providing reliable and efficient energy solutions for healthcare.

Question: What is the formula for Ohm's Law?

Answer: Ohm's Law is expressed as  $V = IR$ , where V is the potential difference, I is the current, and R is the resistance.

Question: What is herkogamy?

Answer: Herkogamy is an adaptation in flowers where the stamens and stigma are positioned at a distance to avoid self-pollination and promote cross-pollination.

Question: What is the first ionisation energy of silicon?

Answer: The first ionisation energy of silicon is 787 kJ/mol.

Question: How is the molar mass of a substance defined?

Answer: The molar mass of a substance is the mass of one mole of that substance, expressed in grams per mole (g/mol) or kilograms per mole (kg/mol).

Question: What are the two main factors that limiting friction depends on?

Answer: Limiting friction depends on the nature of the contact surfaces and the normal reaction force.

Question: What is the absolute zero temperature in the Kelvin scale?

Answer: Absolute zero temperature in the Kelvin scale is 0 K, corresponding to  $-273.15^{\circ}\text{C}$ , where the kinetic energy of particles is zero.

Question: Explain the concept of coulombic efficiency in batteries and its significance.

Answer: Coulombic efficiency in batteries is the ratio of the charge extracted during discharge to the charge input during charging. It indicates the efficiency of charge storage and retrieval, with higher values representing better battery performance and lower losses.

Question: What are endothermic reactions, and give an example from the document?

Answer: Endothermic reactions absorb heat from the surroundings. An example is the reaction between citric acid and sodium bicarbonate.

Question: What is non-uniform motion?

Answer: Non-uniform motion occurs when an object moves with varying speed and/or direction.

Question: What is the importance of stirring the mixture well in Activity 8.4?

Answer: To keep the temperature uniform throughout the mixture.

Question: How does the acceleration of an object change with an increase in force?

Answer: The acceleration of an object increases with an increase in force, as they are directly proportional.

Question: How do catalysts affect the activation energy of a reaction?

Answer: Catalysts lower the activation energy, making it easier for reactants to collide and form products, thus increasing the reaction rate.

Question: What changes occur in the fetus during the fourth month of development?

Answer: During the fourth month, the fetus starts developing a skeleton and hair begins to grow.

Question: What happens when the forces acting on an object are not aligned along the same line?

Answer: When the forces acting on an object are not aligned along the same line, the object will experience a net moment, causing it to rotate or move, indicating that it is not in equilibrium.

Question: How do animals perform excretion?

Answer: Animals perform excretion by eliminating metabolic waste products such as urea, carbon dioxide, and excess salts through organs like the kidneys, lungs, and skin.

Question: How does kidney function affect the body's ability to detoxify?

Answer: The kidneys filter and excrete waste products and toxins from the blood, playing a crucial role in the body's detoxification process.

Question: What is the function of connective tissue?

Answer: Connective tissue provides connection and support between tissues and organs, and it also plays a role in protection, transportation, and maintaining homeostasis.

Question: How is an ammonia ( $\text{NH}_3$ ) molecule formed?

Answer: An ammonia ( $\text{NH}_3$ ) molecule is formed when a nitrogen atom shares three pairs of electrons with three hydrogen atoms, forming three single bonds.

Question: How do potassium and fluorine atoms achieve a stable electronic configuration in potassium fluoride?

Answer: Potassium atoms lose electrons to form  $\text{K}^+$  ions, and fluorine atoms gain electrons to form  $\text{F}^-$  ions. The electrostatic attraction between these ions forms potassium fluoride (KF).

Question: What is the significance of the number of turns in a coil for electromagnetic devices?

Answer: More turns in a coil increase the induced electromotive force, enhancing the performance of electromagnetic devices like generators and transformers.

Question: How does the orientation of the coil affect the induced voltage in a dynamo?

Answer: The orientation of the coil affects the induced voltage, with maximum values generated when the coil is perpendicular to the magnetic field lines.

Question: What are the two types of reproduction?

Answer: The two types of reproduction are asexual reproduction and sexual reproduction.

Question: How do the stems of monocots and dicots differ?

Answer: Monocot stems have an even diameter, while dicot stems are broad at the base and thin at the tip.

Question: How does the orientation of a coil affect the induced electromotive force?

Answer: The orientation of the coil relative to the magnetic field affects the induced electromotive force, with maximum induction occurring when the



coil intersects the field lines perpendicularly.

Question: What are the benefits of using traditional agricultural methods?

Answer: Traditional agricultural methods, such as using local seeds and organic farming, promote sustainability, reduce dependency on chemical inputs, and support biodiversity. They are often more resilient to environmental changes and pests.

Question: What is the role of the cathode in electroplating?

Answer: The cathode is the object to be plated, where the metal ions are reduced and deposited as a thin metallic layer, providing the desired coating.

Question: What are the conditions for maintaining equilibrium in a system of forces acting on an object?

Answer: The conditions for maintaining equilibrium are that the forces must be coplanar, their lines of action must intersect at a common point, and the resultant of any two forces must be equal in magnitude and opposite in direction to the third force.

Question: How do you measure the resistance of a light-dependent resistor (LDR) under different light conditions?

Answer: Use a multimeter set to the resistance ( $\Omega$ ) mode, expose the LDR to different light conditions, and measure the resistance value displayed on the multimeter.

Question: How is the chemical formula of ammonia written?

Answer: The chemical formula of ammonia is  $\text{NH}_3$ , indicating one nitrogen atom and three hydrogen atoms.

Question: What is the role of pressure in the solubility of gases in water?

Answer: Increased pressure increases the solubility of gases in water.

Question: What is the role of the primary coil in a transformer?

Answer: The primary coil is connected to the power supply and generates a magnetic field that induces a voltage in the secondary coil.

Question: What are the direct effects of environmental pollution?

Answer: Direct effects of environmental pollution include acid rain, global warming, ozone layer depletion, photochemical smog, and biomagnification.

Question: How does the electrolysis of copper sulfate solution demonstrate the transfer of copper ions?

Answer: The electrolysis of copper sulfate solution demonstrates the transfer of  $\text{Cu}^{2+}$  ions from the anode to the cathode, where they are reduced and deposited as copper metal.

Question: How is the small intestine adapted for efficient absorption of nutrients?

Answer: The small intestine has a long length, circular folds, villi, microvilli, thin epithelial lining, and is highly vascularized, all of which increase the surface area for nutrient absorption.

Question: How does a barometer measure atmospheric pressure?

Answer: A barometer measures atmospheric pressure by balancing the weight of a liquid column against the pressure of the atmosphere, with the height of the column indicating the pressure.

Question: What is the potential energy of a 6 kg object at a height of 5 m?

Answer: The potential energy is 300 Joules (J).

Question: How do you investigate the equilibrium of a meter ruler under the action of three coplanar parallel forces?

Answer: Suspend the meter ruler horizontally using two rubber bands and spring balances at either end. Measure the forces exerted by the balances and compare them to the weight of the ruler to ensure they balance and maintain equilibrium.

Question: What is the role of the octet rule in chemical bonding?

Answer: The octet rule states that atoms tend to gain, lose, or share electrons to achieve a stable configuration of eight electrons in their valence shell, similar to noble gases.

Question: How does pressure influence the reaction rate of gases?

Answer: Increased pressure reduces the volume, raising the number of collisions between gas particles and accelerating the reaction rate.

Question: What is the role of indicators in identifying acids and bases?

Answer: Indicators change color in the presence of acids and bases, helping to identify their acidic or basic nature.

Question: How does the length of a conductor affect its resistance?

Answer: The resistance of a conductor is directly proportional to its length; a longer conductor has higher resistance.

Question: What is the electronic configuration of aluminium?

Answer: The electronic configuration of aluminium is 2, 8, 3.

Question: How is the chemical formula of silicon dioxide written?

Answer: The chemical formula of silicon dioxide is  $\text{SiO}_2$ , indicating one silicon atom and two oxygen atoms.

Question: What are the key features of the Domain Archaea?

Answer: The Domain Archaea includes prokaryotes that can live in extreme environments and are not sensitive to most antibiotics.

