Science

Notes

Chapter 1

Chemical Equations and Reactions

Concise Syllabus Overview Utilizing the 80/20 Principle

🟩 Key Concepts

- ✅ **Chemical Reaction:**

A process in which one or more substances (reactants) are converted to new substances (products).

Observable signs include color change, gas formation, temperature change, and precipitate formation.

- ✅ **Chemical Equation:**

A symbolic representation of a chemical reaction.

For example:

Magnesium reacts with oxygen to form magnesium oxide:

$Mg + O_2 \rightarrow MgO$

- ✅ **Balanced Chemical Equation:**

Number of atoms of each element is the same on both sides. Balancing is done by adjusting coefficients.

🟩 Types of Chemical Reactions

- 🔷 **Combination Reaction:**

Two or more substances combine to form a single product.

Example: Calcium oxide reacts with water to form calcium hydroxide.

$CaO + H_2O \rightarrow Ca(OH)_2$

- 🔷 **Decomposition Reaction:**

A single compound breaks down into two or more products.

Example: Mercuric oxide decomposes on heating to form mercury and oxygen.

$2HgO \rightarrow 2Hg + O_2$

Types:

Thermal (heat)

Photolytic (light)

Electrolytic (electricity)

- 🔷 **Displacement Reaction:**

A more reactive element displaces a less reactive element from its compound.

Example: Zinc displaces copper from copper sulfate solution.

$Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$

- 🔷 **Double Displacement Reaction:**

Two compounds exchange ions to form two new compounds.

Example: Sodium sulfate reacts with barium chloride to form barium sulfate and sodium chloride.

$Na_2SO_4 + BaCl_2 \rightarrow BaSO_4 + 2NaCl$

- 🔷 **Redox Reaction:**

Oxidation and reduction occur together.

Example:

$Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$

Oxidation and Reduction

- ✅ **Oxidation:**

Addition of oxygen

Removal of hydrogen

Loss of electrons

- ✅ **Reduction:**

- Removal of oxygen
- Addition of hydrogen
- Gain of electrons
- Example:
- $CuO + H_2 \rightarrow Cu + H_2O$
- Here, copper oxide is reduced to copper, and hydrogen is oxidized to water.

Effects of Oxidation in Daily Life

- ✅ **Corrosion:**

Iron reacts with oxygen and moisture to form rust (hydrated iron oxide).

$4Fe + 3O_2 + H_2O \rightarrow 2Fe_2O_3 \cdot nH_2O$

Corrosion damages bridges, vehicles, etc.

- ✅ **Rancidity:**

- Oxidation of fats and oils in food results in bad smell and taste.
- Prevention:
- Adding antioxidants (like BHA, BHT)
- Refrigeration
- Vacuum packing

High-Yield Equations to Practice

$C + O_2 \rightarrow CO_2$

$2Pb(NO_3)_2 \rightarrow 2PbO + 4NO_2 + O_2$

$Fe + CuSO_4 \rightarrow FeSO_4 + Cu$

$AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$

$CuO + H_2 \rightarrow Cu + H_2O$

Chapter 2

Acids, Basis and Salts

Key Concepts

✅ Acids:

- Sour in taste.
- Turn blue litmus red.
- Example: HCl, H_2SO_4.

✅ Bases:

- Bitter, soapy feel.
- Turn red litmus blue.
- Example: NaOH, NH_4OH.

✅ Indicators:

- Substances that change color in acidic or basic solutions.
- Examples: Litmus, methyl orange, phenolphthalein.

Important Reactions

✅ Reaction of Acids with Metals:

Acid + Metal → Salt + Hydrogen gas

Example:

$Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2\uparrow$

✅ Reaction of Bases with Metals:

Base + Metal → Salt + Hydrogen gas

Example:

$2NaOH + Zn \rightarrow Na_2ZnO_2 + H_2\uparrow$

✅ Reaction of Acids with Metal Carbonates / Bicarbonates:

Acid + Metal carbonate → Salt + CO_2 + H_2O

Example:

$CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + H_2O$

✅ Reaction of Acids with Metal Oxides:

Acid + Metal oxide → Salt + Water

Example:

$2HCl + CuO \rightarrow CuCl_2 + H_2O$

✅ Reaction of Bases with Non-Metal Oxides:

Base + Non-metal oxide → Salt + Water

Example:

$Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$

pH Scale

✅ Measures the hydrogen ion concentration (acidity or basicity).

✅ pH less than 7: Acidic

✅ pH 7: Neutral

✅ pH more than 7: Basic

✅ pH of common substances:

- Stomach acid (pH ~1-2)
- Blood (pH ~7.4)
- Soap solution (pH ~8-9)

Salts

✅ Salts are formed by neutralization reactions between acids and bases.

✅ Examples:

- Sodium chloride (NaCl)
- Sodium carbonate (washing soda, Na_2CO_3)
- Sodium bicarbonate (baking soda, $NaHCO_3$)
- Plaster of Paris ($CaSO_4 \cdot ½H_2O$)

Important Salts and Their Preparation

✅ Sodium hydroxide (NaOH):

Prepared by electrolysis of brine (chlor-alkali process).

Products: NaOH, Cl_2, H_2.

✅ Baking Soda ($NaHCO_3$):

Preparation: $NaCl + H_2O + CO_2 + NH_3 \rightarrow NH_4Cl + NaHCO_3$

Used in baking, as an antacid, and in soda-acid fire extinguishers.

✅ Washing Soda ($Na_2CO_3 \cdot 10H_2O$):

Prepared by heating baking soda.

Used in cleaning, softening hard water.

✅ Plaster of Paris ($CaSO_4 \cdot ½H_2O$):

Prepared by heating gypsum ($CaSO_4 \cdot 2H_2O$) at 373K.

Used for making casts and sculptures.

Neutralization Reaction

✅ **Reaction of an acid with a base to form salt and water.**

Example:

$HCl + NaOH \rightarrow NaCl + H_2O$

Chapter 3

Metals And Non-Metals

Physical Properties

✅ Metals

- Lustrous (shiny)
- Malleable (can be hammered into sheets)
- Ductile (can be drawn into wires)
- Good conductors of heat and electricity
- Sonorous (produce sound when struck)
- High melting and boiling points (generally)

✅ Non-Metals

- Dull, non-lustrous
- Brittle (break easily)
- Poor conductors of heat and electricity (except graphite)
- Low melting and boiling points (generally)

Chemical Properties

✅ Reaction with Oxygen

- Metals react with oxygen to form metal oxides.
- Example: $4Na + O_2 \rightarrow 2Na_2O$
- Metal oxides are usually basic.
- Some metal oxides show both acidic and basic behavior (amphoteric oxides).
- Example: Al_2O_3

✅ Reaction with Water

- Very reactive metals (like sodium, potassium) react vigorously with water to form metal hydroxides and hydrogen gas.
- Example: $2Na + 2H_2O \rightarrow 2NaOH + H_2\uparrow$
- Less reactive metals (like magnesium) react slowly with water.
- Metals like iron do not react with cold water.

✅ Reaction with Acids

- Metals react with dilute acids to produce salt and hydrogen gas.
- Example: $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2\uparrow$
- Metals like copper, silver, and gold do not react with dilute acids.

