EXPLANATIONS

1. (4) The most common function of a diode is to allow an electric current to pass in one direction (called the diode's forward direction), while blocking current in the opposite direction (the reverse direction).This unidirectional behavior is called rectification or verification and is used to convert alternating current to direct current, including extraction of modulation from radio signals in radio receivers—these diodes are forms of rectifiers diode is a two-terminal electronic component with an asymmetric transfer characteristic, with low (ideally zero) resistance to current flow in one direction, and high (ideally infinite) resistance in the other.

2. (1) Homi Jehangir Bhabha was an Indian nuclear physicist, founding director, and professor of physics at the Tata Institute of Fundamental Research. Colloquially known as "father of Indian nuclear programme," Bhabha gained international prominence after deriving a correct expression for the probability of scattering positrons by electrons, a process now known as Bhabha scattering. His major contribution included his work on Compton scattering, R-process, and furthermore the advancement of nuclear physics. He was awarded Padma Bhushan by Government of India in 1954.

3. (3) The heat content of anthracite ranges from 22 to 28 million Btu per short ton (26 to 33 MJ/kg) on a moist, mineral-matter-free basis. Anthracite ("coal-like") is a hard, compact variety of mineral coal that has a high luster. It has the highest carbon content, the fewest impurities, and the highest calorific content of all types of coals, which also include bituminous coal and lignite. Anthracite is the most metamorphosed type of coal (but still represents low-grade metamorphism), in which the carbon content is between 92.1% and 98%.

4. (1) For fixed (point-to-point) services, communications satellites provide a microwave radio relay technology complementary to that of communication cables. They are also used for mobile applications such as communications to ships, vehicles, planes and hand-held terminals, and for TV and radio broadcasting. Microwave technology is extensively used for point-to-point telecommunications (i.e., non broadcast uses). Microwaves are especially suitable for this use since they are more easily focused into narrow beams than radio waves, and also their comparatively higher frequencies allow broad bandwidth and high data flow.

5. (1) Frequency modulation (FM) conveys information over a carrier wave by varying its instantaneous frequency. This contrasts with amplitude modulation, in which the amplitude of the carrier is varied while its frequency remains constant. Frequency modulation is also used in telemetry, radar, seismic prospecting and newborn EEG seizure monitoring. Frequency modulation is known as phase modulation when the carrier phase modulation is the time integral of the FM signal. FM is widely used for broadcasting music and speech, two-way radio systems, magnetic tape-recording systems and some video-transmission systems.

6. (1) Brake force, also known as Brake Power, is a measure of braking power of a vehicle. Suppose a car whose mass is 'x' and is braked from a speed of y km/hr to come to halt at a uniform retardation in z min. If the speed of the car is doubled in the same distance, then the braking force required to stop the car is four times the original speed i.e. '4v'. Note that all the parameters remain to be same.

7. (2) The quantity of impulse is force × time interval. In classical mechanics, linear momentum or translational momentum is the product of the mass and velocity of an object. For example, a heavy truck moving fast has a large momentum—it takes a large and prolonged force to get the truck up to this speed, and it takes a large and prolonged force to bring it to a stop afterwards. If the truck were lighter or moving slower, then it would have less momentum.

8. (2).The fundamental qualities of Physics are the seven basic quantities that can be used to express all other physical quantities. These are as follows: Length: Metre, Heat: Kelvin, Time: second, Luminous Intensity: Candela, Mass: Kilogram, Electric Current: Ampere, and Amount of substance: Moles.

9. (1) The hole size will increase because in expansion the size between two molecules do not increase so when the molecules on the outer edge move outward. Due to expansion, the size of the hole will also increase so as to compensate the distance change between the molecules. Thermal expansion is the tendency of matter to change in volume in response to a change in temperature. When a substance is heated, its particles begin moving more and thus usually maintain a greater average separation.

10. (2) Radius of a capillary tube is inversely proportional to the height of the liquid column. So, if radius of the tube is doubled, rise of level of water will becomes half of the previous rise in capillary tube. Capillary action, or capillarity, is the ability of a liquid to flow in narrow spaces without the assistance of, and in opposition to external forces like gravity. The effect can be seen in the drawing up of liquids between the hairs of a paint-brush, in a thin tube, in porous materials such as paper, in some non-porous materials such as liquefied carbon fiber, or in a cell. It occurs because of inter-molecular attractive forces between the liquid and solid surrounding surfaces.

11. (3) According to Archimedes principle and we can note that the amount of water displaced by a needle is lesser than the amount of water moved out by the needle (that is displacement of the needle). So the needle initially stays on the surface of the water and then sinks into the water. Surface tension is a contractive tendency of the surface of a liquid that allows it to resist an external force. It is revealed, for example, in the floating of some objects on the surface of water, even though they are denser than water, and in the ability of some insects (e.g. water striders)

to run on the water surface. This property is caused by cohesion of similar molecules, and is responsible for many of the behaviors of liquids.

12. (1) The mass of a star which is two times the mass of the sun turns into a neutron star. A neutron star is a type of stellar remnant that can result from the gravitational collapse of a massive star during a Type II, Type Ib or Type Ic supernova event. Such stars are composed almost entirely of neutrons, which are subatomic particles without electrical charge and with slightly larger mass than protons. Neutron stars are very hot and are supported against further collapse by quantum degeneracy pressure due to the Pauli's exclusion principle. This principle states that no two neutrons (or any other fermionic particles) can occupy the same place and quantum state simultaneously. A typical neutron star has a mass between about 1.4 and 3.2 solar masses (Chandrasekhar Limit), with a corresponding radius of about 12 km if the Akmal–Pandharipande–Ravenhall equation of state (APR EOS) is used.

13. (1) Any mass is attracted to the Earth by the pull of gravity. Gravity accelerates all objects towards the ground at a specific rate. Without any other forces present, the speed of an object in free fall will increase the farther or longer it falls. In general the air resistance on an object depends upon several variables. First, it depends upon the shape of the object. Its shape determines the object's drag coefficient: the more aerodynamic the shape, the less drag. Second, it depends upon the size of the object; specifically the cross-sectional area presented to the airflow (perpendicular to the direction of travel). And lastly, it depends upon the speed of the object. At low speeds the object's resistance is directly proportional to speed, and at higher speeds the object's resistance is proportional to its speed squared. Most objects falling through the air would be considered to be moving at a higher speed, even though that speed might not be great compared to some velocities.

14. (3) All Electrostatic Copiers work under the premise that a charge of electricity is placed on an Image Drum which has the ability to retain the electric charge much like a capacitor holds its charge but with the ability to hold or release the charge depending on how much light and darkness is applied to the Image Drum. A photocopier (also known as a copier or copy machine) is a machine that makes paper copies of documents and other visual images quickly and cheaply. Most current photocopiers use a technology called xerography, a dry process using heat. Copiers can also use other technologies such as ink jet, but xerography is standard for office copying.

15. (1) The energy 1 kilowatt-hour (kWh) is 3600000 joules or 3.6 mega joule. In physics, energy is an indirectly observed quantity that is often understood as the ability of a physical system to do work on other physical systems. However, this must be understood as an overly simplified definition, as the laws of thermodynamics demonstrate that not all energy can perform work.

16. (3) On the surface of the Earth, the escape velocity is about 11.2 kilometers per second (~6.96 mi/s), which is approximately 34 times the speed of sound (Mach 34) and several times the muzzle velocity of a rifle bullet (up to 1.7 km/s). However, at 9,000 km altitude in "space", it is slightly less than 7.1 km/s. In physics, escape velocity is the speed at which the kinetic energy plus the gravitational potential energy of an object is zero. It is the speed needed to "break free" from a gravitational field without further propulsion. A rocket moving out of gravity well does not actually need to attain escape velocity to do so, but could achieve the same result at any speed with a suitable mode of propulsion and sufficient fuel. Escape velocity only applies to ballistic trajectories.

17. (2) We see rainbows because of the geometry of raindrops. When the sun shines from behind us into the rain, incident rays of light enter the drop and are refracted inwards. They are reflected from the back surface of the raindrop, and refracted again as they exit the raindrop and return to our eyes. A rainbow is an optical and meteorological phenomenon that is caused by reflection of light in water droplets in the Earth's atmosphere, resulting in a spectrum of light appearing in the sky.

18. (4) 77-78 calories are released in a large size boiled egg. Boiled eggs are eggs (typically chicken eggs) cooked by immersion in boiling water with their shells unbroken.

19. (2) The refractive index of many materials (such as glass) varies with the wavelength or colour of the light used, a phenomenon known as dispersion. This causes light of different colours to be refracted differently and to leave the prism at different angles, creating an effect similar to a rainbow. In optics, dispersion is the phenomenon in which the phase velocity of a wave depends on its frequency, or alternatively when the group velocity depends on the frequency. Media having such a property are termed dispersive media. Dispersion is sometimes called chromatic dispersion to emphasize its wavelength-dependent nature, or group-velocity dispersion (GVD) to emphasize the role of the group.

20. (2) A boat will float when the weight of the water it displaces equals the weight of the boat and anything will float if it is shaped to displace its own weight of water before it reaches the point where it will submerge. Floating of the boat works on the principle of buoyancy force which is an upward force exerted by a liquid, gas or other fluid, that opposes the weight of an immersed object. In a column of fluid, pressure increases with depth as a result of the weight of the overlying fluid. Thus a column of fluid, or an object submerged in the fluid, experiences greater pressure at the bottom of the column than at the top. This difference in pressure results in a net force that tends to accelerate an object upwards.

21. (2) Surface tension is a contractive tendency of the surface of a liquid that allows it to resist an external force. This property is caused by cohesion of similar molecules, and is responsible for many of the

behaviors of liquids. It is revealed, for example, in the floating of some objects on the surface of water, even though they are denser than water, and in the ability of some insects (e.g. water striders) to run on the water surface.

22. (3) In the late of 17th century British scientist Isaac Newton studied cooling of bodies. Experiments showed that the cooling rate is approximately proportional to the difference of temperatures between the heated body and the environment. This fact can be written as the differential relation :

$\frac{dQ}{dt} = \alpha A(T_S - T)$, where A is the surface area of the body through which the heat is transferred, T is the temperature of the body, TS is the temperature of the surrounding environment, á is the heat transfer coefficient depending on the geometry of the body, state of the surface, heat transfer mode, and other factors. Surface area or volume ratio is an important influence on temperature control. For same volume sphere has minimum surface area, while circular plate has maximum surface area. So sphere cools slowest and plate cools fastest.

23. (4) Optical fibres are used in endoscopic instruments that enable doctors to view internal body parts without having to perform surgery. Fernando Alves Martins of Portugal invented the first fiber optic endoscope in 1963-64. Further innovations included using additional fibres to channel light to the objective end from a powerful external source, thereby achieving the high level of full spectrum illumination that was needed for detailed viewing, and colour photography. The previous practice of a small filament lamp on the tip of the endoscope had left the choice of either viewing in a dim red light or increasing the light output - which carried the risk of burning the inside of the patient. Alongside the advances to the optical side, the ability to 'steer' the tip was developed, as well as innovations in remotely operated surgical instruments contained within the body of the endoscope itself. This was the beginning of "key-hole surgery" as we know it today.

24. (1) Since the amplitudes, frequency and the speed of both the waves are in same, hence the wavelength of the composite wave will be the same as the single wave. The distance between the adjacent nodes will be $\frac{\alpha}{2}$, Speed of the wave, i.e., $V = n\lambda$. Or, $20 = 10\lambda$.

So, $\lambda = 2$ mm. Therefore, $\frac{\alpha}{2} = 1$ mm

25. (2) Newly formed snow reflects about 90 per cent of the sunlight that falls upon it. This means that the sun is powerless to melt clean snow. And when snow does melt, it is not because of the sunlight. Snow does not melt on a spring day because of the sun's heat. It melts because of the warm air from the sea.

26. (3) Sound is a sequence of waves of pressure that propagates through compressible media such as air or water. (Sound can propagate through solids as well, but there are additional modes of propagation). Sound that is perceptible by humans has frequencies from about 20 Hz to 20,000 Hz. In air at standard temperature and pressure, the corresponding wavelengths of sound waves range from 17 m to 17 mm. During propagation, waves can be reflected, refracted, or attenuated by the medium. Now if we consider these cases, then the train which is arriving towards us having whistles of higher pitch because it propagates through a medium which is coming towards us but the train which is leaving propagating trough a medium moving further away from the listener and thus produced whistle of lower pitch.