Question: What is dichogamy?

Answer: Dichogamy is an adaptation where stamens mature earlier than the pistil (proterandry) or the pistil matures earlier than the stamens (protogyny), preventing self-pollination.

Question: How can acids and bases be identified using indicators?

Answer: Indicators like litmus, methyl orange, and phenolphthalein change color in the presence of acids and bases, helping identify them.

Question: What are the benefits of using electrochemical methods for carbon capture and utilization?

Answer: Electrochemical methods for carbon capture and utilization offer benefits like high efficiency, selective conversion of CO<sub>2</sub> to valuable products, integration with renewable energy sources, and reduced environmental impact compared to traditional methods.

Question: Describe the equilibrium of a child sitting on a swing in terms of forces.

Answer: The child remains in equilibrium because the forces exerted by the two ropes balance the weight of the child. These forces are coplanar and parallel, and their magnitudes add up to equal the weight of the child.

Question: How does surface area affect the rate of reaction in heterogeneous systems?

Answer: In heterogeneous systems, a larger surface area of reactants increases the interaction sites, thus accelerating the rate of reaction.

Question: What are the potential health risks associated with exposure to particulate matter (PM<sub>2.5</sub>)?

Answer: Exposure to fine particulate matter (PM<sub>2.5</sub>) increases the risk of respiratory and cardiovascular diseases, lung cancer, and premature death. It is particularly harmful to vulnerable populations.

Question: What is the displacement during the last 3 seconds for an object decelerating from 15 m/s to rest?

Answer: Displacement =  $\frac{1}{2} \times 15 \text{ m/s} \times 3 \text{ s} = 22.5 \text{ meters}$ .

Question: What is the importance of sealing spaces around carbon rods in electrolysis setups?

Answer: Sealing spaces prevents water leakage and ensures that the electrodes are fully immersed for efficient electrolysis.

Question: What role does water play in seed germination?

Answer: Water activates enzymes in the cotyledons, leading to the digestion of stored complex food into simple nutrients, which help develop the radicle and plumule.

Question: How do concave lenses affect light rays coming from a distant object?

Answer: Concave lenses diverge light rays, making them appear to originate from a focal point on the same side as the object.

Question: What occurs during the lag phase of population growth?

Answer: During the lag phase, population growth increases slowly as reproduction gets underway, often starting slowly due to a shortage of reproducing individuals.

Question: What is the purpose of using conducting rods in electromagnetic experiments?

Answer: Conducting rods provide a pathway for electric current, allowing the study of magnetic effects on current-carrying conductors.

Question: How do light rays incident on a concave mirror at an angle behave after reflection?

Answer: They reflect in such a way that the angle of incidence equals the angle of reflection, with respect to the normal line at the point of incidence.

Question: What is the importance of electrolytic cells in industrial applications?

Answer: Electrolytic cells are crucial in industrial applications for processes such as electroplating, extraction of metals, electrorefining, and production of chemicals like chlorine and sodium hydroxide.

Question: How do you investigate the equilibrium of an object under the action of two forces using a block of wood and Newton balances?

Answer: Attach the Newton balances to the block of wood and pull in opposite directions with varying forces. The object remains in equilibrium when the forces are equal in magnitude and opposite in direction, resulting in no net movement.

Question: How is a sodium ion ( $\text{Na}^+$ ) formed from a sodium atom?

Answer: A sodium ion ( $\text{Na}^+$ ) is formed when a sodium atom loses one electron, resulting in a positively charged ion with an electronic configuration of 2, 8.

Question: What is the basic structure of a transistor?

Answer: A transistor is constructed using two p-n junctions formed by three semiconductor regions of type p and n.

Question: What are anemophilous flowers?

Answer: Anemophilous flowers are pollinated by wind. They produce large amounts of small, light pollen and have branched stigmas.

Question: What is the chemical formula for calcium carbonate?

Answer: The chemical formula for calcium carbonate is  $\text{CaCO}_3$ .

Question: How does the electronic configuration affect the chemical reactivity of an element?

Answer: The electronic configuration affects the chemical reactivity of an element by determining the number of valence electrons, which influences how an element reacts with others.

Question: What are the three main types of electric circuits found in households?

Answer: The three main types of electric circuits found in households are lighting circuits, plug circuits, and dedicated circuits for high-power appliances.

Question: Describe the relationship between friction and energy loss in machines.

Answer: Friction in machines causes energy loss by converting mechanical energy into heat, reducing the efficiency of the machine.

Question: How does the sharing of electrons result in the formation of covalent bonds in heteroatomic molecules?

Answer: The sharing of electrons between atoms of different elements in heteroatomic molecules allows them to achieve stable electronic configurations, forming covalent bonds.

Question: How can soil acidity be reduced using bases?

Answer: Basic substances like ash and quicklime (calcium oxide) can be added to acidic soil to reduce its acidity.

Question: What is Faraday's law of electrolysis?

Answer: Faraday's law of electrolysis states that the amount of substance deposited or liberated at an electrode during electrolysis is directly proportional to the quantity of electric charge passed through the electrolyte.

Question: What are the horizontal rows in the Periodic Table called?

Answer: The horizontal rows in the Periodic Table are called periods.

Question: What is the role of an ammeter in an electrical circuit?

Answer: An ammeter measures the current flowing through a circuit and is connected in series with the circuit to ensure accurate measurement.

Question: How does urbanization impact local climate?

Answer: Urbanization increases temperatures through the urban heat island effect, alters precipitation patterns, and affects local weather conditions. It contributes to climate change and environmental degradation.

Question: Why is binomial nomenclature important?

Answer: Binomial nomenclature provides a standardized way to name organisms, avoiding confusion caused by different common names in various languages and regions, and helps in identifying evolutionary relationships.

Question: What is the latent heat of fusion?

Answer: The latent heat of fusion is the amount of heat required to convert a unit mass of a solid into a liquid at its melting point without changing its temperature.

Question: What are the challenges associated with scaling up electrochemical processes for industrial applications?

Answer: Challenges associated with scaling up electrochemical processes include maintaining efficiency and selectivity, managing heat and mass transfer, ensuring material durability, optimizing reactor design, and reducing costs to achieve commercial viability.

Question: What is the significance of the vertical line passing through the center of gravity in maintaining equilibrium?

Answer: The vertical line passing through the center of gravity indicates the line of action of the weight. For equilibrium, the lines of action of other forces must intersect this vertical line and lie in the same plane.

Question: How are transverse waves generated on a string?

Answer: Transverse waves on a string are generated by shaking one end of the string up and down, causing waves to propagate perpendicular to the direction of shaking.

Question: What is the speed of sound in water compared to air?

Answer: The speed of sound in water is about four times faster, approximately 1400 m/s, compared to 330 m/s in air.

Question: What is the pressure exerted at a depth of 2 meters in a tank with water density of  $1000 \text{ kg/m}^3$  and  $g = 10 \text{ m/s}^2$ ?

Answer: The pressure is 20,000 Pa, calculated as  $2 \text{ m} * 1000 \text{ kg/m}^3 * 10 \text{ m/s}^2$ .

Question: What is osteoporosis, and how can it be prevented?

Answer: Osteoporosis is a condition characterized by weakened bones, preventable through adequate calcium and vitamin D intake, regular exercise, and avoiding smoking and excessive alcohol consumption.

Question: What is the effect of temperature on the rate of reaction?

Answer: Increasing temperature generally increases the rate of reaction by providing more kinetic energy for reactant collisions.

Question: Explain the concept of action and reaction with the example of a balloon.

Answer: When air is expelled from a balloon (action), the balloon moves in the opposite direction (reaction) due to the force exerted by the escaping air on the balloon.

Question: What is ground layering?

Answer: Ground layering involves initiating rooting from a branch of the plant closer to the ground level by making a small cut on the underside of the selected twig, bending it, and burying it under the soil. After a few weeks, the twig develops roots and is separated from the mother plant.

Question: How does a liquid crystal display (LCD) produce images?