✅ Reaction with Other Metal Salts (Displacement)

- More reactive metals displace less reactive metals from their salt solutions.
- Example: $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$

Reactivity Series

✅ A list of metals in order of their reactivity.

✅ Highly reactive metals (K, Na, Ca, Mg, Al) at the top.

✅ Less reactive metals (Cu, Ag, Au) at the bottom.

Extraction of Metals

✅ Metals of High Reactivity (K, Na, Ca, Mg, Al)

- Extracted by electrolytic reduction (electrolysis of molten salts).

✅ Metals of Medium Reactivity (Zn, Fe, Pb)

- Extracted by reduction using carbon or carbon monoxide.
- Example:
- $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

✅ Metals of Low Reactivity (Hg, Cu, Ag, Au)

- Found in free state or extracted by heating in air (roasting).

Corrosion

✅ Metals like iron corrode in presence of moisture and oxygen, forming rust (hydrated iron oxide).

✅ Prevention methods:

- Painting
- Oiling/greasing
- Galvanization (coating with zinc)
- Alloying (making alloys)

Alloys

✅ Mixtures of two or more metals or a metal and a non-metal.

✅ Alloys improve properties like hardness, strength, and resistance to corrosion.

✅ Examples:

- Brass (copper + zinc)
- Bronze (copper + tin)
- Steel (iron + carbon)
- Stainless steel (iron + chromium + nickel)

Chapter 4

Carbon And Its Compounds

Carbon: Unique Element

✅ Tetravalent

- Carbon has 4 valence electrons → forms 4 covalent bonds to become stable.

✅ Catenation

- Ability of carbon to form long chains/rings by bonding with itself.

✅ Allotropes of Carbon

- Diamond: Hard, insulator
- Graphite: Soft, conductor
- Fullerene: Molecule shaped like a sphere or tube

Covalent Bonding

✅ Covalent bond:

- Formed when atoms share electrons.
- Example:
  - Methane (CH_4) has carbon sharing electrons with 4 hydrogens.
  - Oxygen molecule (O_2) has double bonds.
  - Nitrogen molecule (N_2) has triple bonds.

Hydrocarbons

✅ Saturated Hydrocarbons

- Single bonds only.
- Called alkanes (general formula: C_nH_{2n+2}).
- Example: Methane (CH_4), Ethane (C_2H_6).

✅ Unsaturated Hydrocarbons

- Double or triple bonds.
- Alkenes (double bonds, C_nH_{2n}). Example: Ethene (C_2H_4).
- Alkynes (triple bonds, C_nH_{2n-2}). Example: Ethyne (C_2H_2).

Functional Groups

✅ Specific atoms or groups of atoms that determine the properties of organic compounds.

✅ Examples:

- Alcohol (–OH)
- Aldehyde (–CHO)
- Ketone (–CO–)
- Carboxylic acid (–COOH)
- Halides (–X)

Homologous Series

✅ Series of compounds with the same functional group and similar chemical properties.

✅ Each member differs by $–CH_2–$ group.

✅ Example:

- Methane (CH_4), Ethane (C_2H_6), Propane (C_3H_8).

Important Chemical Reactions

✅ Combustion

- Carbon compounds + oxygen → CO_2 + H_2O + heat.
- Example: $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

✅ Oxidation

- Alcohols oxidize to acids in presence of oxidizing agents (like alkaline $KMnO_4$).
- Example: Ethanol → Ethanoic acid.

✅ Addition Reaction

- Unsaturated hydrocarbons + hydrogen (in presence of catalyst like nickel).
- Example: Ethene + H_2 → Ethane.

✅ Substitution Reaction

- Saturated hydrocarbons + halogen (like chlorine) → substituted product + hydrogen halide.
- Example: $CH_4 + Cl_2 \rightarrow CH_3Cl + HCl$.

Important Compounds

✅ Ethanol (C_2H_5OH)

- Common alcohol, found in alcoholic drinks.
- Good solvent, used in medicines and perfumes.
- Reacts with sodium to form sodium ethoxide and hydrogen gas.

✅ Ethanoic Acid (CH_3COOH)

- **Also called acetic acid (gives vinegar its sour taste).**
- **Reacts with alcohols to form esters (sweet-smelling compounds).**

✅ Soap and Detergents

- **Soaps: Sodium or potassium salts of fatty acids.**
- **Form micelles in water to clean grease and oil.**

Chapter 5

Life Processes

What are Life Processes?

✅ Life processes are basic activities that living organisms perform to stay alive:

- **Nutrition**
- **Respiration**
- **Transportation**
- **Excretion**

Nutrition

✅ Autotrophic Nutrition

- **Organisms make their own food (like green plants).**
- **Process: Photosynthesis ($CO_2 + H_2O \rightarrow$ Glucose + O_2, in presence of sunlight and chlorophyll).**

✅ Heterotrophic Nutrition

- **Organisms depend on other organisms for food.**
- **Types:**
  - **Holozoic (e.g., humans) – ingest, digest, absorb, assimilate, egest.**
  - **Saprophytic (e.g., fungi) – absorb nutrients from dead matter.**
  - **Parasitic (e.g., leech) – feed on host.**

✅ Human Digestive System (main steps):

- **Mouth (teeth + saliva) → Oesophagus → Stomach (enzymes, HCl) → Small intestine (digestion + absorption) → Large intestine (water absorption).**

Respiration

✅ Definition: Breakdown of food to release energy.

✅ Types:

- **Aerobic: With oxygen → More energy, end products: CO_2 and H_2O.**
- **Anaerobic: Without oxygen → Less energy, end products: Alcohol or lactic acid.**

✅ Human Respiratory System (basic path):

Nostrils → Trachea → Bronchi → Lungs (alveoli for gas exchange).

Transportation

✅ In Humans

- **Circulatory System: Heart, blood vessels, blood.**
- **Heart pumps oxygenated blood via arteries, returns deoxygenated blood via veins.**
- **Components of Blood: RBCs (oxygen transport), WBCs (immunity), platelets (clotting), plasma.**

✅ In Plants

- **Xylem: Water & minerals from roots to leaves.**
- **Phloem: Transports food (glucose) from leaves to other parts.**

Excretion

✅ In Humans

- **Kidneys filter waste from blood → urine.**
- **Urinary system: Kidneys → Ureters → Bladder → Urethra.**

✅ In Plants

- **Waste removal through leaves (transpiration), resins, gums.**

Chapter 6

Control and Co-ordinate

Control and Coordination in Animals

✅ Why Needed?

- To respond to external and internal changes (stimuli).
- Maintain balance and ensure proper functioning of body systems.

✅ Two Main Systems:

- Nervous System
- Endocrine System (Hormonal)

Nervous System in Humans

✅ Basic Unit: Neuron (nerve cell).

✅ Neuron Parts:

- Cell body (cyton)
- Dendrites
- Axon

✅ Transmission of Nerve Impulse

- Electrical impulses travel along the neuron.
- At synapse (gap between neurons), chemical signals pass the impulse.

✅ Human Nervous System Structure

- Central Nervous System (CNS): Brain + Spinal cord.
- Peripheral Nervous System (PNS): Nerves from CNS to body.