27. (4) Holography is a technique which enables three-dimensional images to be made. It involves the use of a laser, interference, diffraction, light intensity recording and suitable illumination of the recording. The image changes as the position and orientation of the viewing system changes in exactly the same way as if the object were still present, thus making the image appear three-dimensional. The holographic recording itself is not an image; it consists of an apparently random structure of varying intensity, density or profile. Holography is a technique that enables a light field, which is generally the product of a light source scattered off objects, to be recorded and later reconstructed when the original light field is no longer present, due to the absence of the original objects.

28. (1) The density of dry air is more than that of moist air (when moisture is removed from air, its density increases). The speed of sound in a medium is inversely proportional to the square root of its density. Therefore, the speed of sound in moist air is more than that in dry air.

29. (2) If ρ_1 is the density of the lead piece of volume v, the volume of water displaced by the ice block and the lead piece while floating is $V\omega = (V-v)\ \rho_1 + v\ \rho_1$. When the ice melts, the lead piece sinks in water since ρ_1 is greater than the density of water. The water produced by the melted ice has the volume $(V-v)\ \rho_1$ and the volume displaced by the lead piece is v. So, the total volume of the water produced by ice and that displaced by the lead piece is $V\ \omega_1 = (V-v)\ \rho_1 + v\ \rho_1 < V\ \omega$. So, the water level goes down.

30. (1) Electrons are generally responsible for heat conduction. The phonons (vibrations of the nuclei) also play a part, depending on the temperature of the medium. It depends on the specific conductor you're using. At some point, in a vacuum, the electrons have to be excited enough to spit out photons, which are Electromagnetic radiation, which in a vacuum should go on forever at the speed of light theoretically.

31. (2) Popular materials for plastic gears are acetal resins such as DELRIN, Duracon M90; nylon resins such as ZYTEL, NYLATRON, MC901 and acetal copolymers such as CELCON. The physical and mechanical properties of these materials vary with regard to strength, rigidity, dimensional stability, lubrication requirements, moisture absorption, etc .A gear is a rotating machine part having cut teeth, or cogs, which

mesh with another toothed part in order to transmit torque. Two or more gears working in tandem are called a transmission and can produce a mechanical advantage through a gear ratio and thus may be considered a simple machine. Geared devices can change the speed, torque, and direction of a power source.

32. (4) The ozone layer absorbs 97–99% of the Sun's medium-frequency ultraviolet light (from about 200 nm to 315 nm wavelength), which potentially damages exposed life forms on Earth. Ozone is formed from di-oxygen by the action of ultraviolet light and also atmospheric electrical discharges, and is present in low concentrations throughout the Earth's atmosphere. In total, ozone makes up only 0.6 parts per million of the atmosphere. Ozone is a powerful oxidant (far more so than di-oxygen) and has many industrial and consumer applications related to oxidation. This same high oxidizing potential, however, causes ozone to damage mucus and respiratory tissues in animals, and also tissues in plants, above concentrations of about 100 parts per billion. This makes ozone a potent respiratory hazard and pollutant near ground level.

33. (1) Curie, in physics, unit of activity of a quantity of a radioactive substance, named in honour of the French physicist Marie Curie. One curie (1 Ci) is equal to 3.7×10^{10} becquerel (Bq). Radioactivity refers to the particles which are emitted from nuclei as a result of nuclear instability. Because the nucleus experiences the intense conflict between the two strongest forces in nature, it should not be surprising that there are many nuclear isotopes which are unstable and emit some kind of radiation. The most common types of radiation are called alpha, beta, and gamma radiation, but there are several other varieties of radioactive decay.

34. (3) An oven that uses micro radiation waves as a source of heat in order to cook food as opposed to a fire source. Conceptualized in 1946, Dr. Perry Spencer allegedly discovered the heating properties of microwaves while studying the magnetron. A microwave oven, often colloquially shortened to microwave, is a kitchen appliance that heats food by dielectric heating accomplished with radiation used to heat polarized molecules in food. Microwave ovens heat foods quickly and efficiently because excitation is fairly uniform in the outer 25–38 mm of a dense (high water content) food item; food is more evenly heated throughout (except in thick, dense objects) than generally occurs in other cooking techniques. A microwave oven works by passing non-ionizing microwave radiation, usually at a frequency of 2.45 gigahertz (GHz)—a wavelength of 122 millimetres (4.80 in)—through the food. Microwave radiation is between common radio and infrared frequencies.

35. (4) When heated from 0^0 to 10^0 C volume of a given mass of water will first decrease and then increase. If the word "ice" or "solid" is not mentioned, the word "water" means liquid water. Water vapor can be produced from the evaporation or boiling of liquid water. So the volume first decreases and then increases again when water droplets form from the vapours due to stoppage of heat.

36. (1) The central mass of the sun becomes increasingly hot and dense, eventually initiating thermonuclear fusion in its core. It is thought that almost all other stars form by this process. nuclear fusion is a nuclear reaction in which two or more atomic nuclei join together, or "fuse", to form a single heavier nucleus. During this process, matter is not conserved because some of the mass of the fusing nuclei is converted to energy which is released. Fusion is the process that powers active stars. The fusion of two nuclei with lower masses than iron (which, along with nickel, has the largest binding energy per nucleon) generally releases energy, while the fusion of nuclei heavier than iron absorbs energy.

37. (3) An LC circuit, also called a resonant circuit, tank circuit, or tuned circuit, consists of an inductor, represented by the letter L, and a capacitor, represented by the letter C. When connected together, they can act as an electrical resonator, an electrical analogue of a tuning fork, storing energy oscillating at the circuit's resonant frequency. When connected together, they can act as an electrical resonator; an electrical analogue of a tuning fork, storing energy oscillating at the circuit's resonant frequency. An LC circuit is an idealized model since it assumes there is no dissipation of energy due to resistance.

38. (3) X-rays are part of the electromagnetic spectrum, an ionizing radiation with wavelengths shorter than ultraviolet light. X-ray tubes evolved from experimental Crookes tubes with which X-rays were first discovered in the late 19th century, and the availability of this controllable source of X-rays created the field of radiography, the imaging of opaque objects with penetrating radiation.

39. (1) The Zener diode is like a general-purpose signal diode. When based in the forward direction it behaves just like a normal signal diode, but when a reverse voltage is applied to it, the voltage remains constant for a wide range of currents and hence widely used for regulated electric supply. The device was named after Clarence Zener, who discovered this electrical property. Many diodes described as "Zener" diodes rely instead on avalanche breakdown as the mechanism. Common applications include providing a reference voltage for voltage regulators, or to protect other semiconductor devices from momentary voltage pulses. Zener diodes are widely used as voltage references and as shunt regulators to regulate the voltage across small circuits.

40. (3) Nuclear fusion is a nuclear reaction in which two or more atomic nuclei join together, or "fuse", to form a single heavier nucleus. During this process, matter is not conserved because some of the mass of the fusing nuclei is converted to energy which is released. Fusion is the process that powers active stars. The fusion of two nuclei with lower masses than iron

(which, along with nickel, has the largest binding energy per nucleon) generally releases energy, while the fusion of nuclei heavier than iron absorbs energy. Fusion generally occurs for lighter elements only, and likewise, that fission normally occurs only for heavier elements.

41. (1) In molecular biology and genetics, mutations are accidental changes in a genomic sequence of DNA: the DNA sequence of a cell's genome or the DNA or RNA sequence in some viruses. These random sequences can be defined as sudden and spontaneous changes in the cell. Mutations are caused by radiation, viruses, transposons and mutagenic chemicals, as well as errors that occur during meiosis or DNA replication. Two nucleotide bases in DNA – cytosine and thymine – are most vulnerable to radiation that can change their properties. UV light can induce adjacent pyrimidine bases in a DNA strand to become covalently joined as a pyrimidine dimer.

42. (2) The structure of graphite is unlike most other network substances. It is formed in 'sheets' of carbon atoms, each of which is bonded to only three others. The fourth valence electron of the carbon atom is de-localized and can move between the different layers, therefore carrying an electrical charge through the network of carbon atoms, a conductor is a material which contains movable electric charges. Unlike diamond (another carbon allotrope), graphite is an electrical conductor, a semimetal. It is, consequently, useful in such applications as arc lamp electrodes. Graphite is the most stable form of carbon under standard conditions. Therefore, it is used in thermo-chemistry as the standard state for defining the heat of formation of carbon compounds.

43. (1) Low temperature and high pressure set of conditions represents the easiest way to liquefy a gas. Liquefaction of gases is physical conversion of a gas into a liquid state (condensation). The processes are used for scientific, industrial and commercial purposes. Many gases can be put into a liquid state at normal atmospheric pressure by simple cooling; a few, such as carbon dioxide, require pressurization as well. Liquefaction is used for analyzing the fundamental properties of gas molecules (intermolecular forces), for storage of gases. The liquefaction of gases is a complicated process that uses various compressions and expansions to achieve high pressures and very low temperatures, using, for example, turbo-expanders.

44. (1) Colour or colour is the visual perceptual property corresponding in humans to the categories called red, green, blue, and others. Colour derives from the spectrum of light (distribution of light power versus wavelength) interacting in the eye with the spectral sensitivities of the light receptors. Colour categories and physical specifications of colour are also associated with objects, materials, light sources, etc., based on their physical properties such as light absorption, reflection, or emission spectra. By defining a colour space, colours can be identified numerically by their coordinates.

45. (3) Hydraulic brakes work on the principle of Pascal's law which states that "pressure at a point in a fluid is equal in all directions in space". According to this law when pressure is applied on a fluid it travels equally in all directions so that uniform braking action is applied on all four wheels. The hydraulic brake is an arrangement of braking mechanism which uses brake fluid, typically containing ethylene glycol, to transfer pressure from the controlling unit, which is usually near the operator of the vehicle, to the actual brake mechanism, which is usually at or near the wheel of the vehicle.

46. (2) Since mercury is 13+ times as dense as water, a given volume of mercury would carry about 4.4 times as much heat, so mercury is best conductor of heat among the given options. It is the only metal that is liquid at standard conditions for temperature and pressure. Mercury has one of the narrowest ranges of its liquid state of any metal. Mercury is used in thermometers, barometers, manometers, sphygmomanometers, float valves, mercury switches, It is used in lighting: electricity passed through mercury vapor in a fluorescent lamp produces short-wave ultraviolet light which then causes the phosphor in the tube to fluoresce, making visible light.

47. (2) Electron microscopes are used to observe a wide range of biological and inorganic specimens including microorganisms, cells, large molecules, biopsy samples, metals, and crystals. An electron microscope uses a beam of electrons to illuminate a specimen and produce a magnified image. An electron microscope (EM) has greater resolving power than a light-powered optical microscope because electrons have wavelengths about 100,000 times shorter than visible light photons. The electron microscope uses electrostatic and electromagnetic "lenses" to control the electron beam and focus it to form an image. Industrially, the electron microscope is often used for quality control and failure analysis.

48. (2) Sonar (originally an acronym for Sound Navigation And Ranging) is a technique that uses sound propagation (usually underwater, as in submarine navigation) to navigate, communicate with or detect objects on or under the surface of the water, such as other vessels. Two types of technology share the name "sonar": passive sonar is essentially listening for the sound made by vessels; active sonar is emitting pulses of sounds and listening for echoes. Sonar may be used as a means of acoustic location and of measurement of the echo characteristics of "targets" in the water.

49. (2) The instrument which uses sound waves to measure the depth of oceans is sonar. Sound waves can travel much faster from one point to another. Sound waves are far more accurate for measuring these vast distances. Sonar may be used as a means of acoustic location and of measurement of the echo characteristics of "targets" in the water. Sonar may also be used in air for robot navigation, and SODAR is used for atmospheric investigations.

50. (4) Red and green is the most convenient combination during day and night time because of very precise visibility. In modern colour theory, also known as the RGB colour model, red, green and blue are additive primary colours. Red, green and blue light combined together makes white light, and these three colours, combined in different mixtures, can produce almost any colour. This is the principle used to make the colours on computer screen and television. The sRGB number of pure red, for example, is 255, 00, 00, which means the red component is at maximum intensity, and there is no green or blue. The sRGB number for crimson is 220, 20, 60, which means that the red is slightly less intense and therefore darker, there is some green, which leans it toward orange; and there is a larger amount of blue, which makes it slightly blue-violet.