Answer: An LCD produces images by manipulating the alignment of liquid crystals with electric fields, controlling light passage through color filters to form images.

Question: What are the uses of sodium chloride in everyday life?

Answer: Sodium chloride is used to flavor and preserve food, produce chemicals, and in various industrial processes.

Question: How does the force on a conductor change with magnetic field strength?

Answer: The force increases with stronger fields, as it is directly proportional to the field strength.

Question: How do string instruments produce sound?

Answer: String instruments produce sound by the vibrations of a stretched string.

Question: How does the length of a conductor affect the force in a magnetic field?

Answer: A longer conductor experiences a greater force, as the force is directly proportional to the conductor's length.

Question: What role does water play in the removal of waste from the body?

Answer: Water facilitates the removal of excretory material and fecal matter from the body.

Question: How much power is exerted by a child lifting a 4 kg bag to a height of 1.5 m in 3 seconds?

Answer: The power exerted is 20 Watts (W).

Question: What is water footprint, and how is it measured?

Answer: Water footprint is the amount of fresh water used in the production or supply of goods and services consumed by a person or group. It is measured in liters and reflects the water used throughout the production process.

Question: Explain the operation of a solenoid in electromechanical systems.

Answer: A solenoid converts electrical energy into mechanical movement by using an electromagnet to move a metal plunger, providing linear actuation for various applications.

Question: What is the purpose of a power amplifier in audio systems?

Answer: A power amplifier increases the power of audio signals, driving speakers to produce sound at higher volumes and with better clarity.

Question: How does the area of cross-section affect the resistance of a conductor?

Answer: The resistance of a conductor is inversely proportional to its area of cross-section; a larger cross-sectional area results in lower resistance.

Question: What is a hydraulic jack and how does it function?

Answer: A hydraulic jack operates on the principle of pressure transmission. A force applied on a small piston generates pressure in the oil, which is transmitted to a larger piston, lifting the vehicle.

Question: What are the main processes involved in excretion?

Answer: Excretion involves the removal of metabolic waste products from the body, including CO<sub>2</sub>, urea, uric acid, salts, and water.

Question: What are the features of vertebrates in the class Aves?

Answer: Vertebrates in the class Aves have a light bony endoskeleton, streamlined bodies, feathers covering their skin, beaks adapted for different modes of nutrition, eyes with eyelids, pentadactyle limbs (forelimbs converted into wings), a four-chambered heart, and are warm-blooded.

Question: What is the function of brushing rings in an alternating current dynamo?

Answer: Brushing rings connect the rotating coil to the external circuit, allowing current to flow continuously despite the coil's rotation.

Question: What is the purpose of miniature circuit breakers (MCBs) in a distribution box?

Answer: MCBs protect individual circuits in the household from overcurrent by automatically disconnecting when the current exceeds the circuit's capacity.

Question: How is ground layering performed?

Answer: Ground layering involves making a small cut on the underside of a branch close to the ground, bending and burying the branch in the soil, and separating it from the mother plant once roots develop.

Question: Explain the role of the cytoplasm in cellular activities.

Answer: The cytoplasm provides a medium for biochemical reactions, houses organelles, and facilitates the movement of materials within the cell, supporting cellular activities.

Question: What is the relationship between sound wave amplitude and energy?

Answer: Higher amplitude sound waves carry more energy, resulting in louder sounds.

Question: What happens when the forces acting on an object are not coplanar?

Answer: When the forces acting on an object are not coplanar, the object will not be in equilibrium and will move or rotate due to the unbalanced forces and moments.

Question: Why is it important to use hot solvent during the filtration step in recrystallization?

Answer: Hot solvent ensures that the solute remains dissolved, allowing impurities to be filtered out while the solution is still saturated.

Question: Why is a polystyrene cup used in Activity 8.4?

Answer: To minimize heat loss to the surroundings and absorption of heat by the container.

Question: How does a U-magnet create a uniform field for studying electromagnetic effects?

Answer: The U-shape focuses the field between the poles, providing a strong, uniform magnetic field for experiments.

Question: How does the electrolysis of sodium chloride solution produce chlorine gas?

Answer: Chlorine gas is produced at the anode by the oxidation of  $\text{Cl}^-$  ions:  
 $2\text{Cl}^- (\text{aq}) \rightarrow \text{Cl}_2 (\text{g}) + 2\text{e}^-$ .

Question: What is the significance of the slope in a displacement-time graph?

Answer: The slope represents the velocity of the object.



Question: How do you find the acceleration of an object from a displacement-time graph?

Answer: Acceleration is found by calculating the second derivative of the displacement with respect to time.

Question: What is the process of vulcanization, and what is its purpose?

Answer: Vulcanization is the process of reacting natural rubber with sulfur to form cross-links, making the rubber harder and less elastic for use in applications like tires and tubes.

Question: What is hypogeal germination?

Answer: Hypogeal germination is when the plumule emerges from the soil but the cotyledon does not. The cotyledon and endosperm supply food for the seedling at its early stage, but the cotyledon does not produce food by photosynthesis. Most monocotyledonous plants show hypogeal germination, such as coconut and corn.

Question: Why does the relative atomic mass have no units?

Answer: The relative atomic mass has no units because it is a ratio of the mass of an atom to the mass of the atomic mass unit ( $1/12$  of carbon-12).

Question: How does a piezoelectric pressure sensor work?

Answer: A piezoelectric pressure sensor works by converting pressure into an electrical charge through the deformation of piezoelectric materials, providing precise pressure measurements.

Question: What is tetrafluoroethene, and what is its structure?

Answer: Tetrafluoroethene is a derivative of ethene where all four hydrogen atoms are replaced by fluorine atoms, with the formula  $C_2F_4$  and a structure similar to ethene but with fluorine atoms.

Question: How do lithium and oxygen atoms achieve a stable electronic configuration in lithium oxide?

Answer: Lithium atoms lose electrons to form  $Li^+$  ions, and oxygen atoms gain electrons to form  $O^{2-}$  ions. The electrostatic attraction between these ions forms lithium oxide ( $Li_2O$ ).

Question: What is the primary function of phloem tissue?

Answer: Phloem tissue transports food (mainly sucrose) synthesized in the leaves throughout the plant body.

Question: How do you calculate the potential difference across a bulb with a resistance of  $4\ \Omega$  and a current of  $0.8\ A$ ?

Answer: Using Ohm's Law,  $V = IR$ , the potential difference is  $V = 0.8\ A \times 4\ \Omega = 3.2\ V$ .

Question: What is the reaction between aluminum and copper sulfate solution?

Answer: Aluminum displaces copper from copper sulfate, forming aluminum sulfate and copper:  $2Al + 3CuSO_4 \rightarrow Al_2(SO_4)_3 + 3Cu$ .

Question: What is syphilis?

Answer: Syphilis is a bacterial STD caused by *Treponema pallidum*, presenting with painless blisters, fever, and throat pain. It can spread to other organs and persist in the blood if not treated early.

Question: What is the role of genes in determining an organism's traits?

Answer: Genes are specific segments of DNA that code for particular traits, determining the physical and physiological characteristics of an organism.

Question: How do you prepare a 1 mol/dm<sup>3</sup> solution of sodium nitrate?

Answer: Weigh the required mass of sodium nitrate, dissolve it in water, and adjust the final volume in a volumetric flask.

Question: What is the significance of hydrogen bonds in the structure of ice?

Answer: Hydrogen bonds in the structure of ice create an open, hexagonal lattice that makes ice less dense than liquid water, allowing it to float.

Question: How can the effect of a catalyst on a reaction be demonstrated experimentally?

Answer: By comparing the rate of gas evolution in reactions with and without the catalyst, the effect of the catalyst can be observed.

Question: How does the design of an electrochemical cell impact its performance?

Answer: The design of an electrochemical cell impacts its performance by influencing factors like electrode configuration, electrolyte composition, ion transport, and heat management. Optimal design ensures efficient reactions, high power output, and long cell life.

Question: How is the efficiency of a transformer related to the input and output power?

Answer: Assuming no energy loss, the power input to the primary coil ( $V_p I_p$ ) is equal to the power output from the secondary coil ( $V_s I_s$ ), according to the law of energy conservation.