✅ Brain Parts and Functions:

- Cerebrum: Thinking, memory, voluntary actions.
- Cerebellum: Balance, coordination.
- Medulla oblongata (brainstem): Involuntary actions (heartbeat, breathing).

Reflex Action

✅ Sudden, automatic response to stimulus (e.g., pulling hand from hot object).

✅ Pathway: Stimulus → Sensory neuron → Spinal cord → Motor neuron → Effector (muscle/gland).

✅ Reflex arcs protect the body from harm.

Coordination in Plants

✅ No Nervous System – they use hormones for control and coordination.

✅ Plant Hormones (Phytohormones):

- Auxins: Cell elongation.
- Gibberellins: Growth of stems.
- Cytokinins: Cell division.
- Abscisic Acid: Inhibits growth (stress hormone).
- Ethylene: Ripening of fruits.

✅ Tropic Movements

- Directional growth in response to stimuli.
- Types:
  - Phototropism: Response to light (shoots bend towards light).
  - Geotropism: Response to gravity (roots grow downwards).
  - Hydrotropism: Response to water.
  - Thigmotropism: Response to touch (like tendrils).

Endocrine System in Animals

✅ Glands produce hormones → chemical messengers controlling processes like growth, metabolism, reproduction.

✅ Examples:

- Pituitary gland: Master gland, controls other glands.
- Thyroid gland: Thyroxine (controls metabolism).
- Adrenal glands: Adrenaline (fight or flight hormone).
- Pancreas: Insulin (controls blood sugar).
- Testes/Ovaries: Reproductive hormones (testosterone, estrogen).

Chapter 7

Control and Co-ordinate

Reproduction: Purpose

✅ Process of producing new organisms of the same species.

✅ Ensures survival of the species and genetic continuity.

Types of Reproduction

✅ Asexual Reproduction

- Single parent.
- Offspring are identical to the parent (clones).
- Methods:
  - Binary Fission (e.g., Amoeba, bacteria)
  - Budding (e.g., yeast, Hydra)
  - Fragmentation (e.g., Spirogyra)
  - Regeneration (e.g., Planaria)
  - Spore Formation (e.g., fungi, Rhizopus)
  - Vegetative Propagation (in plants, like potato tubers, runners, etc.)

✅ Sexual Reproduction

- Two parents.
- Fusion of male and female gametes.
- Results in variation (not identical to parents).

Sexual Reproduction in Plants

✅ Flowers: Main reproductive organs.

- Stamen (male): Anther (pollen), filament.
- Carpel/Pistil (female): Stigma, style, ovary.

✅ Pollination

- Transfer of pollen from anther to stigma.
- Types:
  - Self-pollination: Same flower/plant.
  - Cross-pollination: Between different plants.

✅ Fertilization

- Fusion of male gamete (pollen) with female gamete (egg) to form zygote.
- Zygote → embryo → seed.

Sexual Reproduction in Humans

✅ Male Reproductive System

- Testes (produce sperms + testosterone).
- Vas deferens, urethra.
- Penis for transfer of sperm.

✅ Female Reproductive System

- Ovaries (produce eggs and estrogen/progesterone).
- Fallopian tubes (site of fertilization).
- Uterus (where embryo develops).
- Vagina (birth canal).

✅ Menstrual Cycle

- Monthly cycle (~28 days).
- Involves release of an egg (ovulation) and preparation of uterus lining.
- If fertilization doesn't happen → lining sheds (menstruation).

Fertilization and Development

✅ Fertilization

- Sperm + egg → zygote (in fallopian tube).

✅ Development

- Zygote divides → embryo → implants in uterus lining → develops into fetus.

Importance of Variation

✅ Sexual reproduction introduces variations due to mixing of genes.

✅ Variations help species survive environmental changes (evolutionary advantage).

Contraception

✅ Methods to prevent pregnancy:

- Barrier: condoms, diaphragms.
- Chemical: pills, spermicides.
- Surgical: vasectomy (male), tubectomy (female).
- Natural: avoiding sex during fertile period.

Tips for 90%+ Scoring

- 🔷 Label diagrams: human reproductive systems, flower structure.
- 🔷 Understand examples of asexual reproduction.
- 🔷 Memorize steps of fertilization and menstrual cycle.
- 🔷 Revise NCERT diagrams and practice short answers.

Chapter 8

Heredity and Evolution

Heredity: Basic Concepts

✅ Heredity

- Transmission of traits from parents to offspring.

✅ Variation

- Differences in traits among individuals of a species.

✅ Genetics

- Study of heredity and variation.

Mendel's Experiments

✅ Father of Genetics: Gregor Mendel.

✅ Experiment: Pea plant (Pisum sativum).

✅ Key conclusions:

- Traits are controlled by "factors" (genes).
- Each trait has two alleles (forms of gene) – dominant & recessive.
- Only dominant allele is expressed when present.

✅ Monohybrid Cross

- Involves one trait (e.g., plant height).
- Phenotypic ratio in F_2 generation: 3:1.

Sex Determination

✅ In humans:

- Female: XX chromosomes.
- Male: XY chromosomes.
- Sperm determines the sex (carries either X or Y).
- If sperm with X → female (XX), with Y → male (XY).

Evolution

✅ Definition

- Gradual change in inherited traits of a species over generations.

✅ Charles Darwin's Theory

- Natural selection: Organisms with favorable traits survive and reproduce.

✅ Speciation

- Formation of new species due to:
  - Genetic drift
  - Natural selection
  - Geographical isolation

Tracing Evolutionary Relationships

✅ Homologous Organs

- Same structure, different functions (e.g., forelimbs of human, cat, whale).
- Indicate common ancestry.

✅ Analogous Organs

- Different structures, same functions (e.g., wings of bat and bird).
- Not evidence of common ancestry.

✅ Fossils

- Preserved remains of ancient organisms → show past life forms.

✅ Evolutionary Relationships (Embryology)

- Similarities in early embryonic stages indicate common ancestry.

Evolution vs. Acquired Traits

✅ Inherited traits: Passed from parents (e.g., eye color).

✅ Acquired traits: Developed during lifetime (e.g., bodybuilding) → not inherited.

Chapter 9

Heredity and Evolution

Light and Reflection

✅ Light

- Form of energy that enables us to see objects.
- Travels in straight lines (rectilinear propagation).

✅ Reflection of Light

- Bouncing back of light from a smooth surface.

✅ Laws of Reflection

- Angle of incidence = angle of reflection.
- Incident ray, reflected ray, and normal lie in the same plane.

Types of Reflection

✅ Regular Reflection

- Occurs on smooth surfaces (like mirrors).
- Produces clear images.

✅ Diffuse Reflection

- Occurs on rough surfaces (like paper).
- No clear image formed.

Spherical Mirrors

✅ Types:

- Concave mirror (converging).
- Convex mirror (diverging).

✅ Key Terms

- Pole (P): Centre of mirror's surface.
- Centre of Curvature (C): Centre of the sphere of which the mirror is part.
- Principal Axis: Line passing through pole and centre of curvature.
- Focus (F): Point where parallel rays meet after reflection (concave) or appear to diverge from (convex).
- Focal length (f): Distance between pole and focus.

Image Formation by Spherical Mirrors

✅ Concave Mirror

- Can form real/inverted or virtual/erect images depending on the object's position.
- Uses: Solar cooker, dentist mirror.