51. (2) A hygrometer is an instrument used for measuring the moisture content in the environment. Humidity measurement instruments usually rely on measurements of some other quantity such as temperature, pressure, mass or a mechanical or electrical change in a substance as moisture is absorbed. By calibration and calculation, these measured quantities can lead to a measurement of humidity. Modern electronic devices use temperature of condensation, or changes in electrical capacitance or resistance to measure humidity changes. Besides greenhouses and industrial spaces, hygrometers are also used in some incubators (egg), saunas, humidors and museums.

52. (3) The Milky Way is a barred spiral galaxy 100,000–120,000 light-years in diameter containing 200–400 billion stars. It may contain at least as many planets, with an estimated 10 billion of those orbiting in the habitable zone of their parent stars. The Milky Way is the galaxy that contains our Solar System. This name derives from its appearance as a dim "milky" glowing band arching across the night sky, in which the naked eye cannot distinguish individual stars.

53. (1).Shortly after blackbody radiation was understood, it was noticed that the spectra of stars look extremely similar to blackbody radiation curves of various temperatures, ranging from a few thousand Kelvin to ~50,000 Kelvin. The obvious conclusion is that stars are similar to blackbodies, and that the colour variation of stars is a direct consequence of their surface temperatures.

54. (3) The electrolyte consists of a solvent (water, an organic liquid, or even a solid) and one or more chemicals that dissociate into ions in the solvent. These ions serve to deliver electrons and chemical matter through the cell interior to balance the flow of electric current outside the cell during cell operation. An electrolyte is a liquid or gel that contains ions and can be decomposed by electrolysis, e.g., that present in a battery. Commonly, electrolytes are solutions of acids, bases, or salts. Electrolyte solutions can also result from the dissolution of some biological (e.g., DNA, polypeptides) and synthetic polymers (e.g., polystyrene sulfonate), termed poly-electrolytes, which contain charged functional groups.

55. (2) An anemometer is a device for measuring wind speed, and is a common weather station instrument. The term is derived from the Greek word anemos, meaning wind, and is used to describe any airspeed measurement instrument used in meteorology or aerodynamics. Anemometers can be divided into two classes: those that measure the wind's speed, and those that measure the wind's pressure; but as there is a close connection between the pressure and the speed, an anemometer designed for one will give information about both.

56. (2) It is just because woolen clothes have fibres and between those fibres air is trapped which reduces heat loss. Air reduces heat loss because it is an insulator or poor conductor of heat. Wool has several qualities that distinguish it from hair or fur: it is crimped, it is elastic, and it grows in staples (clusters).Wool's scaling and crimp make it easier to spin the fleece by helping the individual fibers attach to each other, so they stay together. Because of the crimp, wool fabrics have a greater bulk than other textiles, and retain air, which causes the product to retain heat.

57. (4) The time period 'T' of a simple pendulum is given by $T = 2\pi\sqrt{\frac{l}{g}}$, where l is the length and g is the acceleration due to gravity. Let us suppose g be to be a constant, then $T = 2\pi\sqrt{l}$. So the time period of a pendulum is directly proportional to the square root of its length. So, if the length increases, its time period also increase. It means that it takes longer to complete one oscillation. So when its length is halved, its time period is decreased by a factor of $\sqrt{2}$.

58. (3) Mist is a phenomenon caused by small droplets of water suspended in air. It can occur as part of natural weather or volcanic activity, and is common in cold air above warmer water, in exhaled air in the cold, and in a steam room of a sauna. It can also be created artificially with aerosol canisters if the humidity conditions are right. The only difference between mist and fog is visibility. Mist usually occurs near the shores, and is often associated with fog. Mist can be as high as mountain tops when extreme temperatures are low. Freezing mist is similar to freezing fog, only the density is less and the visibility greater.

59. (2) A cricketer lowers his hands while taking a catch to decrease the rate of momentum. Cricketers increase the time by pulling their hand's backward with the ball while taking a catch. Linear momentum or translational momentum is the product of the mass and velocity of an object. For example, a heavy truck moving fast has a large momentum—it takes a large and prolonged force to get the truck up to this speed, and it takes a large and prolonged force to bring it to a stop afterwards. If the truck were lighter, or moving slower, then it would have less momentum.

60. (2) In summer, when the barometer falls suddenly, a thunderstorm can be expected, and if it does not rise again upon its cessation, the weather will probably continue unsettled for several days. In summer, when a thunderstorm happens, there is little or no depression of the barometer.

61. (2) If a particle dropped from the top of a tower uniformly falls on ground at a distance which is equal to the height of tower then a parabolic path will be traversed by a particle because when the particle is dropped that point is called the point of projection and when it reaches the ground that point is called the point of impact. Now, if the two points is met with one another the curve emerges is parabolic in nature. Hence, we can say that the path followed by the particle is of parabolic trajectories.

62. (1) It is widely accepted that the first prototype of an electron microscope was built by Ernst Ruska and Max Knoll in 1931; it was not more powerful than an optical microscope, but it demonstrated the principle that is still used in today's sophisticated and powerful instruments, and earned its builders a share of a Nobel Prize. An electron microscope uses a beam of electrons to illuminate a specimen and produce a magnified image. An electron microscope (EM) has greater resolving power than a light-powered optical microscope because electrons have wavelengths about 100,000 times shorter than visible light photons. The electron microscope uses electrostatic and electro-magnetic "lenses" to control the electron beam and focus it to form an image.

63. (3) Diffusion is one of several transport phenomena that occur in nature. A distinguis-hing feature of diffusion is that it results in mixing or mass transport without requiring bulk motion. Thus, diffusion should not be confused with convection or advection, which are other transport mechanisms that use bulk motion to move particles from one place to another. From the atomistic point of view, diffusion is considered as a result of the random walk of the diffusing particles. In molecular diffusion, the moving molecules are self-propelled by thermal energy.

64. (3) Cloudless nights are colder because the nights that have clouds provide a blanket for the earth and trap some of the hot day air where as the cloudless nights have no protection so all the hot air rises up into the sky. radiation is a process in which energetic particles or energetic waves travel through vacuum, or through matter-containing media that are not required for their propagation. Waves of a massive medium itself, such as water waves or sound waves, are usually not considered to be forms of "radiation" in this sense. By contrast, gravitational waves, which are waves of space-time itself, qualify as a type of radiation.

65. (3) Sound travels faster in liquids and non-porous solids than it does in air. It travels about 4.3 times as fast in water (1,484 m/s), and nearly 15 times as fast in iron (5,120 m/s), than in air at 20 degrees Celsius. Sound waves in solids are composed of compression waves (just as in gases and liquids), but also exhibit a different type of sound wave called a shear wave, which occurs only in solids. The speed of sound is the distance travelled during a unit of time by a sound wave propagating through an elastic medium. In dry air at 20 °C (68 °F), the speed of sound is 343.2 metres per second (1,126 ft/s). This is 1,236 kilometres per hour (768 mph), or about one kilometer in three seconds or approximately one mile in five seconds.

66. (4) Gas is easily compressed so it would have a more versatile range of measurement at least in our atmospheric conditions. Liquid is not so easily compressed, so, very little pressure via mass w/ gravity or heat would cause it to quickly jump between changes. A gas thermometer measures temperature by the variation in volume or pressure of a gas. One common apparatus is a constant volume thermometer. Gas thermometers are often used to calibrate other thermometers.

67. (3) A type of glass that contains cerium and other rare earths and has a high absorption of ultraviolet radiation is used in sunglasses. Sunglasses or sun glasses are a form of protective eyewear designed primarily to prevent bright sunlight and high-energy visible light from damaging or discomforting the eyes. They can sometimes also function as a visual aid, as variously termed spectacles or glasses exist, featuring lenses that are coloured, polarized or darkened. In the early 20th century they were also known as sun cheaters. The colour of the lens can vary depending on style, fashion, and purpose, but for general use, red, grey, green, or brown are recommended to avoid or minimize colour distortion, which could affect safety when, for instance, driving a car or a school bus.

68. (3) The speed of light with the rise in the temperature of the medium remains unaltered because speed of light doesn't depend on temperature. It does depend, however, on the refractive index of the substance it is travelling through. The speed of light in vacuum, commonly denoted c, is a universal physical constant important in many areas of physics. Its value is 299,792,458 metres per second, a figure that is exact because the length of the metre is defined from this constant and the international standard for time. The speed at which light propagates through transparent materials, such as glass or air, is less than c.

69. (4) It is just because woolen clothes have fibres and between those fibres air is trapped which reduces heat loss. Air reduces heat loss because it is an insulator or poor conductor of heat. Hence, all the heat from our body gets trapped inside the clothes which makes us feels warmer with the clothes.

70. (4) Basically, refrigeration system consists of devices that compress and expand refrigerant gas . When refrigerant gas is compressed it expels heat and when it is suddenly expanded, absorbs heat. A refrigerator (colloquially fridge) is a common household appliance that consists of a thermally insulated compartment and a heat pump (mechanical, electronic, or chemical) that transfers heat from the inside of the fridge to its external environment so that the inside of the fridge is cooled to a temperature below the ambient temperature of the room. A vapor compression cycle is used in most household refrigerators, refrigerator–freezers and freezers. In this cycle, a circulating refrigerant such as R134a enters a compressor as low-pressure vapor at or slightly above the temperature of the refrigerator interior. The vapor is compressed and exits the compressor as high-pressure superheated vapor. The superheated vapor

travels under pressure through coils or tubes comprising the condenser, which are passively cooled by exposure to air in the room. The condenser cools the vapor, which liquefies. As the refrigerant leaves the condenser, it is still under pressure but is now only slightly above room temperature. This liquid refrigerant is forced through a metering or throttling device, also known as an expansion valve (essentially a pin-hole sized constriction in the tubing) to an area of much lower pressure.

71. (1) Shortwave radio is used for broadcasting of voice and music, and long-distance communication to ships and aircraft, or to remote areas out of reach of wired communication or other radio services and that's why it is more energetic than long waves. Shortwave radio is radio communication using the upper MF (medium frequency) and all of the HF (high frequency) portion of the radio spectrum, between 1,800–30,000 kHz. Shortwave radio received its name because the wavelengths in this band are shorter than 200 m (1500 kHz) which marked the original upper limit of the medium frequency band first used for radio communications. The broadcast medium wave band now extends above the 200 m/1500 kHz limit, and the amateur radio 1.8 MHz – 2.0 MHz band (known as the "top band") is the lowest-frequency band considered to be 'shortwave'.

72. (3) Sudden and great fluctuations of the barometer at any time of the year indicate unsettled weather for several days, perhaps a fortnight. If the barometer falls two or three-tenths of an inch in four hours, one can expect a gale of wind. If the surface of the mercury in the cistern of the barometer vibrates upon the approach of a storm, the gale can be expected to be severe. In summer, when the barometer falls suddenly, a thunderstorm can be expected, and if it does not rise again upon its cessation, the weather will probably continue unsettled for several days.

73. (4) Graphite has a tendency to behave very much like a metal because the carbon molecules arrange themselves into a lattice structure. The crystal lattice is the same orientation that metal forms, and it allows the free-movement of electrons, making it a good electrical conductor. The characteristics possesses by the graphite for conduction is far better than the dry air paper and kerosene and that's what makes it a good conductor.

74. (4) A non-renewable resource is a natural resource which cannot be reproduced, grown, generated, or used on a scale which can sustain its consumption rate. So, coal is non-renewable source of energy. Once it is depleted, there is no more available for future needs. Fossil fuels (such as coal, petroleum, and natural gas), nuclear power (uranium) and certain aquifers are examples of non-renewable resources. In contrast, resources such as timber (when harvested sustainably) and wind (used to power energy conversion systems) are considered renewable resources. Natural resources such as coal, petroleum (crude oil) and natural gas take thousands of years to form naturally and cannot be replaced as fast as they are being consumed.