Question: How does a diode protect a device from damage due to incorrect power connections?

Answer: A diode prevents damage by blocking current flow if the power connections are reversed. It allows current flow only when the correct polarity is applied.

Question: How are organisms classified into groups?

Answer: Organisms are classified into groups to make it easier to study them, identify specific characteristics, understand the biosphere, reveal relationships between groups, and identify organisms with economic uses.

Question: What are the two forces acting on an object suspended by a spring balance?

Answer: The two forces acting on an object suspended by a spring balance are the gravitational force (weight) pulling it downwards and the upward force exerted by the spring to keep the object from falling.

Question: How does the area of cross-section affect the resistance of a conductor?

Answer: The resistance of a conductor is inversely proportional to its area of cross-section; a larger cross-sectional area results in lower resistance.

Question: What is the role of a voltage comparator in electronic circuits?

Answer: A voltage comparator compares two input voltages and outputs a signal indicating which input is higher, used in applications like zero-crossing detectors and level shifters.

Question: What are the potential impacts of climate change on marine ecosystems?

Answer: Climate change affects marine ecosystems through ocean acidification, rising sea temperatures, and altered ocean currents. It impacts marine biodiversity, food webs, and ecosystem stability.

Question: How does a moving coil microphone generate electrical signals?

Answer: A moving coil microphone generates electrical signals by vibrating a coil within a magnetic field, inducing an electromotive force corresponding to sound waves.

Question: What happens to the flower after fertilization?

Answer: After fertilization, the ovary develops into a fruit, the wall of the ovary becomes the pericarp, and the fertilized ovule develops into a seed.

Question: What is the magnitude and direction of the resultant force if two collinear forces of 10 N and 6 N act in opposite directions?

Answer: The magnitude of the resultant force is 4 N in the direction of the 10 N force.

Question: What are the environmental benefits of using electrochemical water treatment methods?

Answer: Electrochemical water treatment methods offer environmental benefits by providing efficient removal of contaminants, reducing chemical usage, minimizing sludge production, and allowing on-site treatment without hazardous byproducts.

Question: How does solubility influence the formulation of agricultural products?

Answer: Solubility affects the formulation of agricultural products by determining the effectiveness, stability, and application methods of fertilizers, pesticides, and herbicides.

Question: What is the concentration of a solution containing 1 mol of NaCl in 500 cm<sup>3</sup> of water?

Answer: The concentration is 2 mol/dm<sup>3</sup>.

Question: What is the significance of the latent heat of fusion in phase change processes?

Answer: The latent heat of fusion is significant in phase change processes because it quantifies the energy required to convert a solid into a liquid at its melting point, providing insight into the energy dynamics of phase transitions.

Question: What is the relative molecular mass of glucose (C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>)?

Answer: The relative molecular mass of glucose is 180, calculated as 6 x 12 for carbon, 12 x 1 for hydrogen, and 6 x 16 for oxygen.

Question: What is the function of the cytoplasm in cells?

Answer: The cytoplasm is the gel-like substance within the cell that houses organelles and facilitates the movement of materials and biochemical reactions.

Question: What is required to move a body at rest?

Answer: To move a body at rest, a force must be applied in the direction needed to move the body.

Question: What are the physical properties of oxygen gas?

Answer: Oxygen gas is colorless, odorless, denser than air, supports combustion, and slightly soluble in water.

Question: What is the momentum of a body of mass 2000 kg moving at a velocity of 20 m/s?

Answer: The momentum is  $p = m \times v = 2000 \times 20 = 40000$  kg m/s.

Question: What are the conditions for maintaining equilibrium in a system of forces acting on an object?

Answer: The conditions for maintaining equilibrium are that the forces must be coplanar, their lines of action must intersect at a common point, and the resultant of any two forces must be equal in magnitude and opposite in direction to the third force.

Question: What is coordination, and why is it important?

Answer: Coordination is the maintenance of proper balance between stimulus and response, ensuring smooth functioning of body processes.

Question: What are unisexual flowers?

Answer: Unisexual flowers have either male or female reproductive parts. Staminate flowers have only androecium, while pistillate flowers have only gynoecium.

Question: How does Newton's first law explain the need for helmets in sports?

Answer: Helmets provide protection by distributing the force of impact and reducing the acceleration experienced by the head. Newton's first law explains that the head tends to remain in motion during impact, and the helmet provides the necessary external force to stop the motion.

Question: Why do physicians advise chewing food well for easy digestion?

Answer: Chewing food increases the surface area, facilitating more efficient chemical reactions during digestion.

Question: What is the role of cardiac muscle tissue?

Answer: Cardiac muscle tissue contracts rhythmically to pump blood throughout the body, maintaining circulation and ensuring oxygen and nutrient delivery.

Question: What is the significance of the lines of action of forces in maintaining equilibrium in a system of three parallel forces?

Answer: The lines of action of the three parallel forces must be aligned for equilibrium to be maintained. Forces that are not aligned will result in a net moment, causing the object to rotate or move.

Question: Calculate the power of a bulb connected to a 12V source with a current of 2A.

Answer: The power (P) of the bulb is  $P = VI = 12V \times 2A = 24W$ .

Question: What is inertia?

Answer: Inertia is the tendency of an object to resist changes in its state of motion. An object at rest stays at rest, and an object in motion stays in motion unless acted upon by an external force.

Question: How does the reaction of zinc with hydrochloric acid demonstrate a single displacement reaction?

Answer: Zinc displaces hydrogen from hydrochloric acid, forming zinc chloride and hydrogen gas:  $Zn + 2HCl \rightarrow ZnCl_2 + H_2$ .

Question: How do you measure the current flowing through a circuit with a multimeter?

Answer: Set the multimeter to the current (A) mode, connect the probes in series with the circuit, and read the current value displayed on the multimeter.

Question: How is the position of an element in the Periodic Table determined?

Answer: The position of an element in the Periodic Table is determined by its atomic number and electronic configuration.

Question: What happens when the coil in an alternating current dynamo is parallel to the magnetic field?

Answer: When the coil is parallel to the magnetic field, the induced electromotive force becomes zero as the conductors do not intersect the field lines.

Question: How can the pain from a wasp sting be relieved using neutralization?

Answer: Applying a weak acid like lime juice or vinegar neutralizes the basic poison from a wasp sting.

Question: What is the significance of the rate of reaction in chemical processes?

Answer: The rate of reaction determines how quickly products are formed, affecting the efficiency and feasibility of chemical processes.

Question: What is the relationship between electronegativity and bond polarity?

Answer: The relationship between electronegativity and bond polarity is that a greater difference in electronegativity between two bonded atoms results in a more polar bond, with a larger separation of partial charges.

Question: What are the deficiency symptoms of potassium in plants?

Answer: Deficiency symptoms of potassium in plants include yellow or brown patches in leaves.

Question: What is the significance of the van der Waals equation for real gases?

Answer: The van der Waals equation accounts for the finite size of gas molecules and intermolecular forces, providing a more accurate model for real gas behavior compared to the Ideal Gas Law.

Question: How do convex mirrors enhance safety in vehicles and shops?

Answer: Convex mirrors provide a wider field of view, allowing drivers and shopkeepers to see a larger area, enhancing safety and security.

Question: What is the primary mode of nutrition for green plants?

Answer: Green plants use autotrophic mode of nutrition, producing their own food through photosynthesis.

Question: What is the role of the placenta in fetal development?

Answer: The placenta facilitates the exchange of nutrients, oxygen, and waste products between the mother and fetus through the umbilical cord.

Question: What are some applications of transformers?

Answer: Transformers are used in power stations to step up voltage for transmission, in power substations to step down voltage for distribution, in appliances like computers and radios, and in devices requiring high voltages like microwave ovens and X-ray tubes.

Question: What is the difference between genotype and phenotype?

Answer: Genotype is the genetic makeup of an organism, determining its traits, while phenotype is the observable expression of those traits.

Question: What are the main reasons for the rapid growth of the human population?