✅ Convex Mirror

- Always forms virtual, erect, diminished images.
- Uses: Rear-view mirrors.

Mirror Formula

✅ Formula:

- 1f=1v+1u\frac{1}{f} = \frac{1}{v} + \frac{1}{u}f1=v1+u1fff: focal length
- uuu: object distance
- vvv: image distance

✅ Magnification (m)

- m=h′h=vum = \frac{h'}{h} = \frac{v}{u}m=hh′=uvh′h': image height
- hhh: object height

Refraction of Light

✅ Refraction

- Bending of light as it passes from one medium to another.
- Caused by change in speed of light.

✅ Laws of Refraction

- Incident ray, refracted ray, and normal lie in the same plane.
- sinisinr=constant=μ\frac{\sin i}{\sin r} = \text{constant} = \musinrsini=constant=μ (refractive index).

✅ Refractive Index

μ=speed of light in vacuum (c)speed of light in medium (v)\mu = \frac{\text{speed of light in vacuum (c)}}{\text{speed of light in medium (v)}}μ=speed of light in medium (v)speed of light in vacuum (c)

Lenses

✅ Convex Lens (converging)

- Thicker at the centre.
- Used in magnifying glasses, cameras.

✅ Concave Lens (diverging)

- Thinner at the centre.
- Used in spectacles for myopia.

✅ Lens Formula

1f=1v−1u\frac{1}{f} = \frac{1}{v} - \frac{1}{u}f1=v1−u1

✅ Magnification for Lenses

m=h′h=vum = \frac{h'}{h} = \frac{v}{u}m=hh′=uv

Chapter 10

The Human Eye and the Colourful World

Structure of the Human Eye

✅ Main Parts

- Cornea: Transparent front part that refracts light.
- Iris: Colored part controlling pupil size.
- Pupil: Opening for light entry.
- Lens: Focuses light on retina.
- Retina: Light-sensitive layer with photoreceptors.
- Ciliary muscles: Change lens shape for focusing (accommodation).
- Optic nerve: Carries signals to the brain.

✅ Power of Accommodation

- Ability of the eye lens to adjust focal length to see near and distant objects clearly.

Defects of Vision

✅ Myopia (Nearsightedness)

- Can see nearby objects clearly, distant ones are blurry.
- Cause: Eyeball too long or lens too curved → image in front of retina.
- Correction: Concave lens.

✅ Hypermetropia (Farsightedness)

- Can see distant objects clearly, near ones are blurry.
- Cause: Eyeball too short or lens too thin → image behind retina.
- Correction: Convex lens.

✅ Presbyopia

- Age-related loss of accommodation (elderly people).
- Corrected by bifocal lenses.

✅ Astigmatism

- Uneven cornea curvature → blurred/distorted vision.
- Corrected by cylindrical lenses.

Refraction by a Prism

✅ Prism: Transparent object with triangular cross-section.

✅ When light passes through a prism:

- Deviates from original path → emerges as a spectrum (dispersion).

✅ Dispersion of Light

- Splitting of white light into 7 colors (VIBGYOR).
- Caused because different colors have different refractive indices.

Atmospheric Refraction Effects

✅ Twinkling of Stars

- Starlight bends while passing through Earth's atmosphere (different air layers).
- Causes stars to appear twinkling.

✅ Advanced Sunrise & Delayed Sunset

- Sun appears earlier and sets later because of atmospheric refraction (sunlight bending).

Scattering of Light

✅ Why is the sky blue?

- Shorter wavelengths (blue) scatter more than red.
- Hence, sky appears blue.

✅ Why are sunsets red?

- Sunlight travels longer at sunset → blue light scattered out → red light reaches our eyes.

✅ Tyndall Effect

- Scattering of light by small particles in colloids or suspensions.
- Example: Sunlight through trees in mist.

Chapter 11

Electricity

Electric Current

✅ Electric current (I)

- Flow of electric charge.
- SI unit: Ampere (A).
- Direction: From positive to negative terminal of the cell.

✅ Formula

I=QtI = \frac{Q}{t}I=tQwhere:

- III = current (A)
- QQQ = charge (C)
- ttt = time (s)

Electric Potential and Potential Difference

✅ Potential Difference (V)

- Work done to move a unit charge from one point to another.
- SI unit: Volt (V).

✅ Formula

V=WQV = \frac{W}{Q}V=QWwhere:

- VVV = potential difference (V)
- WWW = work done (J)
- QQQ = charge (C)

Ohm's Law

✅ Statement:

At constant temperature, the current flowing through a conductor is directly proportional to the potential difference across it.

✅ Formula

V=IRV = IRV=IRwhere:

- VVV = potential difference (V)
- III = current (A)
- RRR = resistance (Ω)

Resistance

✅ Definition:

- Opposition to the flow of electric current.
- SI unit: Ohm (Ω).

✅ Factors affecting resistance

- Length of conductor (R∝lR \propto lR∝l).
- Area of cross-section (R∝1AR \propto \frac{1}{A}R∝A1).
- Material (resistivity).
- Temperature.

✅ Resistivity (ρ\rhoρ)

- Resistance of a material's unit length and unit area.
- SI unit: Ωm.

Resistors in Series and Parallel

✅ Series

- Total resistance: Req=R1+R2+R3+…R_{\text{eq}} = R_1 + R_2 + R_3 + \ldotsReq=R1+R2+R3+…
- Current same in all resistors.
- Potential difference divides.

✅ Parallel

- Total resistance:
- 1Req=1R1+1R2+…\frac{1}{R_{\text{eq}}} = \frac{1}{R_1} + \frac{1}{R_2} + \ldotsReq1=R11+R21+…Potential difference same across each branch.
- Current divides.

Heating Effect of Electric Current

✅ Joule's Law

- Heat produced (HHH) by a current III flowing through resistance RRR in time ttt:
- H=I2RtH = I^2 R tH=I2RtSI unit: Joule (J).

✅ Applications

- Electric heater, electric bulb filament.

Electric Power

✅ Definition

- Rate at which electric energy is consumed.
- SI unit: Watt (W).

✅ Formula

P=VI=I2R=V2RP = VI = I^2 R = \frac{V^2}{R}P=VI=I2R=RV2

Chapter 12

Electricity

Magnetic Field

✅ Magnetic field

- Region around a magnet or current-carrying conductor where magnetic forces are observed.

✅ Magnetic field lines

- Imaginary lines showing direction of magnetic force.
- Emerge from north pole and enter south pole.

✅ Properties

- No two lines cross each other.
- Denser lines → stronger field.

Magnetic Field Due to a Current-Carrying Conductor

✅ Straight conductor

- Magnetic field in concentric circles around conductor.

✅ Right-hand thumb rule

- Thumb in direction of current, curled fingers show direction of magnetic field.

Magnetic Field Due to a Circular Loop

✅ Current in circular loop

- Field lines become concentric circles near wire.
- At center: magnetic field straight and strong.

Solenoid and Electromagnets

✅ Solenoid

- Coil of wire with many turns.
- Magnetic field like bar magnet.
- Increases with current and number of turns.

✅ Electromagnet

- Soft iron core in solenoid → strong temporary magnet.