75. (2) In photosynthesis, solar energy is converted to chemical energy. The chemical energy is stored in the form of glucose (sugar). Carbon dioxide, water, and sunlight are used to produce glucose, oxygen, and water. Photosynthesis is a process used by plants and other organisms to convert the light energy captured from the sun into chemical energy that can be used to fuel the organism's activities. Photosynthesis occurs in plants, algae, and many species of bacteria, but not in archaea. Photosynthetic organisms are called photo-autotrophs, since they can create their own food. In plants, algae, and cyanobacteria, photosynthesis uses carbon dioxide and water, releasing oxygen as a waste product. Photosynthesis is vital for all aerobic life on Earth.

76. (3) The name "equinox" is derived from the Latin aequus (equal) and nox (night), because around the equinox, the night and day have approximately equal length. An equinox occurs twice a year (around 20 March and 22 September), when the tilt of the Earth's axis is inclined neither away from nor towards the Sun, the center of the Sun being in the same plane as the Earth's equator. The term equinox can also be used in a broader sense, meaning the date when such a passage happens. The equinoxes are the only times when the sub-solar point is on the Equator. This point (the place on the Earth's surface where the center of the Sun can be observed exactly overhead) crosses the Equator moving northward at the March equinox and crosses the Equator moving southward at the September equinox.

77. (3) The radiation (light, heat, etc.) travels through the intervening 150, 000,000 kilometers in 8 minutes. Radiation is a process in which energetic particles or energetic waves travel through vacuum, or through matter-containing media that are not required for their propagation. Waves of a massive medium itself, such as water waves or sound waves, are usually not considered to be forms of "radiation" in this sense. By contrast, gravitational waves, which are waves of space-time itself, qualify as a type of radiation. By contrast, most non-ionizing radiation is harmful to organisms only in proportion to the thermal energy deposited, and is conventionally considered harmless at low powers which do not produce significant temperature rise.

78. (2) The work done on any object goes into changing the kinetic energy of that object. Since the work done by the car engine is equal to the change in kinetic energy of the car we can say that kinetic energy is being used in performing work. The kinetic energy of an object is the energy which it possesses due to its motion. It is defined as the work needed to accelerate a body of a given mass from rest to its stated velocity. Having gained this energy during its acceleration, the body maintains this kinetic energy unless its speed changes. The same amount of work is done by the body in decelerating from its current speed to a state of rest.

79. (3) Glass transmits visible light but blocks infrared thermal radiation from escaping. This amplifies the heat trapping effect. A solar cooker, or solar oven, is

a device which uses the energy of direct sunlight to heat food or drink to cook it or sterilize it. The vast majority of the solar cookers presently in use are relatively cheap, low-tech devices. Because they use no fuel and cost nothing to operate, many nonprofit organizations are promoting their use worldwide to help reduce fuel costs for low-income people, reduce air pollution and slow deforestation and desertification, caused by use of firewood for cooking. Solar cooking is a form of outdoor cooking and is often used in situations where minimal fuel consumption is important, or the danger of accidental fires is high.

80. (3) In this case the given equation shows that that the velocity is linear with time and therefore the particle is moving with constant acceleration because for a particle to acquire constant acceleration the graph of the velocity time graph should be in linear with the time function.

81. (3) Guglielmo Marconi sent out the first wireless signals. In the early summer of 1895 and despite an intervening hill, Marconi achieved signal transmission and reception over a distance of about 2km. Success was indicated initially by the waving of a handkerchief and progressed to the need to fire a gun. The theory of relativity transformed theoretical physics and astronomy during the 20th century. When first published, relativity superseded a 200-year-old theory of mechanics stated by Isaac Newton. In 1900 Max Planck made a profound discovery in modern physics / Quantum Theory. He showed (from purely formal / mathematical foundations) that light must be emitted and absorbed in discrete amounts if it was to correctly describe observed phenomena (i.e. Blackbody radiation). The Wright brothers, Orville (August 19, 1871 – January 30, 1948) and Wilbur (April 16, 1867 – May 30, 1912), were two American brothers, inventors, and aviation pioneers who were credited with inventing and building the world's first successful airplane and making the first controlled, powered and sustained heavier-than-air human flight, on December 17, 1903.

82. (2) This is inertia of direction. It is the ability of body to be in a state of direction of motion .for example sun holds planets in a fixed elliptical path .this is one of the examples of inertia of direction. Inertia of direction is non-existent however inertia only apply to a body at rest or moving with a constant velocity. It is the property possessed by a body to resist change. In other way we can say that if a body moves in a particular direction under the action of a force and if the force is removed then the will continue to move in the same direction unless stopped under the action of another opposing force for a body at rest it under the inertia of rest whereas inertia of motion is for bodies in motion.

83. (3) In this case, if we increase the pressure on the ice the ice-water system wants to try to lower it again. It can do that by making itself fit into a smaller volume. But since water fills a smaller volume when it's liquid, rather than solid, it will go to a lower melting point — allowing more solid to become liquid and hence when we increase pressure, the melting point of ice decreases because of the inversal relationship between the pressure and melting point of ice.

84. (1 Longitudinal waves cannot travel through vacuum because such wave requires a medium such as solid liquid or air to travel through. They cannot travel through vacuum or in space. Longitudinal waves, also known as "l-waves", are waves that have the same direction of vibration as their direction of travel, which means that the movement of the medium is in the same direction as, or the opposite direction to, the motion of the wave. Mechanical longitudinal waves are also called compressional waves or compression waves. Longitudinal waves include sound waves (vibrations in pressure, particle displacement, and particle velocity propagated in an elastic medium) and seismic P-waves (created by earthquakes and explosions).

85. (1) An electrostatic precipitator (ESP), or electrostatic air cleaner is a particulate collection device that removes particles from a flowing gas (such as air) using the force of an induced electrostatic charge. An electrostatic precipitator (ESP) or electrostatic air cleaner is a particulate collection device that removes particles from a flowing gas (such as air) using the force of an induced electrostatic charge. Electrostatic precipitators are highly efficient filtration devices that minimally impede the flow of gases through the device, and can easily remove fine particulate matter such as dust and smoke from the air stream. In contrast to wet scrubbers which apply energy directly to the flowing fluid medium, an ESP applies energy only to the particulate matter being collected and therefore is very efficient in its consumption of energy (in the form of electricity).

86. (4) Tungsten is used because it has the highest melting point of all the metallic elements. It melts at 3410 degrees Celsius. When current passes through the filament it heats it up. When the filament reaches a certain temperature it starts to give off light, that's how we get a light bulb. The first successful light bulb filaments were made of carbon (from carbonized paper or bamboo). In 1906, the tungsten filament was introduced. Tungsten metal was initially not available in a form that allowed it to be drawn into fine wires. Filaments made from sintered tungsten powder were quite fragile. The advantage of the coiled coil is that evaporation of the tungsten filament is at the rate of a tungsten cylinder having a diameter equal to that of the coiled coil.

87. (2) The visible spectrum is the portion of the electromagnetic spectrum that is visible to (can be detected by) the human eye. Electromagnetic radiation in this range of wavelengths is called visible light or simply light. A typical human eye will respond to wavelengths from about 390 to 750 nm in terms of angstrom it is in between 3900 A° - 7600 A°. In terms of frequency, this corresponds to a band in the vicinity of 400–790 THz. A light-adapted eye generally has its maximum sensitivity at around 555 nm (540 THz), in the green region of the optical spectrum (luminosity function). The spectrum does not, however, contain

all the colours that the human eyes and brain can distinguish. Unsaturated colours such as pink, or purple variations such as magenta, are absent, for example, because they can be made only by a mix of multiple wavelengths.

88. (3) Galileo is often credited with being the first scientist to try to determine the speed of light. Galileo's experiment was carried out by the Accademia del Cimento of Florence, Italy, in 1667, with the lanterns separated by about one mile, but no delay was observed. The actual delay in this experiment would have been about 11 microseconds. The first quantitative estimate of the speed of light was made in 1676 by Romer. From the observation that the periods of Jupiter's innermost moon Io appeared to be shorter when the Earth was approaching Jupiter than when receding from it, he concluded that light travels at a finite speed, and estimated that it takes light 22 minutes to cross the diameter of Earth's orbit.

89. (2) This is caused due to the interference caused by the electromagnetic waves generated by a passing vehicle. These waves were within the same frequency range as that of the waves of TV reception and hence caused Interference. interference is a phenomenon in which two waves superimpose to form a resultant wave of greater or lower amplitude. Interference usually refers to the interaction of waves that are correlated or coherent with each other, either because they come from the same source or because they have the same or nearly the same frequency. Interference effects can be observed with all types of waves, for example, light, radio, acoustic, and surface water waves and due to the interference caused by the vehicle electromagnetic disturbances occurs in the TV reception and gets distorted.

90. (3) The spectrum of the Sun's solar radiation is close to that of a black body with a temperature of about 5,800 K. The Sun emits Electromagnetic radiation across most of the electromagnetic spectrum. Although the Sun produces Gamma rays as a result of the nuclear fusion process, these super high energy photons are converted to lower energy photons before they reach the Sun's surface and are emitted out into space. nuclear fusion is a nuclear reaction in which two or more atomic nuclei join together, or "fuse", to form a single heavier nucleus. During this process, matter is not conserved because some of the mass of the fusing nuclei is converted to energy which is released. Fusion is the process that powers active stars. The fusion of two nuclei with lower masses than iron (which, along with nickel, has the largest binding energy per nucleon) generally releases energy, while the fusion of nuclei heavier than iron absorbs energy.

91. (2),The sky is blue because the molecules in the air scatter light in the higher wavelengths (that is, the blue light), while lower wavelength light (that is, the light on the red end of the spectrum) goes through to the ground. So the light that get finally reflected down from the scattering is blue, therefore a blue sky. This is called Rayleigh scattering. Rayleigh scattering, named after the British physicist Lord Rayleigh, is the elastic scattering of light or other electromagnetic radiation by particles much smaller than the wavelength of the light. The particles may be individual atoms or molecules. It can occur when light travels through transparent solids and liquids, but is most prominently seen in gases.

92. (2) A dynamo is a device for converting mechanical energy into electrical energy, esp. one that produces direct current. A dynamo is an electrical generator that produces direct current with the use of a commutator. Dynamos were the first electrical generators capable of delivering power for industry, and the foundation upon which many other later electric-power conversion devices were based, including the electric motor, the alternating-current alternator, and the rotary converter. A dynamo has the disadvantages of a mechanical commutator. Also, converting alternating to direct current using power rectification devices (vacuum tube or more recently solid state) is effective and usually economic.

93. (4) It is because of the capillary action phenomenon because of which oil rise up the wick in a lamp. Capillary action, or capillarity, is the ability of a liquid to flow in narrow spaces without the assistance of, and in opposition to external forces like gravity. The effect can be seen in the drawing up of liquids between the hairs of a paint-brush, in a thin tube, in porous materials such as paper, in some non-porous materials such as liquefied carbon fiber, or in a cell. It occurs because of inter-molecular attractive forces between the liquid and solid surrounding surfaces.

94. (1) Most of the ultraviolet radiation in sunlight is absorbed by oxygen in Earth's atmosphere, which forms the ozone layer of the lower stratosphere. UV light is found in sunlight (where it constitutes about 10% of the energy in vacuum) and is emitted by electric arcs and specialized lights such as black lights. It can cause chemical reactions, and causes many substances to glow or fluoresce. Most ultraviolet is classified as non-ionizing radiation. The higher energies of the ultraviolet spectrum from wavelengths about 10 nm to 120 nm ('extreme' ultraviolet) are ionizing, but this type of ultraviolet in sunlight is blocked by normal di-oxygen in air, and does not reach the ground. In addition to short wave UV blocked by oxygen, a great deal (>97%) of mid-range ultraviolet (almost all UV above 280 nm and most above 315 nm) is blocked by the ozone layer, and like ionizing short wave UV, would cause much damage to living organisms if it penetrated the atmosphere.

95. (3) Nichrome is the most common domestic heating element and is found in many household products. Commonly, items such as toasters, hair dryers and heaters use nichrome coils to pass electricity and give off heat. Nichrome is made of 80 percent nickel and 20 percent chromium, and its high melting point of 1,400 degrees Celsius. Nichrome is a non-magnetic alloy of nickel, chromium, and often iron, usually used as a resistance wire. Patented in 1905, it is the oldest documented form of resistance heating alloy. A common alloy is 80% nickel and 20% chromium, by mass, but there are many others to accommodate

various applications. Due to its relatively high electrical resistivity and resistance to oxidation at high temperatures, it is widely used in electric heating elements, such as in hair dryers, electric ovens, soldering iron, toasters, and even electronic cigarettes.