Answer: The main reasons for the rapid growth of the human population are the increase in birth rate and the decrease in death rate, facilitated by technological development, medical progress, and high food production.

Question: What is the significance of the overall electrolytic reaction for acidulated water?

Answer: The overall electrolytic reaction for acidulated water,  $2\text{H}_2\text{O} (\text{l}) \rightarrow 2\text{H}_2 (\text{g}) + \text{O}_2 (\text{g})$ , demonstrates the decomposition of water into hydrogen and oxygen gases, highlighting the practical application of electrolysis in producing these gases.

Question: What is the function of the testes?

Answer: The testes produce sperms and are comprised of about 250 testicular lobules, each containing around 1000 seminiferous tubules where sperm mother cells are produced.

Question: How does the induced current in a dynamo vary during one complete rotation?

Answer: The induced current alternates direction during one complete rotation, producing a sinusoidal wave of alternating current.

Question: What factors affect the magnitude of the induced electromotive force?

Answer: The magnitude of the induced electromotive force depends on the number of turns in the coil, the strength of the magnet, and the speed of motion of the magnet or coil.

Question: What is the significance of the cytoskeleton in cell division?

Answer: The cytoskeleton forms the mitotic spindle, which ensures accurate segregation of chromosomes during cell division, maintaining genetic stability.

Question: How does the orientation of a coil affect the induced electromotive force?

Answer: The orientation of the coil relative to the magnetic field affects the induced electromotive force, with maximum induction occurring when the coil intersects the field lines perpendicularly.

Question: What is the minimum bias voltage required for a red LED made from GaAs?

Answer: The minimum bias voltage required for a red LED made from GaAs is 1.8 V.

Question: What are the two types of nucleic acids?

Answer: The two types of nucleic acids are DNA and RNA.

Question: What are the changes that occur in the male reproductive system during puberty?

Answer: Changes in the male reproductive system during puberty include the growth of pubertal hair, widened shoulders, deepened voice, accelerated growth of bones and muscles, production of sperms, and growth of genitals.

Question: What are some examples of organisms in the Domain Archaea?

Answer: Examples include Methanogens and Halophiles.

Question: Describe the process of transcription in the nucleus.

Answer: Transcription is the process where DNA is transcribed into mRNA by RNA polymerase, which then carries the genetic information to ribosomes for protein synthesis.

Question: Why is it important to follow safety measures when using electric appliances?

Answer: Following safety measures prevents electric shocks, fires, and other accidents, ensuring the safe and efficient operation of electric appliances.

Question: What is the principle behind the operation of a hydraulic press?

Answer: The principle behind a hydraulic press is that pressure applied to a confined fluid is transmitted undiminished in all directions, allowing a small force applied to a small piston to generate a larger force on a larger piston.

Question: How do you calculate the number of atoms in a given mass of an element?

Answer: The number of atoms in a given mass of an element is calculated by dividing the mass by the molar mass to find the number of moles, then multiplying by Avogadro's constant.

Question: What are some examples of organisms in the phylum Cnidaria?

Answer: Examples of organisms in the phylum Cnidaria include Hydra, Sea anemone, and Jellyfish.

Question: Describe the equilibrium of a rod resting on two supports.

Answer: The rod is in equilibrium because the weight of the rod is balanced by the perpendicular reaction forces exerted by the supports. The forces are coplanar and parallel, and their magnitudes add up to equal the weight of the rod.

Question: How do animals, wind, and water contribute to pollination?

Answer: Animals, wind, and water contribute to pollination by transferring pollen from one flower to another, facilitating fertilization.

Question: How do lenses in cameras focus light?

Answer: Camera lenses adjust their curvature and position to focus light on the film or sensor, capturing clear images.

Question: Why is the zinc electrode considered the negative terminal in a zinc-copper electrochemical cell?

Answer: The zinc electrode is considered the negative terminal because zinc atoms lose electrons (oxidation) and these electrons accumulate on the zinc strip, making it negatively charged.

Question: What are the uses of Sulphuric acid?

Answer: Sulphuric acid is used in fertilizer production, battery acid, paint, plastic, and detergent production, as a dehydrating agent, and for drying gases.

Question: How does the skin regulate body temperature?

Answer: The skin regulates temperature through sweat production and blood vessel dilation or constriction, releasing or retaining heat.

Question: How do bees produce sound?

Answer: Bees produce sound by moving their wings rapidly back and forth.

Question: What is a number pyramid?

Answer: A number pyramid is a graphical representation of the number of organisms in different trophic levels, expressed as the number of organisms per square meter.

Question: What is the purpose of using a U-magnet in electromagnetic experiments?

Answer: A U-magnet provides a strong, uniform field, allowing accurate observation and study of electromagnetic effects.



Question: How are non-flowering seedless plants adapted to their environment?

Answer: Non-flowering seedless plants are adapted to terrestrial environments with low sunlight, shady, and wet places.

Question: Explain the importance of cell division in tissue repair.

Answer: Cell division is crucial for tissue repair, as it replaces damaged or dead cells with new cells, maintaining tissue integrity and function.

Question: Describe the equilibrium of a framed picture hanging on the wall.

Answer: The framed picture is in equilibrium because the tensions in the two strings balance the weight of the picture. The three forces are coplanar, and their lines of action intersect at a common point.

Question: What is the magnitude of the resultant force if two collinear forces of 10 N and 6 N act in the same direction?

Answer: The magnitude of the resultant force is 16 N.

Question: Explain the process of electroplating with a specific example.

Answer: Electroplating involves depositing a thin layer of metal onto an object's surface using electrolysis. For example, in nickel electroplating, the object to be plated is the cathode, and a nickel anode is used. Nickel ions from the electrolyte are reduced and deposited onto the object's surface.

Question: Describe the role of a step-down transformer in a rectification circuit.

Answer: A step-down transformer reduces the high AC voltage from the power supply to a lower voltage suitable for the rectification process and subsequent use in electronic devices.

Question: How does the specific heat capacity of water influence its use in cooling systems?

Answer: The high specific heat capacity of water allows it to absorb and store large amounts of heat energy, making it effective for use in cooling systems.

Question: What plant did Mendel use for his experiments, and why?

Answer: Mendel used the garden pea (*Pisum sativum*) because it can be easily grown, yields quickly, has pure breeding varieties, and exhibits easily observable contrasting characteristics.

Question: How do geneticists study the inheritance of traits in humans?

Answer: Geneticists study the inheritance of traits in humans by analyzing family pedigrees, conducting genetic tests, and studying the genotypes and phenotypes of individuals.

Question: How do bi-concave lenses affect light rays?

Answer: Bi-concave lenses diverge light rays, making them appear to originate from a focal point on the same side as the object.

Question: What is the resultant force if one child pushes an object with 5 N and another child pulls it with 7 N in the same direction?

Answer: The resultant force is 12 N in the same direction.

Question: Describe the construction and working of a loudspeaker, and explain how it converts electrical signals into sound.

Answer: A loudspeaker converts electrical signals into sound waves through the interaction of magnetic fields and mechanical vibrations. The main components and working mechanism are as follows: Construction: Cone: A lightweight cardboard or plastic cone that moves to produce sound waves. Coil (Voice Coil): A coil of wire attached to the narrow end of the cone. It moves within the magnetic field created by the magnet. Magnet: A permanent ring magnet that creates a magnetic field in the region where the coil moves. Supporting Frame: Holds the cone and magnet in place, allowing the coil to move freely within the magnetic field. Working Mechanism: When an electrical signal (audio signal) flows through the coil, it generates a magnetic field around the coil. This magnetic field interacts with the magnetic field of the permanent magnet, producing a force on the coil according to the Lorentz force principle. The direction and magnitude of the force vary with the audio signal, causing the coil to move back and forth. As the coil moves, it pushes and pulls the cone, causing it to vibrate. The vibrating cone moves the air around it, creating pressure waves that propagate as sound waves. The sound waves correspond to the variations in the electrical signal, accurately reproducing the original sound. Application: Loudspeakers are essential components in audio systems, used in everything from home theater systems and musical instruments to public address systems and headphones.