Force on a Current-Carrying Conductor (Motor Principle)

✅ Fleming's Left-Hand Rule

- Forefinger: magnetic field

Middle finger: current

- Thumb: force (motion)

✅ Applications

- Electric motors.

Electric Motor

✅ Working

- Uses magnetic effect of current.
- Armature coil rotates in magnetic field when current passes.

✅ Applications

- Fans, mixers, etc.

Electromagnetic Induction

✅ Faraday's Experiment

- Changing magnetic field induces electric current in nearby conductor.

✅ Fleming's Right-Hand Rule

- Thumb: motion of conductor
- Forefinger: magnetic field
- Middle finger: induced current

✅ Applications

- Electric generators.

Electric Generator

✅ Working

- Mechanical energy converted to electric energy.
- Coil rotates in magnetic field → induced current.

✅ Types

- AC generator: alternating current.
- DC generator: direct current.

Domestic Electric Circuits

✅ Current in homes

- AC supply, 220V, 50Hz.
- Live wire, neutral wire, earth wire.

✅ Safety

- Fuses, circuit breakers to prevent overloading.

Chapter 13

Sources of Energy

What is Energy?

✅ Energy

- Capacity to do work.
- All living and non-living systems need energy for activities.

Good Source of Energy

✅ Characteristics of a good fuel/source:

- High calorific value (more energy/unit mass).
- Easily available.
- Easy to store & transport.
- Affordable.
- Causes less pollution.

Conventional Sources of Energy

✅ Fossil Fuels

- Coal, petroleum, natural gas.
- Non-renewable, cause pollution (CO_2, SO_2).

✅ Thermal Power Plants

- Burn fossil fuels to produce electricity.

✅ Hydropower Plants

- Dams store water → water's potential energy → rotates turbines → electricity.
- Renewable but affects ecosystems.

Non-Conventional Sources of Energy

✅ Solar Energy

- Solar panels (photovoltaic cells) convert sunlight to electricity.
- Solar cookers & heaters.
- Renewable, no pollution.

✅ Wind Energy

- Wind turbines convert kinetic energy of wind to electricity.
- Best in windy areas.

✅ Biomass

- Organic matter (cow dung, plant waste) → biogas (methane-rich fuel).

✅ Geothermal Energy

- Heat from Earth's interior → steam to rotate turbines.

✅ Tidal and Wave Energy

- Movement of ocean water → drives turbines.

Environmental Consequences

✅ Fossil Fuels → air pollution, greenhouse gases.

✅ Dams → affect aquatic ecosystems, human displacement.

✅ Nuclear Energy → radiation risks, disposal of waste.

✅ Renewable sources are better as they're less polluting.

Sustainable Management of Resources

✅ Energy Conservation

- Use energy-efficient appliances.
- Reduce wastage (switch off when not needed).
- Use renewable resources.

Science

Class 10 Most Important Questions

Very Short Questions

- **What is a chemical reaction?**

→ A process where substances (reactants) are converted into new substances (products).

- **Define corrosion.**

→ It is the slow destruction of metals by chemical reaction with the environment.

- **What is the pH of pure water?**

→ 7

- **State the law of reflection.**

→ Angle of incidence = Angle of reflection.

- **What is the SI unit of electric current?**

→ Ampere

- **What is photosynthesis?**

→ The process by which green plants make food using sunlight, CO_2, and water.

- **What is the role of bile in digestion?**

→ Bile emulsifies fats.

- **Define heredity.**

→ The transmission of traits from parents to offspring.

- **What is the main function of kidneys?**

→ Removal of waste (excretion) from the body.

- **What is transpiration?**

→ Loss of water from plant leaves as water vapor.

- **Name the hormone secreted by the pancreas.**

→ Insulin

- **What is reflex action?**

→ An automatic response to a stimulus.

- **What is a homologous series?**

→ A group of organic compounds with similar properties and the same functional group.

- **What is an electric fuse?**

→ A safety device that protects circuits from overload.

- **Name the pigment responsible for photosynthesis.**

→ Chlorophyll

- **What is biodiversity?**

→ Variety of living organisms in a particular area.

- **Define excretion.**

→ Process of removing metabolic wastes from the body.

- **What is the function of the human diaphragm?**

→ Helps in breathing.

- **What is the role of auxins in plants?**

→ Promote plant cell elongation.

- **Name the basic unit of the nervous system.**

→ Neuron

Short Questions

- **1. Differentiate between aerobic and anaerobic respiration.**

Answer:

Aerobic respiration occurs in the presence of oxygen and produces carbon dioxide, water, and a large amount of energy. Anaerobic respiration, on the other hand, takes place in the absence of oxygen and produces less energy along with by-products like lactic acid or ethanol and carbon dioxide. Aerobic respiration is more efficient than anaerobic respiration in terms of energy release.

- **2. Explain the function of the human heart with a labeled diagram.**

Answer:

The human heart is a muscular organ responsible for pumping blood throughout the body. It has four chambers: two atria and two ventricles. Deoxygenated blood enters the right atrium, passes into the right ventricle, and is then pumped to the lungs for oxygenation. Oxygen-rich blood returns to the left atrium, enters the left ventricle, and is pumped to the rest of the body. Valves prevent backflow, and the rhythmic contractions of the heart maintain circulation. (Diagram to be added during textbook revision.)

- **3. Write two differences between real and virtual images.**

Answer:

- Real images are formed when light rays actually converge at a point; these images can be projected on a screen. They are usually inverted. In contrast, virtual images are formed when light rays appear to diverge from a point. These cannot be projected on a screen and are usually erect.

- **4. What is the role of decomposers in the ecosystem?**

Answer:

Decomposers, such as bacteria and fungi, break down dead organisms and organic waste into simpler substances. This process recycles nutrients back into the environment, maintaining the nutrient cycle and ensuring the stability of ecosystems.

- **5. Why is the ozone layer important? What are the effects of ozone depletion?**

Answer:

The ozone layer protects life on Earth by absorbing harmful ultraviolet (UV) radiation from the sun. Depletion of this layer increases the penetration of UV rays, which can lead to health issues like skin cancer and cataracts, harm aquatic life, and negatively affect crop yields.

- **6. How do guard cells regulate the opening and closing of stomata?**

Answer:

Guard cells control the opening and closing of stomata by changing their shape based on water content. When they absorb water, they swell and the stomatal pore opens. When they lose water, they shrink, causing the pore to close. This mechanism helps regulate gas exchange and water loss.

- **7. What is homologous series? Give an example.**

Answer:

A homologous series is a group of organic compounds that share a common functional group and have similar chemical properties. Each successive compound differs by a $-CH_2-$ group. For example, methane (CH_4), ethane (C_2H_6), and propane (C_3H_8) belong to the alkane series.

- **8. Why do we see a rainbow after rain?**

Answer:

A rainbow forms when sunlight passes through raindrops in the atmosphere. The light is refracted, dispersed into its component colors, and then internally reflected within the droplets, finally emerging as a spectrum of colors in the sky.

- **9. What causes dispersion of light? Name a natural phenomenon based on it.**

Answer:

Dispersion of light occurs when white light splits into its component colors as it passes through a medium like a prism. This happens because different colors of light bend by different amounts. A rainbow is a natural phenomenon caused by the dispersion of sunlight by water droplets in the air.