96. (4) An electron microscope uses a beam of electrons to illuminate a specimen and produce a magnified image. An electron microscope (EM) has greater resolving power than a light-powered optical microscope because electrons have wavelengths about 100,000 times shorter than visible light photons. Magnification is the process of enlarging something only in appearance, not in physical size. This enlargement is quantified by a calculated number also called "magnification". When this number is less than one it refers to a reduction in size, sometimes called "de-magnification".

97. (4) Pascal's principle guarantees that the pressure is transmitted equally to all parts of the enclosed fluid system. This gives straight-line braking unless there is a fluid leak or something to cause a significant difference in the friction of the surfaces. The hydraulic brake is an arrangement of braking mechanism which uses brake fluid, typically containing ethylene glycol, to transfer pressure from the controlling unit, which is usually near the operator of the vehicle, to the actual brake mechanism, which is usually at or near the wheel of the vehicle.

98. (1) Mesons are not produced by radioactive decay, but appear in nature only as short-lived products of very high-energy interactions in matter, between particles made of quarks. In cosmic ray interactions, for example, such particles are ordinary protons and neutrons. Mesons are hadronic subatomic particles composed of one quark and one anti-quark, bound together by the strong interaction. Because mesons are composed of sub-particles, they have a physical size, with a radius roughly one femtometre, which is about 2/3 the size of a proton or neutron. All mesons are unstable, with the longest-lived lasting for only a few hundredths of a microsecond. Charged mesons decay (sometimes through intermediate particles) to form electrons and neutrinos.

99. (4) Respiration does not rely on the sun, so it is possible for plants to respire around the clock. The rate of respiration is dependent on temperature: The warmer it is, the more a plant will respire. Drought, extreme winter or frost and heat injury all create a situation for the plant where moisture is not adequate to maintain the proper water levels in plant tissues. Extreme winter cold and frost are similar to summer drought in that frozen water is unavailable to the plant. The air is very dry as well.

100. (2) Displacement-time graph is non linear. Linear motion (also called rectilinear motion) is motion along a straight line, and can therefore be described mathematically using only one spatial dimension. The linear motion can be of two types: uniform linear motion with constant velocity or zero acceleration; non uniform linear motion with variable velocity or non-zero acceleration. The motion of a particle (a point-like object) along a line can be described by its position, which varies with (time). An example of linear motion is an athlete running 100m along a straight track. Linear motion is the most basic of all motion.

101. (3) The characteristics of plasmas are significantly different from those of ordinary neutral gases so that plasmas are considered a distinct "fourth state of matter. plasma is a state of matter similar to gas in which a certain portion of the particles is ionized. Heating a gas may ionize its molecules or atoms (reduce or increase the number of electrons in them), thus turning it into a plasma, which contains charged particles: positive ions and negative electrons or ions. Ionization can be induced by other means, such as strong electromagnetic field applied with a laser or microwave generator, and is accompanied by the dissociation of molecular bonds, if presents.

102. (4) Lambert's Law says that the intensity of emitted light from a surface is directly proportional to the cosine of the angle between the line of view and the normal to the surface. A Lambertian surface is a surface that follows this rule exactly. In practice, most surfaces are not perfectly Lambertian. A surface which obeys Lambert's law is said to be Lambertian, and exhibits Lambertian reflectance. Such a surface has the same radiance when viewed from any angle. This means, for example, that to the human eye it has the same apparent brightness (or luminance). It has the same radiance because, although the emitted power from a given area element is reduced by the cosine of the emission angle, the apparent size (solid angle) of the observed area, as seen by a viewer, is decreased by a corresponding amount. Therefore, its radiance (power per unit solid angle per unit projected source area) is the same.

103. (3) The law of conservation of mass, also known as the principle of mass/matter conservation, states that the mass of an isolated system (closed to all transfers of matter and energy) will remain constant over time. This principle is equivalent to the conservation of energy: when energy or mass is enclosed in a system and none is allowed in or out, its quantity cannot otherwise change over time (hence, its quantity is "conserved" over time). The mass of an isolated system cannot be changed as a result of processes acting inside the system. The law implies that mass can neither be created nor destroyed, although it may be rearranged in space and changed into different types of particles; and that for any chemical process in an isolated system, the mass of the reactants must equal the mass of the products.

104. (3) The decibel (abbreviated dB) is the unit used to measure the intensity of a sound. The decibel scale is a little odd because the human ear is incredibly sensitive. Our ears can hear everything from your fingertip brushing lightly over your skin to a loud jet engine. The decibel (dB) is a logarithmic unit that indicates the ratio of a physical quantity (usually power or intensity) relative to a specified or implied reference level. A ratio in decibels is ten times the logarithm to base 10 of the ratio of two power quantities. The

decibel is used for a wide variety of measurements in science and engineering, most prominently in acoustics, electronics, and control theory.

105. (1) An isoneph is a line indicating equal cloud cover or equal cloudiness. Variations in the degrees of slope, temperature, occurrence of rainfall, may be represented by drawing the lines of equal values on a map. All such maps are termed as Isopleth Map. The word Isopleth is derived from 'Iso' meaning equal and 'pleth' means lines. Thus, an imaginary line, which joins the places of equal values, is referred as Isopleth. The more frequently drawn isopleths include Isotherm (equal temperature), Isobar (equal pressure), Isohyets (equal rainfall), Isonephs (equal cloudiness), Isohels (equal sunshine), contours (equal heights), Isobaths (equal depths), Isohaline (equal salinity), etc.

106. (2) The ionosphere is a part of the upper atmosphere, from about 85 km to 600 km altitude, comprising portions of the mesosphere, thermosphere and exosphere, distinguished because it is ionized by solar radiation. It plays an important part in atmospheric electricity and forms the inner edge of the magnetosphere. It has practical importance because, among other functions, it influences radio propagation to distant places on the Earth. The ionosphere is a shell of electrons and electrically charged atoms and molecules that surrounds the Earth, stretching from a height of about 50 km to more than 1000 km. It owes its existence primarily to ultraviolet radiation from the Sun.

107. (2) Cryogenics is the study of how to get to low temperatures and of how materials behave when they get there. Besides the familiar temperature scales of Fahrenheit and Celsius (Centigrade), cryogenicists use other temperature scales, the Kelvin and Rankine temperature scales. One of the more modern processes being used to treat metals (as well as other materials) is cryogenic tempering. While the science of heat treatment is well known and widely understood, the principles of cryogenic tempering remain a mystery to most people in industry.

108. (4) Special theory of relativity postulates that the speed of light is a universal constant. We cannot reach speeds greater than the speed of light by the relativistic addition of velocities. The equation is how to reconcile with this result of special relativity with Newton's second law, F=ma. It would be seen that any constant force, no matter how small, applied for a considerably very long time, should continuously accelerate any mass 'm' at a rate a=f/m until the speed was arbitrarily very large. Einstein, concluded that energy has inertia i.e. the more energy a body possess, the more inertia that body will display. Since, inertia is a property of matter, which is associated with mass. Thus from Einstein's argument mass is simply a property attributed to the total energy of the body and only the total energy is required, to know the total mass of the body.

109. (3) An atomic clock is a clock device that uses an electronic transition frequency in the microwave, optical, or ultraviolet region of the electromagnetic spectrum of atoms as a frequency standard for its timekeeping element. Atomic clocks are the most accurate time and frequency standards known, and are used as primary standards for international time distribution services, to control the wave frequency of television broadcasts, and in global navigation satellite systems such as GPS.

110. (3) Nose bleeds can occur at high altitudes. The bleeding may be caused by the change in air pressure associated with the change in altitude or the cold dry air common at high altitudes. No matter the cause, the symptoms and treatment of a high altitude bloody nose are the same. A nose bleed is defined as the discharge of blood from the nostrils. Stress and anxiety raises the blood pressure, complicating the nose bleed. At high elevations, there's less oxygen in the air for us to breathe in. When we travel from a low elevation to a high one, our body needs time to adjust to the lower levels of oxygen reaching your bloodstream. Eventually, our respiration and heart activity increase and we produce more red blood cells to transport the oxygen to where it needs to go.

111. (2) The primary reason why the colour red is used for danger signals is that red light is scattered the least by air molecules. The effect of scattering is inversely related to the fourth power of the wavelength of a colour. Therefore blue which has the least wavelength of all the visible radiations is scattered the most and red which has the highest wavelength of all the colours we can see is scattered the least. So red light is able to travel the longest distance through fog, rain, and the alike. Also, red is a colour we inherently perceive as one that is associated with danger.

112. (1) Simple microscope - light microscope consisting of a short focus single convex lens is used to produce an enlarged image. The magnifying glass was invented by Roger Bacon in 1250. In the original 'simple' microscopes, a single light path went through the object viewed and one lens, increasing the visibility of the object by some amount (magnification). (One light path, one lens = simple microscope) Compound refers to the fact that in order to enlarge an image; a single light path passes through a series of lenses in a line. Each lens magnifies the image over the previous one. (One light path, multiple lenses = compound microscope) Usually, a modern compound microscope has multiple lenses within the eye tube, and a series of three or four objective lenses on the 'head' which can be rotated into place. The image produced is a two dimensional (2-D) image.

113. (4) Surface tension is a contractive tendency of the surface of a liquid that allows it to resist an external force. It is revealed, for example, in the floating of some objects on the surface of water, even though they are denser than water, and in the ability of some insects (e.g. water striders) to run on the water surface. This property is caused by cohesion of similar molecules, and is responsible for many of the behaviors of liquids. Surface tension is responsible

for the shape of liquid droplets. Although easily deformed, droplets of water tend to be pulled into a spherical shape by the cohesive forces of the surface layer. Water has the greatest surface tension, due to greater forces between the molecules of water compared to oil (mainly due to hydrogen bonding of water molecules to each other). So an oil droplet spreads over it.

114. (3) A rectifier is an electrical device that converts alternating current (AC), which periodically reverses direction, to direct current (DC), which flows in only one direction. The process is known as rectification. Physically, rectifiers take a number of forms, including vacuum tube diodes, mercury-arc valves, solid-state diodes, silicon-controlled rectifiers and other silicon-based semiconductor switches. Rectifiers have many uses, but are often found serving as components of DC power supplies and high-voltage direct current power transmission systems. Rectification may serve in roles other than to generate direct current for use as a source of power. As noted, detectors of radio signals serve as rectifiers.

115. (1) The knot (pronounced not) is a unit of speed equal to one nautical mile (1.852 km) per hour, approximately 1.151 mph. There is no standard abbreviation but km is commonly used. The knot is a non-SI unit accepted for use with the International System of Units (SI). Worldwide, the knot is used in meteorology, and in maritime and air navigation—for example, a vessel travelling at 1 knot along a meridian travels one minute of geographic latitude in one hour. The speeds of vessels relative to the fluids in which they travel (boat speeds and air speeds) are measured in knots.

116. (3) Three wires enter most homes from the power pole—two "hot" wires and a third "neutral" wire. Each hot wire provides 120-volt current for conventional lights, receptacles, and appliances when paired with the neutral wire, which is normally kept at zero volts or "ground potential." When both hot wires are used together with the neutral, they power large 240-volt appliances such as air conditioners and electric ovens. All the electric appliances stop working in a house when the main switch is put off because the electric circuit (the path where the electricity travels) gets opened. A circuit needs to be closed in order for current to flow through it and thus all electric appliances to work. Switching off the main supply involves breaking the circuit and hence the current flow through the circuit. Turning off a wall switch does not necessarily turn off the power to a fixture or receptacle; the power at the circuit breaker should be shut off. On the electrical box, we can see a row of switch. One main switch is particular unique in colour or size. This is the main switch which cuts off the supply from live and neutral wire. In rest of the switches, only the live wire is disconnected. This is an important note to take, and the same applies to the wall switches.

117. (3) In physics, radiation is a process in which energetic particles or energetic waves travel through vacuum, or through matter-containing media that are not required for their propagation. Waves of a massive medium itself, such as water waves or sound waves, are usually not considered to be forms of "radiation" in this sense. By contrast, gravitational waves, which are waves of space-time itself, qualify as a type of radiation. Heat from the sun also reaches earth by the process of radiation.