Question: What are the advantages of using electroplating for coating metal objects?

Answer: Electroplating provides a durable and attractive finish, enhances corrosion resistance, improves wear resistance, and offers cost-effective surface treatment for various metal objects.

Question: How does the RCCB protect against electric shocks?

Answer: The RCCB detects current leaks to the ground and automatically disconnects the power supply, preventing electric shocks and potential injuries.

Question: What is the significance of the principal axis in lenses?

Answer: The principal axis is the reference line for measuring angles and distances in ray diagrams, crucial for analyzing lens behavior.

Question: What does a curved line on a displacement-time graph indicate?

Answer: A curved line indicates non-uniform velocity.

Question: What are the causes of water scarcity?

Answer: Causes of water scarcity include over-extraction, pollution, climate change, population growth, and inefficient water management practices.

Question: What experiment demonstrates that sound cannot travel through a vacuum?

Answer: The bell jar experiment, where an electric bell becomes inaudible as air is removed from the jar, demonstrates that sound cannot travel through a vacuum.

Question: What is the role of carbon brushes in an alternating current dynamo?

Answer: Carbon brushes maintain contact with the rotating brushing rings, allowing current to flow to the external circuit without wearing out quickly.

Question: What is the role of friction in Newton's first law?

Answer: Friction is the resistive force that opposes motion and is the reason why moving objects eventually come to rest even without an external force applied.

Question: What is the significance of the Nyquist sampling theorem in digital signal processing?

Answer: The Nyquist sampling theorem states that to accurately reconstruct a signal, it must be sampled at least twice the frequency of its highest component, preventing aliasing and ensuring faithful signal representation.

Question: What happens to the image when the object distance is equal to twice the focal length?

Answer: The image is real, inverted, and the same size as the object, formed at twice the focal length on the opposite side of the lens.

Question: How does a permanent magnet differ from an electromagnet?

Answer: A permanent magnet retains its magnetism indefinitely, while an electromagnet only exhibits magnetism when an electric current flows through its coil.

Question: What is the effect of solvent-solvent interactions on solubility?

Answer: Strong solvent-solvent interactions can decrease solubility by making it harder for the solute to disrupt these interactions and dissolve.

Question: What factors affect the magnitude of the force on a current-carrying conductor?

Answer: The magnitude of the force depends on the magnitude of the current, the length of the conductor, and the strength of the magnetic field.

Question: What are the four principal parts of a flower?

Answer: The four principal parts of a flower are the calyx, corolla, androecium (stamen), and gynoecium (pistil).

Question: Why is it important to understand the factors affecting the rate of reaction?

Answer: Understanding these factors allows for better control and optimization of chemical processes in industrial and laboratory settings.

Question: Describe Mendel's concept of "factors" in inheritance.

Answer: Mendel referred to the units of inheritance as "factors," which are now known as genes. Each trait is determined by a pair of factors, one from each parent.

Question: What is the electronic configuration of neon?

Answer: The electronic configuration of neon is 2, 8.

Question: How does electromagnetic induction enable the operation of a moving coil microphone?

Answer: Electromagnetic induction enables the microphone to convert sound waves into electrical signals by inducing a current in the vibrating coil.

Question: What is a virus?

Answer: A virus is an acellular entity that can only reproduce inside a host cell. It is composed of a nucleic acid enclosed by a protein capsid and does not possess any organelles for metabolic reactions.

Question: How does the polarity of a molecule affect its intermolecular forces?

Answer: The polarity of a molecule affects its intermolecular forces by creating dipole-dipole interactions, where positive and negative ends of polar molecules attract each other, increasing the strength of the intermolecular forces.

Question: What are amino acids?

Answer: Amino acids are the building blocks of proteins, made up of a central carbon atom bonded to an amino group, a carboxyl group, a hydrogen atom, and an R group.

Question: What is the electronic configuration of carbon?

Answer: The electronic configuration of carbon is 2, 4.

Question: What are the main differences between monocots and dicots?

Answer: Monocots have a single cotyledon, unbranched stems, fibrous roots, parallel venation, trimerous flowers, no secondary growth, and even stem diameter. Dicots have two cotyledons, branched stems, tap root systems, reticulate venation, tetra- or pentamerous flowers, secondary growth, and broad base stems.

Question: How does a solar inverter convert energy from solar panels?

Answer: A solar inverter converts the DC electricity generated by solar panels into AC electricity, making it compatible with the power grid and household appliances.

Question: What is the electronic configuration of phosphorus?

Answer: The electronic configuration of phosphorus is 2, 8, 5.

Question: What is the significance of the Ideal Gas Law in understanding gas behavior?

Answer: The Ideal Gas Law ( $PV = nRT$ ) describes the relationship between pressure, volume, temperature, and the number of moles of a gas, providing a comprehensive model for gas behavior.

Question: What are the primary components of pancreatic juice, and what do they digest?

Answer: Pancreatic juice contains trypsin (digests proteins), amylase (digests starch), and lipase (digests lipids), aiding in the breakdown of food in the small intestine.

Question: What is the balanced chemical equation for the reaction between sodium and chlorine?

Answer: The balanced chemical equation for sodium reacting with chlorine is:  $2\text{Na} + \text{Cl}_2 \rightarrow 2\text{NaCl}$ .

Question: What is the resultant force of two forces of 8 N and 16 N acting on a trolley?

Answer: The resultant force is 24 N.

Question: How does an ultrasonic sensor measure distance?

Answer: An ultrasonic sensor emits high-frequency sound waves and measures the time it takes for the waves to reflect back from an object, determining the object's distance based on the time delay.

Question: How does the stomach contribute to food digestion?

Answer: The stomach mixes the food bolus with gastric juice to form chyme, which is then gradually released into the small intestine for further digestion.

Question: Materials required :- Two small beakers, kerosene, sugar Method :- Take 50 ml each of the solvents water and kerosene at the same temperature into two small beakers. Add 5 g of sugar into each of them and stir. In which solvent does sugar dissolve? What does this Activity show about the solubility of sugar in different solvents?

Answer: Activity shows that sugar dissolves completely in water but remains almost undissolved in kerosene, indicating that the nature of the solvent affects solubility.

Question: What are the functions of the seminal vesicles, prostate gland, and Cowper's glands?

Answer: These glands secrete a white fluid that provides nutrition and transportation for sperms. This fluid, combined with sperms, is called seminal fluid or semen.

Question: What is electronic waste (e-waste)?

Answer: Electronic waste, or e-waste, consists of discarded electronic devices and components that can release harmful substances into the environment.

Question: How does the orientation of the coil affect the induced voltage in a dynamo?

Answer: The orientation of the coil affects the induced voltage, with maximum values generated when the coil is perpendicular to the magnetic field lines.

Question: What is the reaction between sodium hydroxide and sulphuric acid?

Answer: Sodium hydroxide reacts with sulphuric acid to form sodium sulphate and water ( $2\text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$ ).

Question: Describe the process of electrochemical synthesis of ammonia and its importance.

Answer: The electrochemical synthesis of ammonia involves the reduction of nitrogen gas and hydrogen gas using an electrochemical cell, providing a sustainable and energy-efficient alternative to the traditional Haber-Bosch process. It is important for producing ammonia, a key ingredient in fertilizers, with lower energy consumption and reduced carbon footprint.

Question: How is carbon dioxide gas used in fire extinguishers?

Answer: Carbon dioxide, being a non-supporter of combustion, is used in fire extinguishers to smother flames and prevent fires from spreading.

Question: How is the purity of metals improved through electrolysis?

Answer: The purity of metals is improved through electrolysis by using an electrolytic refining process, where impure metal is used as the anode, pure metal is deposited at the cathode, and impurities are left behind or collected as sludge.

Question: In what ratio do hydrogen and oxygen combine in carbohydrates?

Answer: Hydrogen and oxygen combine in a 2:1 ratio in carbohydrates.

Question: What is the resultant force if two forces of 10 N and 6 N act in opposite directions?

Answer: The resultant force is 4 N in the direction of the 10 N force.