- **10. What is biodiversity? Why is it important to conserve it?**

Answer:

Biodiversity refers to the variety of living organisms in a particular habitat or on Earth. It is important to conserve biodiversity because it ensures the stability of ecosystems, supports food chains, provides natural resources, and maintains ecological balance.

- **11. Why do we use convex mirrors in vehicles?**

Answer:

Convex mirrors are used in vehicles as rear-view mirrors because they provide a wider field of view compared to plane or concave mirrors. Although the images formed are smaller and virtual, they allow the driver to see more area behind the vehicle, enhancing safety.

- **12. Draw the ray diagram for image formation by a concave mirror when the object is placed beyond the center of curvature.**

Answer:

When an object is placed beyond the center of curvature (C) of a concave mirror, the image formed is real, inverted, and diminished. It is formed between the focus (F) and the center of curvature (C). (Ray diagram should be drawn based on textbook reference.)

- **13. List any two differences between metals and non-metals based on chemical properties.**

Answer:

Metals tend to lose electrons during chemical reactions and form positive ions, whereas non-metals gain electrons to form negative ions. Metals usually form basic oxides when reacting with oxygen, while non-metals form acidic oxides.

- **14. Why do acids conduct electricity in aqueous solution?**

Answer:

Acids release hydrogen ions (H^+) in aqueous solutions. These ions are charged particles that move freely and conduct electricity, making acidic solutions good conductors.

- **15. What is transpiration? Mention its two functions.**

Answer:

Transpiration is the process by which water vapor is lost from the aerial parts of a plant, especially through the stomata of leaves. It helps in cooling the plant and aids in the upward movement of water and minerals from the roots.

- **16. Differentiate between biodegradable and non-biodegradable substances.**

Answer:

Biodegradable substances can be broken down by natural processes and microorganisms into harmless components. Examples include food waste and paper. Non-biodegradable substances cannot be broken down easily and persist in the environment, leading to pollution. Examples include plastic and glass.

- **17. Why does the sun appear reddish early in the morning?**

Answer:

During sunrise, sunlight has to travel a longer path through the atmosphere. The shorter blue and violet wavelengths are scattered out due to atmospheric particles, while the longer red wavelengths reach our eyes, making the sun appear reddish.

- **18. Name any two methods of contraception and explain how they prevent pregnancy.**

Answer:

One method is the use of condoms, which physically block the sperm from reaching the egg. Another is intrauterine devices (IUDs) like the copper-T, which prevent the implantation of a fertilized egg in the uterus. Both methods are effective in preventing pregnancy without affecting hormonal balance.

- **19. Define the law of conservation of mass with an example.**

Answer:

The law of conservation of mass states that mass is neither created nor destroyed during a chemical reaction. For example, in the reaction between hydrogen and oxygen to form water, the total mass of the reactants equals the total mass of the product.

- **20. Why is DNA copying an essential part of reproduction?**

Answer:

DNA copying ensures that genetic information is passed on from parent to offspring during reproduction. It maintains the continuity of traits across generations and also introduces variation, which is essential for evolution and adaptation.

Long Questions

1. Explain the process of digestion in the human alimentary canal.

Answer:

Digestion begins in the mouth, where the teeth break down food mechanically, and saliva containing the enzyme salivary amylase starts digesting starch. The food then travels down the esophagus to the stomach, where gastric juice containing hydrochloric acid and pepsin digests proteins. From the stomach, food moves to the small intestine, where bile from the liver emulsifies fats, and pancreatic juice digests carbohydrates, proteins, and fats. The digested nutrients are absorbed through the walls of the small intestine into the bloodstream. The undigested food passes into the large intestine, where water is absorbed, and the remaining waste is excreted through the anus.

2. Describe the process of photosynthesis and write its balanced chemical equation.

Answer:

Photosynthesis is the process by which green plants synthesize their food using sunlight, carbon dioxide, and water. It takes place in the chloroplasts of leaf cells, which contain chlorophyll. During the process, light energy is converted into chemical energy, and glucose is formed along with oxygen as a byproduct. The balanced chemical equation for photosynthesis is:

$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$ (in the presence of sunlight and chlorophyll).

3. Describe the working of a nephron.

Answer:

The nephron is the structural and functional unit of the kidney. It begins with the Bowman's capsule, which surrounds a bundle of capillaries called the glomerulus. Blood pressure forces water and small molecules into the capsule through a process called filtration. This filtrate travels through the tubule where essential substances like glucose, amino acids, and water are reabsorbed into the blood. The remaining waste, such as urea and excess water, forms urine, which flows through collecting ducts into the ureter for excretion.

4. How is electricity generated in a thermal power plant?

Answer:

In a thermal power plant, fossil fuels such as coal, oil, or natural gas are burned in a boiler to heat water and produce steam. This steam is directed under high pressure onto turbine blades, causing the turbine to spin. The turbine is connected to a generator, and the mechanical energy of the spinning turbine is converted into electrical energy by electromagnetic induction. The electricity generated is then transmitted through power lines for domestic and industrial use.

5. List the advantages and disadvantages of using fossil fuels.

Answer:

Fossil fuels are advantageous because they are energy-rich and can be used efficiently to generate electricity and power vehicles. They are relatively easy to store and transport. However, the disadvantages include the release of harmful gases like carbon dioxide, sulfur dioxide, and nitrogen oxides, which contribute to air pollution and climate change. Additionally, fossil fuels are non-renewable resources, meaning they will eventually deplete and are not sustainable in the long term.

6. State the laws of refraction of light. Explain refraction through a rectangular glass slab.

Answer:

There are two laws of refraction: (1) The incident ray, refracted ray, and the normal all lie in the same plane. (2) The ratio of the sine of the angle of incidence to the sine of the angle of refraction is constant for a given pair of media (Snell's law). When a light ray passes through a rectangular glass slab, it bends towards the normal upon entering (due to slowing down in the denser medium) and bends away from the normal when exiting into the rarer medium (air). Although the ray emerges parallel to the original path, it is laterally displaced.

7. Differentiate between A.C. and D.C. current. Give one use of each.

Answer:

Alternating current (A.C.) is the type of current that changes direction periodically. It is used in homes and industries for running appliances and machines. Direct current (D.C.), on the other hand, flows in one direction and is commonly used in devices like mobile phones, flashlights, and in batteries. A.C. is suitable for transmission over long distances with minimal energy loss, whereas D.C. is typically used for low-voltage applications.

8. Explain the formation of images by convex lenses with ray diagrams for different object positions.

Answer:

A convex lens forms different types of images depending on the position of the object. When the object is placed beyond 2F, the image is real, inverted, and diminished. At 2F, the image is real, inverted, and of the same size. Between F and 2F, the image is real, inverted, and magnified. At F, the image is formed at infinity. If the object is placed between F and the optical center, the image is virtual, erect, and magnified. These image formations are best understood through ray diagrams showing how light rays converge after passing through the lens.