118. (1) Boyle's law states that the absolute pressure and volume of a given mass of confined gas are inversely proportional, if the temperature remains unchanged within a closed system. Thus, it states that the product of pressure and volume is a constant for a given mass of confined gas as long as the temperature is constant. The law was named after chemist and physicist Robert Boyle, who published the original law in 1662.

119. (3) A burn is an injury to the body's tissue resulting from heat, chemicals, electricity or sunlight. Burns are often classified as first degree (those causing damage to the outer layer of the skin, the epidermis), second degree (causing deeper damage to the dermis, the layer beneath the epidermis),third degree (those causing the deepest and most severe damage — destruction of all layers of the skin and damage to tissues underneath. A steam burn is a burn caused by steam, usually from boiling water. Although the skin will not be charred, as would be the case with a flame burn, blisters and redness will appear. A third degree steam burn will penetrate deep into the flesh, and may be white, heavily blistered, and numb. The larger concern with steam burns is the airway, however. Inhaling steam can cause serious damage to the bronchial tubes, and could potentially lead to death.

120. (2) Atmospheric pressure is basically the weight of air in the atmosphere above the reservoir, so the level of mercury continues to change until the weight of mercury in the glass tube is exactly equal to the weight of air above the reservoir. In areas of low pressure, air is rising away from the surface of the earth more quickly than it can be replaced by air flowing in from surrounding areas. This reduces the weight of air above the reservoir so the mercury level drops to a lower level. A slowly rising atmospheric pressure, over a week or two, typically indicates settled weather that will last a long time. A sudden drop in atmospheric pressure over a few hours often forecasts an approaching storm, with heavy rain and strong winds.

121. (3) The term energy is used to describe the capacity of a system to do work on another system. Energy of all types (Surface Tension, Kinetic, Potential etc.) have the same dimension and unit as that of Work. Both energy and work have the same dimensional formula of $M^1L^2T^{-2}$. In the SI system, both have the same units of Newton meter.

122. (2) Magnetism is a property of materials that respond to an applied magnetic field. Permanent magnets have persistent magnetic fields caused by ferromagnetism. That is the strongest and most familiar type of magnetism. However, all materials are influenced

varyingly by the presence of a magnetic field. When a material is put in a magnetic field, the electrons circling the nucleus will experience, in addition to their Coulomb attraction to the nucleus, a Lorentz force from the magnetic field. Depending on which direction the electron is orbiting, this force may increase the centripetal force on the electrons, pulling them in towards the nucleus, or it may decrease the force, pulling them away from the nucleus. This effect systematically increases the orbital magnetic moments that were aligned opposite the field, and decreases the ones aligned parallel to the field (in accordance with Lenz's law). This results in a small bulk magnetic moment, with an opposite direction to the applied field.

123. (2) Myopia is commonly known shortsighted. It is a condition of the eye where the light that comes in does not directly focus on the retina but in front of it. This causes the image that one sees when looking at a distant object to be out of focus but in focus when looking at a close object. Eye care professionals most commonly correct myopia through the use of corrective lenses, such as glasses or contact lenses. It may also be corrected by refractive surgery, though there are cases of associated side effects. The corrective lenses have a negative optical power (i.e. are concave) which compensates for the excessive positive diopters of the myopic eye.

124. (4) Scintillation or twinkling is generic terms for variations in apparent brightness or position of a distant luminous object viewed through a medium. If the object lies outside the Earth's atmosphere, as in the case of stars and planets, the phenomenon is termed astronomical scintillation; within the atmosphere, the phenomenon is termed terrestrial scintillation. As one of the three principal factors governing astronomical seeing, atmospheric scintillation is defined as variations in illuminance only. Scintillation does not cause images of planets to flicker. Most scintillation effects are caused by anomalous refraction caused by small-scale fluctuations in air density usually related to temperature gradients.

125. (4) Seismometers are instrument that measures motion of the ground, including those of seismic waves generated by earthquakes, volcanic eruptions and other seismic sources. Records of seismic waves allow seismologists to map the interior of the earth and locate and measure the size of these different sources. Seismograph is another Greek term meaning to draw siesmo waves. It is often used to mean seismometer, though it is more applicable to the older instruments in which the measuring and recording of ground motion were combined than to modern systems, in which these functions are separated.

126. (4) Ultrasound is a cyclic sound pressure wave with a frequency greater than the upper limit of the human hearing range. Ultrasound is thus not separated from "normal" (audible) sound based on differences in physical properties, only the fact that humans cannot hear it. Although this limit varies from person to person, it is approximately 20 kilohertz (20,000 hertz) in healthy, young adults. Bats use a variety of ultrasonic ranging (echolocation) techniques to detect their prey. They can detect frequencies beyond 100 kHz, possibly up to 200 kHz.

127. (3) The Sun formed about 4.6 billion years ago from the gravitational collapse of a region within a large molecular cloud. Most of the matter gathered in the center, while the rest flattened into an orbiting disk that would become the Solar System. The central mass became increasingly hot and dense, eventually initiating thermonuclear fusion in its core. It is thought that almost all other stars form by this process.

128. (4) A multimeter or a multitester, also known as a VOM (Volt-Ohm meter), is an electronic measuring instrument that combines several measurement functions in one unit. A typical multimeter may include features such as the ability to measure voltage, current and resistance. Multimeters may use analog or digital circuits—analog multimeters (AMM) and digital multimeters (often abbreviated DMM or DVOM.) A multimeter can be a hand-held device useful for basic fault finding and field service work or a bench instrument which can measure to a very high degree of accuracy. They can be used to troubleshoot electrical problems in a wide array of industrial and household devices such as electronic equipment, motor controls, domestic appliances, power supplies, and wiring systems.

129. (4) In optics, a prism is a transparent optical element with flat, polished surfaces that refract light. At least two of the flat surfaces must have an angle between them. The exact angles between the surfaces depend on the application. The traditional geometrical shape is that of a triangular prism with a triangular base and rectangular sides, and in colloquial use "prism" usually refers to this type. A prism can be used to break light up into its constituent spectral colours (the colours of the rainbow). Prisms can also be used to reflect light, or to split light into components with different polarizations. Prisms are sometimes used for the internal reflection at the surfaces rather than for dispersion.

130. (1) A nuclear reactor is a device to initiate and control a sustained nuclear chain reaction. Most commonly they are used for generating electricity and for the propulsion of ships. Usually heat from nuclear fission is passed to a working fluid (water or gas), which runs through turbines that power either ship's propellers or generators. Some produce isotopes for medical and industrial use, and some are run only for research. Just as conventional power stations generate electricity by harnessing the thermal energy released from burning fossil fuels, nuclear reactors convert the thermal energy released from nuclear fission.

131. (2) Sonar (originally an acronym for Sound Navigation And Ranging) is a technique that uses sound propagation (usually underwater, as in submarine navigation) to navigate, communicate with or detect objects on or under the surface of the water, such as other vessels. Sonar may be used as a means of acoustic location and of measurement of the echo

characteristics of "targets" in the water. The term sonar is also used for the equipment used to generate and receive the sound.

132. (3) Dispersion occurs when different frequencies of light have different phase velocities, due either to material properties (material dispersion) or to the geometry of an optical waveguide (waveguide dispersion). A spectrometer (spectro-photometer, spectrograph or spectroscope) is an instrument used to measure properties of light over a specific portion of the electromagnetic spectrum, typically used in spectroscopic analysis to identify materials. The variable measured is most often the light's intensity but could also, for instance, be the polarization state.

133. (2) A fountain pen is a nib pen that, unlike its predecessor the dip pen, contains an internal reservoir of water-based liquid ink. The pen draws ink from the reservoir through a feed to the nib and deposits it on paper via a combination of gravity and capillary action. Capillary action, or capillarity, is the ability of a liquid to flow in narrow spaces without the assistance of, and in opposition to external forces like gravity. The effect can be seen in the drawing up of liquids between the hairs of a paint-brush, in a thin tube, in porous materials such as paper, in some non-porous materials such as liquefied carbon fiber, or in a cell.

134. (1) A gas pycnometer is a laboratory device used for measuring the density — or more accurately the volume — of solids, be they regularly shaped, porous or non-porous, monolithic, powdered, granular or in some way comminuted, employing some method of gas displacement and the volume-pressure relationship known as Boyle's Law. A gas pycnometer is also sometimes referred to as a helium pycnometer. While pycnometer (of any type) is recognized as density measuring devices they are in fact devices for measuring volume only.

135. (3) An optical fiber (or optical fibre) is a flexible, transparent fiber made of glass (silica) or plastic, slightly thicker than a human hair. It functions as a waveguide, or "light pipe", to transmit light between the two ends of the fiber. The field of applied science and engineering concerned with the design and application of optical fibers is known as fiber optics. Optical fibers are widely used in fiber-optic communications, which permits transmission over longer distances and at higher bandwidths (data rates) than other forms of communication. Fibers are used instead of metal wires because signals travel along them with less loss and are also immune to electromagnetic interference.

136. (4) The decibel (dB) is a logarithmic unit that indicates the ratio of a physical quantity (usually power or intensity) relative to a specified or implied reference level. A ratio in decibels is ten times the logarithm to base 10 of the ratio of two power quantities. A decibel is one tenth of a bel, a seldom-used unit commonly used to measure sound level. The decibel is used for a wide variety of measurements in science and engineering, most prominently in acoustics, electronics, and control theory. In electronics, the gains of amplifiers, attenuation of signals, and signal-to-noise ratios are often expressed in decibels.

137. (4) Infrared imaging is used extensively for military and civilian purposes. Military applications include target acquisition, surveillance, night vision, homing and tracking. Non-military uses include thermal efficiency analysis, environmental monitoring, industrial facility inspections, remote temperature sensing, short-ranged wireless communication, spectro-scopy, and weather forecasting. Infrared astronomy uses sensor-equipped telescopes to penetrate dusty regions of space, such as molecular clouds; detect objects such as planets, and to view highly red-shifted objects from the early days of the universe. There are two main types of remote sensing: passive remote sensing and active remote sensing. Reflected sunlight is the most common source of radiation measured by passive sensors. Examples of passive remote sensors include film photography, infrared, charge-coupled devices, and radiometers.

138. (3) Changes in weather involve air movements, formation of clouds, and precipitation. Energy is needed to make all these things happen. That energy comes from the sun. Heat energy enters and moves through the atmosphere in three different ways. One way that heat energy is transferred is radiation. Hot bodies such as the sun radiate their energy mainly in the form of short waves. These short waves are seen as visible light. Cooler bodies such as Earth radiate their energy as longer waves.

139. (2) A rectifier is an electrical device that converts alternating current (AC), which periodically reverses direction, to direct current (DC), which flows in only one direction. The process is known as rectification. Physically, rectifiers take a number of forms, including vacuum tube diodes, mercury-arc valves, solid-state diodes, silicon-controlled rectifiers and other silicon-based semiconductor switches. Rectifiers have many uses, but are often found serving as components of DC power supplies and high-voltage direct current power transmission systems. Rectification may serve in roles other than to generate direct current for use as a source of power.

140. (1) The electromagnetic spectrum is the name we use when we talk about different types of radiation as a group. The parts of the electromagnetic spectrum, arranged from highest energy to lowest, are gamma rays, X-rays, ultraviolet light, visible light, infrared light, microwaves, and radio waves. All the parts of the electromagnetic spectrum are the same thing — radiation. Radiation is made up of a stream of photons — particles without mass that move in a wave pattern, all at the same speed — the speed of light. Each photon contains a certain amount of energy. The only difference between the parts of the electromagnetic spectrum is the amount of energy the photons contain. Radio waves have the least energy, and gamma rays have the most

141. (2) An anemometer is a device for measuring wind speed, and is a common weather station instrument. The term is derived from the Greek word anemos, meaning wind, and is used to describe any airspeed measurement instrument used in meteorology or aerodynamics. The first known description of an anemometer was given by Leon Battista Alberti around 1450.

142. (1) Sir Isaac Newton brought out his monograph, titled 'Philosophiæ Naturalis Principia Mathematica,' in 1687. In this work, Newton described universal gravitation and the three laws of motion, which dominated the scientific view of the physical universe for the next three centuries. Newton showed that the motions of objects on Earth and of celestial bodies are governed by the same set of natural laws, by demonstrating the consistency between Kepler's laws of planetary motion and his theory of gravitation, thus removing the last doubts about helio-centrism and advancing the Scientific Revolution. Newton's law of universal gravitation states that every point mass in the universe attracts every other point mass with a force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between them.