Question: What is the electronic configuration of sodium?

Answer: The electronic configuration of sodium is 2, 8, 1.

Question: How does the coil's position affect the electromotive force in an alternating current dynamo?

Answer: The electromotive force varies with the coil's position, reaching maximum values when the coil intersects the magnetic field lines perpendicularly.

Question: How does the distance between the lens and the object affect the image formed by a convex lens?

Answer: The size, nature, and position of the image vary depending on the object's distance from the lens.

Question: How does cellular respiration in living organisms qualify as an exothermic reaction?

Answer: It releases energy in the form of heat as glucose is broken down to produce ATP.

Question: How does a moving coil microphone generate electrical signals?

Answer: A moving coil microphone generates electrical signals by vibrating a coil within a magnetic field, inducing an electromotive force corresponding to sound waves.

Question: What are the common characteristics of living organisms?

Answer: The common characteristics of living organisms include cellular organization, nutrition, respiration, irritability and coordination, excretion, movement, reproduction, growth, and development.

Question: What is the function of a rectifier diode in power supplies?

Answer: A rectifier diode converts AC to DC by allowing current to flow in only one direction, providing the necessary DC voltage for electronic devices.

Question: Describe the construction and working of a zinc-carbon dry cell.

Answer: A zinc-carbon dry cell consists of a zinc anode, a carbon rod cathode surrounded by a manganese dioxide and carbon powder mixture, and an electrolyte paste of ammonium chloride. The zinc anode undergoes oxidation, and manganese dioxide is reduced, generating electrical energy.

Question: How does the release of chlorofluorocarbons (CFCs) affect the ozone layer?

Answer: CFCs break down ozone molecules in the stratosphere, leading to ozone depletion and the formation of ozone holes. This allows harmful ultraviolet radiation to reach the Earth's surface, increasing the risk of skin cancer and other health issues.

Question: How is the rate of doing work related to power?

Answer: The rate of doing work is the power, defined as the amount of work done per unit time.

Question: How is a carbon tetrachloride ( $\text{CCl}_4$ ) molecule formed?

Answer: A carbon tetrachloride ( $\text{CCl}_4$ ) molecule is formed when a carbon atom shares four pairs of electrons with four chlorine atoms.

Question: What is the significance of clockwise and anti-clockwise moments in determining the equilibrium of an object?

Answer: Clockwise and anti-clockwise moments determine the equilibrium of an object. When the sum of clockwise moments equals the sum of anti-clockwise moments, the object is in equilibrium and does not rotate.

Question: What is the significance of Mendel's choice of the garden pea plant for his experiments?

Answer: The garden pea plant's ease of cultivation, short generation time, and clear contrasting traits made it an ideal choice for Mendel's genetic experiments, allowing for accurate observations of inheritance patterns.

Question: How do animals perform digestion?

Answer: Animals perform digestion by breaking down food into smaller molecules through mechanical and chemical processes, allowing nutrients to be absorbed and utilized by the body.

Question: What is the valency of silicon?

Answer: The valency of silicon is 4.

Question: How is static friction related to the applied force before the motion starts?

Answer: Static friction increases with the applied force but only up to a certain maximum value, which is the limiting frictional force.

Question: What are some common acids used in laboratory experiments?

Answer: Hydrochloric acid (HCl), nitric acid (HNO<sub>3</sub>), and sulphuric acid (H<sub>2</sub>SO<sub>4</sub>) are common acids used in laboratory experiments.

Question: What is an n-type semiconductor and how is it created?

Answer: An n-type semiconductor is created by doping an intrinsic semiconductor with a group V element, such as phosphorous, which adds extra free electrons to the lattice, increasing conductivity.

Question: What is the role of the nucleolus in eukaryotic cells?

Answer: The nucleolus is responsible for producing and assembling ribosomal RNA (rRNA) and ribosomal subunits, which are essential for protein synthesis.

Question: How do animals perform osmoregulation?

Answer: Animals perform osmoregulation by regulating the balance of water and electrolytes through organs such as the kidneys, which filter blood, reabsorb needed substances, and excrete excess salts and water.

Question: What is gravitational acceleration?

Answer: Gravitational acceleration is the acceleration caused by the earth's gravitational attraction, symbolized by 'g', with an average value of approximately 9.8 m/s<sup>2</sup> at sea level.

Question: What are the 4Rs of waste management?

Answer: The 4Rs of waste management are Reuse (use items again), Reduce (minimize unnecessary items), Replace (use eco-friendly alternatives), and Recycle (convert waste into new products). These practices help manage waste effectively and sustainably.

Question: What is the working principle of a solenoid in electromechanical systems?

Answer: A solenoid converts electrical energy into mechanical movement by using an electromagnet to move a metal plunger, providing linear actuation for various applications.

Question: What are the three components of the biosphere?

Answer: The three components of the biosphere are the lithosphere, hydrosphere, and atmosphere.

Question: What is sustainable development?

Answer: Sustainable development is the practice of meeting present needs without compromising the ability of future generations to meet their own needs.

Question: What is global warming?

Answer: Global warming is the long-term increase in Earth's average surface temperature due to human activities and natural processes.

Question: How does the speed of a rotating coil influence the dynamo's output?

Answer: A faster rotating coil increases the rate of change of the magnetic field, generating higher voltage and more electrical power.



Question: What is the importance of intercalated discs in cardiac muscle tissue?

Answer: Intercalated discs connect cardiac muscle cells, allowing synchronized contractions and efficient heart function.

Question: What is the role of a volumetric flask in preparing standard solutions?

Answer: A volumetric flask ensures precise measurement of the solution's final volume for accurate concentration.

Question: What is the resultant force when two forces of 8 N and 16 N act on a trolley?

Answer: The resultant force is 24 N.

Question: What components are essential for the operation of a bicycle dynamo?

Answer: Essential components of a bicycle dynamo include the rotating coil, magnetic field, mechanical connection to the tire, and electrical circuit.

Question: What are the four classes of solutes and solvents based on polarity and composition?

Answer: The four classes are polar organic solutes/solvents, non-polar organic solutes/solvents, polar inorganic solutes/solvents, and non-polar inorganic solutes/solvents.

Question: What are the three conditions necessary for an object to remain in equilibrium under two forces?

Answer: The three conditions necessary for an object to remain in equilibrium under two forces are: (1) the forces must have equal magnitudes, (2) the forces must act in opposite directions, and (3) the forces must lie along the same line of action.

Question: What is the purpose of the axle in an alternating current dynamo?

Answer: The axle rotates the coil within the magnetic field, enabling continuous induction of electromotive force and generation of alternating current.

Question: How does natural classification explain the relationships among organisms?

Answer: Natural classification explains the evolutionary relationships among organisms by considering morphological, physiological, cytological, and molecular biological features.

Question: Describe the process of electrochemical hydrogenation and its applications.

Answer: Electrochemical hydrogenation involves the reduction of unsaturated organic compounds using hydrogen gas produced electrochemically. It is used in the synthesis of pharmaceuticals, agrochemicals, and fine chemicals, offering a cleaner alternative to traditional hydrogenation methods.

Question: What is the valency of aluminium?

Answer: The valency of aluminium is 3.

Question: How do pH buffers work in biological systems?

Answer: pH buffers maintain a stable pH in biological systems by neutralizing excess acids or bases, essential for proper enzyme function and metabolic processes

Question: Name a few plants from which essential oils are commonly extracted.

Answer: Cinnamon, citronella, lemongrass, eucalyptus, clove, rose, jasmine, lemon, and nutmeg.

Question: How does an electrochemical gradient drive the production of ATP in cells?

Answer: An electrochemical gradient, created by the transport of protons across the mitochondrial membrane, drives the production of ATP in cells through chemiosmosis. The flow of protons back into the mitochondrial matrix through ATP synthase generates ATP from ADP and inorganic phosphate.

Question: What is the role of epigenetics in gene expression?

Answer: Epigenetics studies how environmental factors and chemical modifications to DNA and histones can affect gene expression without changing the underlying DNA sequence, influencing development and disease.