9. How does a basic electric circuit work? State Ohm's law.

Answer:

An electric circuit provides a path for current to flow from the positive terminal of the source to the negative terminal through a load (such as a bulb). Ohm's Law states that the current flowing through a conductor is directly proportional to the voltage across it, provided the temperature remains constant. The law is mathematically expressed as $V = IR$, where V is voltage, I is current, and R is resistance. This law is fundamental in analyzing and designing electrical circuits.

10. List three differences between magnetic field lines around a bar magnet and those around a current-carrying straight conductor.

Answer:

Magnetic field lines around a bar magnet emerge from the north pole and enter the south pole, forming closed loops outside the magnet. These lines are fixed in shape and represent a dipole pattern. In contrast, magnetic field lines around a current-carrying straight conductor form concentric circles centered on the wire. The direction of the field depends on the direction of the current and can be determined using the right-hand thumb rule. The bar magnet has fixed poles, whereas the conductor does not have magnetic poles.

11. Explain Mendel's monohybrid cross with the help of a diagram.

Answer:

In a monohybrid cross, Mendel studied the inheritance of a single trait — plant height. He crossed pure tall (TT) pea plants with pure dwarf (tt) plants. The F1 generation consisted of all tall plants (Tt), showing that tallness is a dominant trait. When these F1 plants were self-crossed, the F2 generation showed a ratio of 3 tall plants to 1 dwarf plant. This demonstrated the laws of dominance and segregation — dominant alleles mask the effect of recessive ones, and alleles segregate independently during gamete formation. (Include Punnett square for better understanding.)

12. What is speciation? What factors lead to speciation?

Answer:

Speciation is the evolutionary process through which new species arise. It occurs when populations of the same species become reproductively isolated and undergo genetic changes over time. The key factors that lead to speciation include geographical isolation (such as mountains or rivers), genetic drift, natural selection, and mutation. Over generations, these differences accumulate, leading to the formation of a new species that can no longer interbreed with the original population.

13. Differentiate between analogous and homologous organs with examples.

Answer:

Analogous organs are those that have similar functions but different structures and evolutionary origins. For example, the wings of birds and insects both help in flight but have different anatomical structures. Homologous organs, on the other hand, have a common origin but may perform different functions. For example, the forelimbs of humans, cats, and bats have the same bone structure but are adapted for different functions such as grasping, walking, and flying respectively. These similarities suggest a common ancestry.

14. Draw the human male reproductive system and label its parts.

Answer:

(Drawing to be made during revision.)

The human male reproductive system includes the following parts:

- Testes: Produce sperm and testosterone
- Vas deferens: Transports sperm
- Seminal vesicles: Secrete part of the seminal fluid
- Urethra: Carries sperm and urine outside the body
- Penis: External organ for transferring sperm

15. What is the importance of variation in organisms?

Answer:

Variations are essential for the survival of species, especially in changing environments. They provide raw material for natural selection, enabling some individuals to survive, reproduce, and pass on beneficial traits. Without variation, all organisms would be equally affected by diseases or environmental changes, leading to extinction. Over time, variations can lead to evolution and the emergence of new species.

16. Describe the importance of pH in everyday life with examples.

Answer:

pH plays a crucial role in various aspects of daily life. For example, our stomach secretes hydrochloric acid (pH ~2) to digest food, but excessive acidity can cause ulcers, which are treated with antacids that neutralize excess acid. Tooth decay occurs when bacteria produce acids that lower the pH in the mouth below 5.5. In agriculture, soil pH affects nutrient availability to plants. Similarly, acid rain, with a low pH, harms buildings and plant life. Hence, maintaining the right pH is vital in many fields.

17. State the characteristics of the image formed by a plane mirror.

Answer:

A plane mirror forms an image that is virtual, meaning it cannot be projected on a screen. The image is also erect and laterally inverted, meaning the left and right sides are reversed. It is of the same size as the object and appears to be located as far behind the mirror as the object is in front of it. These properties make plane mirrors useful in daily applications like grooming and interior design.

18. Describe any three physical properties of metals.

Answer:

Metals have several characteristic physical properties. First, they are malleable, meaning they can be hammered into thin sheets. Second, they are ductile, so they can be drawn into wires. Third, metals are good conductors of heat and electricity due to the presence of free electrons. These properties make metals highly useful in manufacturing, electrical wiring, and construction.

19. What happens when zinc reacts with dilute hydrochloric acid? Write the equation.

Answer:

When zinc reacts with dilute hydrochloric acid, it displaces hydrogen from the acid, forming zinc chloride and releasing hydrogen gas. This is an example of a single displacement reaction.

Reaction: $Zn + 2HCl \rightarrow ZnCl_2 + H_2\uparrow$

20. Explain the formation and decomposition of baking soda.

Answer:

Baking soda (sodium hydrogen carbonate) is prepared by reacting sodium chloride with ammonia and carbon dioxide in the presence of water. When heated, baking soda decomposes into sodium carbonate, carbon dioxide, and water. This decomposition reaction is used in baking, where the released CO_2 causes dough to rise.

Decomposition reaction: $2NaHCO_3 \rightarrow Na_2CO_3 + CO_2 + H_2O$

21. What is sustainable management? Suggest two practices for forest conservation.

Answer:

Sustainable management involves using natural resources in a way that meets current needs without compromising future generations. In forest conservation, this means balancing tree harvesting with reforestation. Two effective practices include: (1) afforestation — planting new trees to replenish forests, and (2) Joint Forest Management (JFM) — involving local communities in forest protection and management, which increases awareness and shared responsibility.

22. Explain the working of the human eye.

Answer:

The human eye functions like a camera. Light enters through the cornea, passes through the aqueous humor, and then through the pupil — the opening in the iris. The lens focuses the light onto the retina, where photoreceptor cells (rods and cones) convert light into electrical signals. These signals are transmitted via the optic nerve to the brain, which interprets them as visual images. The lens changes shape to focus on near or distant objects, a process called accommodation.

23. Explain how eye defects like myopia and hypermetropia are corrected.

Answer:

Myopia or short-sightedness occurs when the image of a distant object forms in front of the retina, usually due to a longer eyeball or overly curved lens. It is corrected using concave lenses, which diverge the light rays before they enter the eye.

Hypermetropia or long-sightedness happens when the image of a nearby object forms behind the retina due to a shorter eyeball or flatter lens. It is corrected using convex lenses, which converge the light rays before they enter the eye.

24. What are trophic levels? Explain the flow of energy in a food chain.

Answer:

Trophic levels represent the positions of organisms in a food chain, based on their source of energy. Producers (plants) form the first trophic level. Herbivores that consume plants are at the second level, followed by carnivores at higher levels. Energy transfer is unidirectional and follows the 10% law — only about 10% of energy is passed from one level to the next, while the rest is lost as heat. This limits the number of trophic levels in an ecosystem.

25. List the benefits of classifying elements into the Modern Periodic Table.

Answer:

The Modern Periodic Table arranges elements based on atomic number, which provides a logical and predictive framework. Elements in the same group have similar chemical properties. It helps in identifying trends such as electronegativity, valency, and atomic size. It also made it possible to predict the properties of undiscovered elements and understand the relationships among existing ones, making the study of chemistry more systematic.