143. (3) A lightning rod is a metal rod or metallic object mounted on top of a building, electrically bonded using a wire or electrical conductor to interface with ground or "earth" through an electrode, engineered to protect the building in the event of lightning strike. If lightning targets the building it will preferentially strike the rod and be conducted to ground through the wire, instead of passing through the building, where it could start a fire or cause electrocution. Copper and its alloys are the most common materials used in lightning protection. Copper does not attract lightning, but it effectively and rapidly facilitates the transmission of lightning energy to the ground because of its excellent electrical conductivity and corrosion resistance characteristics. Also, it bends easily compared to other conductor materials.

144. (3) A hydrogen atom is very light. Most of the air on earth is made up of nitrogen, oxygen, and carbon dioxide. All of these elements are heavier than hydrogen, so the balloon is pushed upwards. Hydrogen weighs 0.08988 grams per liter. Nitrogen, which makes up 80% of the air we breathe, weighs 1.2506 grams per liter. Hydrogen filled balloons follow the same principle as we do when we float in the water; the law of buoyancy. If the water we displace weighs more than we do, we will float.

145. (3) In electricity, a battery is a device consisting of one or more electrochemical cells that convert stored chemical energy into electrical energy. A battery is a device that converts chemical energy directly to electrical energy. It consists of a number of voltaic cells; each voltaic cell consists of two half-cells connected in series by a conductive electrolyte containing anions and cations. One half-cell includes electrolyte and the electrode to which anions (negatively charged ions) migrate, i.e., the anode or negative electrode; the other half-cell includes electrolyte and the electrode to which cations (positively charged ions) migrate, i.e., the cathode or positive electrode. In the redox reaction that powers the battery, cations are reduced (electrons are added) at the cathode, while anions are oxidized (electrons are removed) at the anode.

146. (1) Astigmatism is an optical defect in which vision is blurred due to the inability of the optics of the eye to focus a point object into a sharp focused image on the retina. This may be due to an irregular or toric curvature of the cornea or lens. The two types of astigmatism are regular and irregular. Irregular astigmatism is often caused by a corneal scar or scattering in the crystalline lens, and cannot be corrected by standard spectacle lenses, but can be corrected by contact lenses. Regular astigmatism arising from either the cornea or crystalline lens can be corrected by a toric lens. This optical shape gives rise to regular astigmatism in the eye. Toric lens is somewhat similar in significance to cylindrical cells.

147. (2) Superconductivity is a phenomenon of exactly zero electrical resistance and expulsion of magnetic fields occurring in certain materials when cooled below a characteristic critical temperature. It is characterized by the Meissner effect, the complete ejection of magnetic field lines from the interior of the superconductor as it transitions into the superconducting state. The electrical resistivity of a metallic conductor decreases gradually as temperature is lowered. In a superconductor, the resistance drops abruptly to zero when the material is cooled below its critical temperature. An electric current flowing in a loop of superconducting wire can persist indefinitely with no power source.

148. (4) In a Laser all the atoms emit the light waves of same frequency, amplitude and phase. A laser is a device that emits light (electromagnetic radiation) through a process of optical amplification based on the stimulated emission of photons. The term "laser" originated as an acronym for Light Amplification by Stimulated Emission of Radiation.

149. (2) Heat capacity (usually denoted by a capital C, often with subscripts), or thermal capacity, is the measurable physical quantity that characterizes the amount of heat required to change a substance's temperature by a given amount. In the International System of Units (SI), heat capacity is expressed in units of joule(s) (J) per Kelvin (K). Among iron piece, water, gold piece and benzene; water has the maximum heat capacity i.e. 4.1813 j/g.k.

150. (2) Relative humidity is the ratio of the partial pressure of water vapor in an air-water mixture to the saturated vapor pressure of water at a prescribed temperature. The relative humidity of air depends not only on temperature but also on the pressure of the system of interest. If the system at State A is isobarically heated (heating with no change in system pressure) then the relative humidity of the system decreases because the saturated vapor pressure of water increases with increasing temperature.

151. (3) Fleming's right hand rule shows the direction of induced current when a conductor moves in a magnetic field. The right hand is held with the thumb, first finger and second finger mutually perpendicular to each other. The rule is named after British engineer John Ambrose Fleming.

152. (4) AM broadcasting is the process of radio broadcasting using amplitude modulation. AM was the first method of impressing sound on a radio signal and is still widely used today. An AM receiver detects amplitude variations in the radio waves at a particular frequency. It then amplifies changes in the signal voltage to drive a loudspeaker or earphones. The earliest crystal radio receivers used a crystal diode detector with no amplification.

153. (1) Complementary colours are pairs of colours that are of "opposite" hue in some colour model. In colour theory, two colours are called complementary if, when mixed in the proper proportion, they produce a neutral colour (grey, white, or black). In roughly-perceptual colour models, the neutral colours (white, grey, and black) lie along a central axis. In the RGB colour model (and derived models such as HSV), primary colours and secondary colours are paired in this way: red and cyan; green and magenta; blue and yellow.

154. (2) Indigo is a dye different than any other. It does not require any mordant. Rather it is dyed through a living fermentation process. The process "reduces" the Indigo, changing it from blue to yellow. In this state, it dissolves in an alkaline solution. The fibre is worked in the solution, or "vat". When brought out to the air, it is a bright green. Slowly the air changes it to the beautiful deep and rich blue of Indigo.

155. (2) The energy stored in a spring of a watch is potential energy which is as a result of winding of the string. This energy is used to run the watch as it converts this potential energy to rotational kinetic energy. Wind-up watches function due to the winding of a small dial on the outside of the watch. This dial transfers the energy produced by your hand to the internal components of the watch.

156. (2) Weightlessness in space is caused by the simple physical factors that cause the limitation of gravity. While on Earth, external forces are pushing or pulling on a person's body, however when a spacecraft enters orbit, the people and objects aboard the craft enter a state of free fall. Essentially, the vehicle and all of its contents are falling towards the Earth causing the sensation of weightlessness similar to the state a person feels when enjoying the amusement park ride. Many people believe that a lack of gravity is the root cause for weightlessness in space. However, a spacecraft needs gravity in order to orbit around the Earth. Gravity supplies a centripetal force which is responsible for the orbital motion. This means that the spacecraft is falling towards the Earth without colliding with it due to tangential velocity. Despite this fact, spacecraft in orbit around Earth still experience a certain amount of weighted force.

157. (2) Therm is a non-SI unit of heat energy equal to 100,000 British thermal units (BTU). It is approximately the energy equivalent of burning 100 cubic feet (often referred to as 1 CCF) of natural gas. Since (Natural Gas) meters measure volume and not energy content, a therm factor is used by (Natural) gas companies to convert the volume of gas used to its heat equivalent, and thus calculate the actual energy use.

158. (4) Newton's laws of motion are three physical laws that form the basis for classical mechanics. They describe the relationship between the forces acting on a body and its motion due to those forces. The first law states that if the net force (the vector sum of all forces acting on an object) is zero, then the velocity of the object is constant. Newton's first law is often referred to as the law of inertia. Thus, a condition necessary for the uniform motion of a particle relative to an inertial reference frame is that the total net force acting on it is zero.

159. (3) The apparent depth will look less that its real depth due to the refraction of light. First of all, imagine an object at the bottom of the pond, emitting three beams of light: one straight to the centre of your eye, one above your eye, and one below. Now, as light travels faster in air than it does in water, it will accelerate as it breaks the surface, at which point it bends away from the 'normal' - the imaginary line perpendicular to the surface. So back to those three beams, the one coming straight at your eye, and as such perfectly vertical, will not bend one way or another as it leaves the water. The other two beams, however, will bend further away from that middle beam, creating a 'triangle' with a larger base, if you were to draw a diagram. These new trajectories, if traced backwards, and ignoring a reverse bending in water, will all meet at a new point, higher than the actual point of origin.

160. (4) The oldest energy known to man is Geothermal energy. This geothermal energy originates from the original formation of the planet, from radioactive decay of minerals, and from solar energy absorbed at the surface. It has been used for space heating and bathing since ancient Roman times, but is now better known for generating electricity. Geothermal energy is thermal energy generated and stored in the Earth. Thermal energy is the energy that determines the temperature of matter. The Geothermal energy of the Earth's crust originates from the original formation of the planet (20%) and from radioactive decay of minerals (80%).

161. (3) Thermal energy, but in most cases coal is used for electricity. The steel industry uses coal (or coke rather) in blast furnaces. Thermal energy is the part of the total internal energy of a thermodynamic system or sample of matter that results in the system temperature. This quantity may be difficult to determine or even meaningless unless the system has attained its temperature only through heating, and not been subjected to work input or output, or any other energy-changing processes.

162. (3) It is tidal locking that causes the synchronous rotation which causes the Moon to present "just one side" to the Earth all the time. The Moon rotates (spins) but very slowly, making one turn on its axis in the same time it takes to revolve (orbit) around the Earth. So it maintains a "constant face" in our direction. We actually see slightly more than half of its surface as it turns. Tidal locking (or captured rotation) occurs when the gravitational gradient makes

one side of an astronomical body always face another, an effect known as synchronous rotation. For example, the same side of the Earth's Moon always faces the Earth. A tidally locked body takes just as long to rotate around its own axis as it does to revolve around its partner. This causes one hemisphere constantly to face the partner body.

163. (2) The temperature may fall below 0^0 C during cold frosty nights which converts the water inside the pipes into ice, resulting in an increase in volume. This exerts great force on the pipes and as a result, they burst.

164. (3) Gravity is pulling the man down while friction with the air slows him down. With the parachute out it adds more friction slowing him down because air resistance works against the very large surface area of the parachute. A free falling skydiver that has not yet opened his parachute can make his downward speed vary between about 110 mph and 225 mph-using air resistance. A spread eagled position presents the maximum area, and we fall the slowest.

165. (3) A psychrometer consists of two thermometers, one which is dry and one which is kept moist with distilled water on a sock or wick. The two thermometers are thus called the dry-bulb and the wet-bulb. Relative humidity is computed from the ambient temperature as shown by the dry-bulb thermometer and the difference in temperatures as shown by the wet-bulb and dry-bulb thermometers. The sling psychrometer, where the thermometers are attached to a handle or length of rope and spun around in the air for a few minutes, is sometimes used for field measurements, but is being replaced by more convenient electronic sensors.

166. (1) Curved mirror that reflects light from its inner surface, the curve being inward. It may be either circular or parabolic in section. A concave mirror converges parallel light rays inward to the point of principal focus. The image formed by a concave mirror is real (reduced and inverted) if the object is not too close to the mirror. A real image is formed at the point of convergence. If the object is close to the mirror then the image formed will be virtual, enlarged, and upright, as the rays of light cannot converge to a point. Only a parabolic concave mirror has a true, single-point principal focus for parallel rays. For this reason, parabolic mirrors are used as reflectors to focus light in telescopes, or to focus microwaves in satellite communication systems.

167. (1) The apparent depth will look less that its real depth due to the refraction of light. Refraction is the bending of a wave when it enters a medium where it's speed is different. The refraction of light when it passes from a fast medium to a slow medium bends the light ray toward the normal to the boundary between the two media. The amount of bending depends on the indices of refraction of the two media and is described quantitatively by Snell's Law.

168. (4) A rectifier is an electrical device that converts alternating current (AC), which periodically reverses direction, to direct current (DC), which flows in only one direction. The process is known as rectification. Physically, rectifiers take a number of forms, including vacuum tube diodes, mercury-arc valves, solid-state diodes, silicon-controlled rectifiers and other silicon-based semiconductor switches.

169. (3) In physics, elasticity is a physical property of materials which return to their original shape after the stress that caused their deformation is no longer applied. For very small deformations, most elastic materials, such as springs, exhibit linear elasticity. This means that they are characterized by a linear relationship between stress and strain (the relative amount of deformation). To describe elastic properties of linear objects like wires, rods, or columns which are stretched or compressed, a convenient parameter is the ratio of the stress to the strain, a parameter called the "Young's modulus" or "Modulus of Elasticity" of the material. Young's modulus can be used to predict the elongation or compression of an object as long as the stress is less than the yield strength of the material. Among rubber, steel, wet clay and plastic; steel has the maximum elasticity ranging between 180-200 gpa.