Question: What is the principle of operation of a liquid-in-glass thermometer?

Answer: A liquid-in-glass thermometer operates on the principle of thermal expansion, where the liquid (typically mercury or alcohol) expands or contracts with temperature changes, moving along a calibrated scale.

Question: What are some examples of dicots and their features?

Answer: Examples of dicots include chillies, jak, and blue lotus. They have reticulate venation, tetra- or pentamerous flowers, and undergo secondary growth.

Question: What are some examples of monocots?

Answer: Examples of monocots include paddy, grass, and arecanut.

Question: How do plants respond to environmental stress?

Answer: Plants respond to environmental stress through various mechanisms, such as closing stomata to reduce water loss, producing stress-related hormones, and altering growth patterns.

Question: What is the resistance of a nichrome wire coil if a current of 0.5 A flows through it with a potential difference of 3 V?

Answer: Using Ohm's Law,  $R = V/I$ , the resistance is  $R = 3 \text{ V} / 0.5 \text{ A} = 6 \Omega$ .

Question: What is the significance of grafting in plant propagation?

Answer: Grafting allows the propagation of plants with desirable traits, including disease resistance and strong root systems, by fusing the stock and scion.

Question: How is the human reproductive process regulated?

Answer: The human reproductive process is regulated by hormones such as FSH, LH, testosterone, estrogen, and progesterone, secreted by various endocrine glands.

Question: How do you maintain equilibrium in an object under the action of more than three forces?

Answer: Maintain equilibrium by applying the forces in such a way that their resultant is zero, meaning the sum of the forces and moments balance out, resulting in no net force or moment acting on the object.

Question: What is the pressure exerted at a depth of 2 meters in a tank with water density of  $1000 \text{ kg/m}^3$  and  $g = 10 \text{ m/s}^2$ ?

Answer: The pressure is  $20,000 \text{ Pa}$ , calculated as  $2 \text{ m} * 1000 \text{ kg/m}^3 * 10 \text{ m/s}^2$ .

Question: What are the main features of an animal cell?

Answer: Animal cells are covered by a plasma membrane, have a centralized nucleus, and contain cytoplasm, a gelatinous material.

Question: What is the function of the Golgi apparatus in a cell?

Answer: The Golgi apparatus modifies, sorts, and packages proteins and lipids for secretion or delivery to other organelles, playing a key role in the cell's transport system.

Question: What is the chemical formula for sodium chloride?

Answer: The chemical formula for sodium chloride is  $\text{NaCl}$ .

Question: What are the functions of hair and nails?

Answer: Hair provides protection and insulation, while nails protect the fingertips and enhance fine motor skills.

Question: Calculate the relative molecular mass of carbon dioxide ( $\text{CO}_2$ ).

Answer: The relative molecular mass of carbon dioxide is 44, calculated as 12 for carbon plus  $2 \times 16$  for oxygen.

Question: What is the specific heat capacity of aluminium, and how is it measured?

Answer: The specific heat capacity of aluminium is  $900 \text{ J kg}^{-1} \text{ K}^{-1}$ . It is measured by supplying a known amount of heat to a known mass of aluminium and recording the resulting temperature change.

Question: What is the effect of a plano-convex lens on light rays?

Answer: A plano-convex lens converges light rays to a focal point on the convex side.

Question: What is the main difference between simple distillation and steam distillation?

Answer: Simple distillation separates components based on boiling points, while steam distillation is used to extract volatile compounds from plant materials using steam, preventing decomposition.

Question: What are the features of invertebrates in the phylum Cnidaria?

Answer: Invertebrates in the phylum Cnidaria are aquatic, mostly marine, diploblastic with a coelenteron, have radial symmetry, and are predators with nematocysts.

Question: What is the electronegativity value of fluorine?

Answer: Fluorine has an electronegativity value of 4.0 on the Pauling scale, the highest of all elements.

Question: How is pitch related to frequency?

Answer: Pitch is the perception of sound frequency; higher frequencies correspond to higher pitches.

Question: How do lysosomes facilitate cellular recycling?

Answer: Lysosomes break down damaged or unnecessary cellular components, recycling their building blocks for new cellular structures and functions, maintaining cellular health.

Question: What is the primary function of sclerenchyma tissue?

Answer: The primary function of sclerenchyma tissue is to provide mechanical strength and support to the plant body.

Question: What is the role of companion cells in relation to sieve tube elements?

Answer: Companion cells support sieve tube elements by managing their metabolic activities and aiding in the transport of nutrients.

Question: How do strong acids behave in an aqueous medium?

Answer: Strong acids completely ionize in an aqueous medium, meaning all acid molecules dissociate into  $\text{H}^+$  ions and corresponding negative ions.

Question: What is the velocity of an object that travels 12 meters in 3 seconds?

Answer:  $\text{Velocity} = 12 \text{ m} / 3 \text{ s} = 4 \text{ m/s}$ .

Question: How does the release of methane ( $\text{CH}_4$ ) affect the environment?

Answer: The release of methane ( $\text{CH}_4$ ) affects the environment by contributing to the greenhouse effect and global warming, as methane is a potent greenhouse gas.

Question: How does the pH of the stomach aid in digestion?

Answer: The acidic pH of the stomach activates digestive enzymes and helps break down food, aiding in nutrient absorption.

Question: How do inhibitors affect the rate of chemical reactions?

Answer: Inhibitors slow down reactions by decreasing the frequency of effective collisions between reactant particles.

Question: What is the concentration of a solution containing 0.2 mol of urea in  $1 \text{ dm}^3$  of water?

Answer: The concentration is  $0.2 \text{ mol/dm}^3$ .

Question: What is the function of the diaphragm in a moving coil microphone?

Answer: The diaphragm in a moving coil microphone vibrates in response to sound waves, moving the attached coil and inducing an electromotive force.

Question: What is the role of genes in determining an organism's traits?

Answer: Genes are specific segments of DNA that code for particular traits, determining the physical and physiological characteristics of an organism.

Question: Why does the rate of reaction increase with higher concentration of reactants?

Answer: Higher concentration increases the number of reactant particles, leading to more collisions and a faster reaction rate.

Question: How do lateral meristems contribute to plant growth?

Answer: Lateral meristems are located laterally in the stems and roots, parallel to the longitudinal axis, and contribute to increasing the diameter of the plant.

Question: What is the valency of potassium?

Answer: The valency of potassium is 1.

Question: What are the three main parts of the brain?

Answer: The cerebrum, cerebellum, and medulla oblongata.

Question: What is the reaction between zinc and sulfuric acid?

Answer: Zinc reacts with sulfuric acid to form zinc sulfate and hydrogen gas:  $\text{Zn} + \text{H}_2\text{SO}_4 \rightarrow \text{ZnSO}_4 + \text{H}_2$ .

Question: What is the role of ribosomes in the cell?

Answer: Ribosomes are the site of protein synthesis, where they translate mRNA into amino acid sequences, forming proteins.

Question: How do infrared rays contribute to thermal imaging?

Answer: Infrared rays are used in thermal imaging to detect heat emitted by objects, allowing for the visualization of temperature differences.

Question: What is the atomic number of fluorine?

Answer: The atomic number of fluorine is 9.

Question: What is the first ionisation energy of helium?

Answer: The first ionisation energy of helium is 2372 kJ/mol.

Question: How is the center of gravity related to the equilibrium of a lamina?

Answer: The center of gravity is the point where the weight of the lamina acts. For equilibrium, the lines of action of the forces must pass through the center of gravity and lie in the same plane.

Question: What is the role of accurate weighing in solution preparation?

Answer: Accurate weighing ensures the correct amount of solute is used, resulting in the desired concentration of the solution.

Question: What are the symptoms and treatment of tuberculosis?

Answer: Symptoms of tuberculosis include coughing blood, fever, tiredness, weight loss, and loss of appetite. It can be treated with proper medical intervention and prevented with vaccines.

Question: How does lactic acid fermentation occur in human cells?

Answer: During anaerobic respiration, glucose is broken down into lactic acid, releasing energy, which can accumulate in muscles causing pain and cramps.