26. Explain the causes and effects of acid rain.

Answer:

Acid rain is caused by the release of sulfur dioxide (SO_2) and nitrogen oxides (NO_x) into the atmosphere from burning fossil fuels. These gases react with water vapor to form sulfuric and nitric acids, which fall as acid rain. The effects include damage to buildings and monuments (especially those made of marble), harm to aquatic life due to lowered pH of water bodies, and soil degradation affecting plant growth.

27. Write the steps involved in extraction of metals from ores.

Answer:

Metal extraction involves several steps: (1) Concentration of the ore to remove impurities; (2) Conversion to oxide form, often by roasting or calcination; (3) Reduction of the oxide to metal using a reducing agent such as carbon or through electrolysis; and (4) Purification of the metal to remove any remaining impurities, often through electrolytic refining. These steps depend on the reactivity of the metal.

28. What are isomers? Draw isomers of butane.

Answer:

Isomers are compounds with the same molecular formula but different structural arrangements of atoms. Butane (C_4H_{10}) has two isomers:

- n-butane, where four carbon atoms form a straight chain.
- iso-butane (or 2-methylpropane), where three carbon atoms form a chain and the fourth is attached as a branch.

29. Describe the structure and function of the human brain.

Answer:

The human brain is divided into three main parts. The cerebrum is the largest part and is responsible for thinking, reasoning, memory, and voluntary actions. The cerebellum lies below the cerebrum and coordinates movement and balance. The medulla oblongata controls involuntary actions such as heartbeat and breathing. All parts work together to maintain body functions and respond to stimuli.

30. State the differences between biodegradable and non-biodegradable pollutants. Give two examples of each.

Answer:

Biodegradable pollutants are substances that can be broken down by microorganisms into simpler, harmless substances. Examples include food waste and paper. Non-biodegradable pollutants cannot be easily broken down and persist in the environment for a long time, causing pollution. Examples include plastics and pesticides. Managing non-biodegradable waste is a major environmental challenge today.

Science

IMPORTANT MCQ

1. Which of the following is a redox reaction?

(a) $NaCl \rightarrow Na + Cl_2$

(b) $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$

(c) $H_2 + Cl_2 \rightarrow 2HCl$

(d) $NaOH + HCl \rightarrow NaCl + H_2O$

Answer: (b)

2. Which of these does not conduct electricity?

(a) Dilute HCl

(b) Sugar solution

(c) NaOH solution

(d) Lemon juice

Answer: (b)

3. Which of the following metals is the most reactive?

(a) Zinc

(b) Copper

(c) Sodium

(d) Iron

Answer: (c)

4. Which type of bond is present in methane (CH_4)?

(a) Ionic

(b) Metallic

(c) Covalent

(d) Hydrogen

Answer: (c)

5. Site of photosynthesis in a plant cell is:

(a) Mitochondria

(b) Ribosome

(c) Chloroplast

(d) Cytoplasm

Answer: (c)

6. The main function of the cerebellum is:

(a) Hearing

(b) Balancing

(c) Smell

(d) Taste

Answer: (b)

7. Budding occurs in:

(a) Hydra

(b) Amoeba

(c) Paramecium

(d) Spirogyra

Answer: (a)

8. Who is known as the father of genetics?

(a) Darwin

(b) Mendel

(c) Lamarck

(d) Watson

Answer: (b)

9. The focal length of a concave mirror is:

(a) Positive

(b) Negative

(c) Zero

(d) Infinity

Answer: (b)

10. The sky appears blue because:

(a) Blue light is scattered the least

(b) Blue light is scattered the most

(c) Red light is scattered the most

(d) All lights scatter equally

Answer: (b)

11. The SI unit of electric power is:

(a) Volt

(b) Ampere

(c) Watt

(d) Ohm

Answer: (c)

12. A current-carrying conductor produces:

(a) Heat only

(b) Light only

(c) Magnetic field

(d) Sound

Answer: (c)

13. Which of these is a renewable source of energy?

(a) Coal

(b) Petroleum

(c) Solar energy

(d) Natural gas

Answer: (c)

✅ MCQ 14:

Which gas is evolved when dilute HCl reacts with zinc?

(a) Oxygen

(b) Hydrogen

(c) Carbon dioxide

(d) Nitrogen

Answer: (b) Hydrogen

✅ MCQ 15:

The green coating on copper is due to:

(a) Copper oxide

(b) Copper carbonate

(c) Copper sulfate

(d) Copper chloride

Answer: (b) Copper carbonate

✅ MCQ 16:

The common name for ethanol is:

(a) Vinegar

(b) Spirit

(c) Alcohol

(d) Acetone

Answer: (c) Alcohol

✅ MCQ 16:

The common name for ethanol is:

(a) Vinegar
(b) Spirit
(c) Alcohol
(d) Acetone
Answer: (c) Alcohol

✅ MCQ 17:

Opening and closing of stomata is controlled by:

(a) Xylem
(b) Guard cells
(c) Phloem
(d) Root hair
Answer: (b) Guard cells

✅ MCQ 18:

Which part of the neuron receives impulses?

(a) Axon
(b) Myelin sheath
(c) Dendrite
(d) Synapse
Answer: (c) Dendrite

✅ MCQ 19:

Amoeba reproduces by:

(a) Budding
(b) Fragmentation
(c) Binary fission
(d) Sporulation
Answer: (c) Binary fission

✅ MCQ 20:

The male reproductive cell in humans is:

(a) Ovum
(b) Pollen
(c) Zygote
(d) Sperm
Answer: (d) Sperm

✅ MCQ 21:

The cell organelle responsible for respiration is:

(a) Chloroplast

(b) Ribosome

(c) Mitochondria

(d) Nucleus

Answer: (c) Mitochondria

✅ MCQ 22:

The scientist who gave the laws of inheritance is:

(a) Darwin

(b) Mendel

(c) Lamarck

(d) Watson

Answer: (b) Mendel

✅ MCQ 23:

Which color deviates most in a glass prism?

(a) Red

(b) Green

(c) Blue

(d) Violet

Answer: (d) Violet

✅ MCQ 24:

A convex lens always forms a real, inverted image except when the object is:

(a) At 2F

(b) At F

(c) Between F and O

(d) Beyond 2F

Answer: (c) Between F and O

✅ MCQ 25:

The device that converts chemical energy to electrical energy is:

(a) Electric motor
(b) Generator
(c) Battery
(d) Transformer
Answer: (c) Battery

✅ MCQ 26:

The SI unit of resistivity is:

(a) Ohm-meter
(b) Ohm
(c) Ampere
(d) Coulomb
Answer: (a) Ohm-meter

✅ MCQ 27:

The earth wire is used to prevent:

(a) Short circuit
(b) Overheating
(c) Electric shock
(d) Overload
Answer: (c) Electric shock

✅ MCQ 28:

An electric generator converts:

(a) Electrical to mechanical energy
(b) Mechanical to electrical energy
(c) Heat to electrical energy
(d) Light to electrical energy
Answer: (b) Mechanical to electrical energy

✅ MCQ 29:

The cleanest fuel among the following is:

(a) Coal

(b) Petrol

(c) Diesel

(d) Methane

Answer: (d) Methane

✅ MCQ 30:

Which renewable energy is best utilized in coastal areas?

(a) Wind energy

(b) Biomass energy

(c) Tidal energy

(d) Solar energy

Answer: (c) Tidal energy