170. (4) We need light to see what is around us and to see colour. Light bounces off the objects we look at. These reflect different amounts of light which we see as different colours. Our eyes need light to work. Light entering the eye is collected by the retina and processed by the brain to obtain the pictures that we need to see. Light is an essential part of this process, for example it is difficult to read when light levels are low. Sometimes light can cause problems for our vision. Usually our eyes adjust to the new source of light and we are able to see clearly again after a few seconds. The eye adjusts to the new level of light by making our pupil smaller (constricting). When a person walking in bright light enters a dark room, he is not able to see clearly because the iris is unable to dilate the pupil immediately. This phenomenon is called as photophobia.

171. (3) The main theory of swing bowling surrounded turbulent and laminar airflow. Laminar air separates from the surface of the ball earlier than turbulent flow air, so that the separation point moves toward the front of the ball on the laminar side. On the turbulent flow side it remains towards the back; inducing a greater lift force on the turbulent airflow side of the ball. The calculated net lift force is not enough to account for the amount of swing observed: Additional force is provided by the pressure-gradient force.

172. (3) Air is a good insulator. Therefore, we feel warmer as the heat can't conduct away as easily. The reason layers work to keep us warm is that they form air pockets in between each layer which is insulated by our body heat. The more pocket of air we have, the more insulation we have, thus the warmer we are.

173. (1) Long distance propagation of radio waves depends on an invisible layer of charged particles, which envelops the Earth. This layer of charged particles known as the ionosphere has been in existence for millions of years. For those, who pioneered the long distance radio communication during the early part of the twentieth century, the ionosphere came as a boon.

174. (4) Sound is a mechanical wave that is an oscillation of pressure transmitted through a solid, liquid, or gas, composed of frequencies within the range of hearing. Sound also travels through plasma. Sound is a sequence of waves of pressure that propagates through compressible media such as air or water. (Sound can propagate through solids as well, but there are additional modes of propagation). Sound cannot travel through a vacuum because it does not provide the medium to propagate.

175. (4) Photocells are scientifically known as photo-resistors. A photo-resistor or light dependent resistor (LDR) is a resistor whose resistance decreases with increasing incident light intensity; in other words, it exhibits photoconductivity. A photo-resistor is made of a high resistance semiconductor. If light falling on the device is of high enough frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electron conduct electricity, thereby lowering resistance. Photo-resistors are basically photocells.

176. (3) Atmospheric pressure is basically the weight of air in the atmosphere above the reservoir, so the level of mercury continues to change until the weight of mercury in the glass tube is exactly equal to the weight of air above the reservoir. In areas of low pressure, air is rising away from the surface of the earth more quickly than it can be replaced by air flowing in from surrounding areas. This reduces the weight of air above the reservoir so the mercury level drops to a lower level. A sudden drop in atmospheric pressure over a few hours often forecasts an approaching storm, with heavy rain and strong winds.

177. (3) Following the density principle, the density of the egg compared to the density of the tap water is lesser (the density principle states that an object or substance with lesser density will float on the surface of the substance or object which has the greater density). Now, with salt, salt makes the density of the tap water to increase and increases also the salinity of the water making the egg float because the density of the water with salt is now greater than the density of the egg and that is why an egg sinks in soft water but floats in a concentrated solution of salt.

178. (3) The answer is related to the conservation of angular momentum. The person on the rotating table will maintain approximately the same angular momentum during the spin. If he moves his arms in, it will reduce the rotational inertia by reducing the distance of the mass of her arms and hands from the axis of rotation. In order to maintain the same angular momentum, angular rotation is increased. However, when he spreads his hands outward, the angular rotation is decreased. The spin becomes slower.

179. (2) The Moon and other celestial bodies contain a vast amount of natural resources. One, and in abundance, is helium-3. It is estimated that forty tons of it can meet twenty five percent of the global energy demand for one year. This clean, non-radioactive and safe source of energy scarcely exists on Earth. Helium-3 derives from the dismantlement of old and outdated nuclear warheads. Helium-3 is used within medicine, scientific research, and well logging operations in the oil and gas industry, and for homeland security. Major space nations such as Russia, China, India, and Japan appear to have integrated within their space programmes to commercially exploit the Moon for helium-3 in the future.

180. (4) Smog is a type of air pollution; the word "smog" was coined in the early 20th century as a portmanteau of the words smoke and fog to refer to smoky fog. The word was then intended to refer to what was sometimes known as pea soup fog, a familiar and serious problem in London from the 19th century to the mid 20th century. This kind of smog is caused by the burning of large amounts of coal within a city; this smog contains soot particulates from smoke, sulfur dioxide and other components. Modern smog, as found for example in Los Angeles, is a type of air pollution derived from vehicular emission from internal combustion engines and industrial fumes that react in the atmosphere with sunlight to form secondary pollutants that also combine with the primary emissions to form photochemical smog.

181. (2) A capacitor (originally known as condenser) is a passive two-terminal electrical component used to store energy in an electric field. Capacitors are widely used in electronic circuits for blocking direct current while allowing alternating current to pass, in filter networks, for smoothing the output of power supplies, in the resonant circuits that tune radios to particular frequencies, in electric power transmission systems for stabilizing voltage and power flow, and for many other purposes. The capacitance is greatest when there is a narrow separation between large areas of conductor; hence capacitor conductors are often called plates, referring to an early means of construction.

182. (4) A polarized 3D system uses polarization glasses to create the illusion of three-dimensional images by restricting the light that reaches each eye, an example of stereoscopy. To present stereoscopic images and films, two images are projected superimposed onto the same screen or display through different polarizing filters. The viewer wears low-cost eyeglasses which contain a pair of different polarizing filters. As each filter passes only that light which is similarly polarized and blocks the light polarized in the opposite direction, each eye sees a different image. This is used to produce a three-dimensional effect by projecting the same scene into both eyes, but depicted from slightly different perspectives.

183. (1) The moment ball is thrown, it is moving with the velocity of the car. According to the inertia of motion it will continue to move in the same direction with the same velocity. As the ball is moving up and the down it will maintain its forward motion but practically it is not possible to neglect the resistance caused by air friction. So, the ball will fall behind him. Inertia is the resistance of any physical object to a change in its state of motion or rest, or the tendency of an object to resist any change in its motion.

184. (1) Saponification is a process that produces soap, usually from fats and lye. In technical terms, saponification involves base (usually caustic soda NaOH) hydrolysis of triglycerides, which are esters of fatty acids, to form the sodium salt of a carboxylate. In addition to soap, such traditional saponification processes produces glycerol. "Saponifiable substances" are those that can be converted into soap. Vegetable oils and animal fats are the main materials that are saponified. These greasy materials, triesters called triglycerides, are mixtures derived from diverse fatty acids. Triglycerides can be converted to soap in either a one- or a two-step process.

185. (1) Work is defined as a force acting through a distance (a length of space), energy is always equivalent to the ability to exert pulls or pushes against the basic forces of nature, along a path of a certain length. In the International System of Units (SI), energy is measured in joules, but in many fields other units, such as kilowatt-hours and kilocalories, are customary. All of these units translate to units of work, which is always defined in terms of forces and the distances that the forces act through.

186. (1) Ventilation is a room air distribution strategy where conditioned outdoor air is supplied at floor level and extracted above the occupied zone, usually at ceiling height. A typical displacement ventilation system, such as one in an office space, supplies conditioned cool air from an air handling unit (AHU) through a low induction diffuser. The cool air spreads through the floor of the space and then rises as the air warms due to heat exchange with heat sources in the space (e.g., occupants, computers, lights). The warmer air has a lower density than the cool air, and thus creates upward convective flows known as thermal plumes. The warm air then exits the zone at the ceiling height of the room.

187. (1) Surface tension is a contractive tendency of the surface of a liquid that allows it to resist an external force. It is revealed, for example, in the floating of some objects on the surface of water, even though they are denser than water, and in the ability of some insects (e.g. water striders) to run on the water surface. This property is caused by cohesion of similar molecules, and is responsible for many of the behaviors of liquids. In the present case, because the forces inside the molecules of water also pulls in the hair on the shaving brush as they have less mass, due to this tension in the surface of the water the hair sticks together.

188. (1) Most liquids have a quite simple behavior when they are cooled (at a fixed pressure): they shrink. The liquid contract as it is cooled; because the molecules are moving slower they are less able to overcome the attractive intermolecular forces drawing them closer to each other. Then the freezing temperature is reached, and the substance solidifies, which causes it to contract some more because crystalline solids are usually tightly packed. Water is one of the few exceptions to this behavior. When liquid water is cooled, it contracts like one would expect until a temperature of approximately 4 degrees Celsius is reached. After that, it expands slightly until it reaches the freezing point, and then when it freezes it expands by approximately 9%.

189. (1) In classical electromagnetism, magneti-zation or magnetic polari-zation is the vector field that expresses the density of permanent or induced magnetic dipole moments in a magnetic material. The origin of the magnetic moments responsible for magnetization can be either microscopic electric currents resulting from the motion of electrons in atoms, or the spin of the electrons or the nuclei. In the process of magnetization of a bar, the entire bulk of the bar gets magnetized. The magnetization of a material is done by electric current. By the process of magnetization, the formed pieces develop North polarity on one end or side and South polarity on the other end or side, in a very short period of time.

190. (2) Raindrops start out as round high in the atmosphere as water collects on dust and smoke particles in clouds. But as raindrops fall, they lose their rounded shape. A raindrop falling through the atmosphere forms as a roughly spherical structure due to the surface tension of water. This surface tension is the "skin" of a body of water that makes the molecules stick together. The cause is the weak hydrogen bonds that occur between water molecules. On smaller raindrops, the surface tension is stronger than in larger drops. The reason is the flow of air around the drop. Air flow on the bottom of the water drop is greater than the airflow at the top.

191. (1) In particle physics, fundamental interactions (sometimes called interactive forces or fundamental forces) are the ways that elementary particles interact with one another. An interaction is fundamental when it cannot be described in terms of other interactions. The four known fundamental interactions are electromagnetism, strong interaction ("strong nuclear force"), weak interaction ("weak nuclear force"), and gravitation. All are non-contact forces. Gravitation is by far the weakest of the four interactions. The weakness of gravity can easily be demonstrated by suspending a pin using a simple magnet (such as a refrigerator magnet). The magnet is able to hold the pin against the gravitational pull of the entire Earth.

192. (2) The speed of sound in an ideal gas is independent of frequency, but it weakly depends on frequency for all real physical situations. It is a function of the square root of the absolute temperature, but is independent of pressure or density for a given ideal gas. Sound speed is slightly dependent on pressure only because air is not quite an ideal gas. In addition, for different gases, the speed of sound is inversely dependent on square root of the mean molecular weight of the gas, and affected to a lesser extent by the number of ways in which the molecules of the gas can store heat from compression, since sound in gases is a type of compression.

193. (2) The density of gases depends upon the temperature. The higher the temperature, the more the molecules are spread out and the lower the density. The result is that warm gases rise and cool gases sink. The same concept helps to explain the

weather resulting in high and low pressures. High pressure means high density, cooler, sinking air. Low pressure means low density, warmer, rising air. In general, density can be changed by changing either the pressure or the temperature.

194. (3) Earthquakes, volcanic eruptions and other underwater explosions (including detonations of underwater nuclear devices), landslides, glacier calvings, meteorite impacts and other disturbances above or below water all have the potential to generate a tsunami. Tsunami can be generated when the sea floor abruptly deforms and vertically displaces the overlying water. Tectonic earthquakes are a particular kind of earthquake that are associated with the Earth's crustal deformation; when these earthquakes occur beneath the sea, the water above the deformed area is displaced from its equilibrium position. More specifically, a tsunami can be generated when thrust faults associated with convergent or destructive plate boundaries move abruptly, resulting in water displacement, owing to the vertical component of movement involved.

195. (1) Photosynthesis, process by which green plants and certain other organisms use the energy of light to convert carbon dioxide and water into the simple sugar glucose. The wavelength most effective in conducting photosynthesis is 420nm. Actually, 420nm is on the blue side of the spectrum, which makes up between 1 and 10% of the light needed for photosynthesis. There is a plateau on the blue side when comparing blue wavelength effects on photosynthesis, and 420nm is right on the edge of it. 430nm would be more in the middle of the plateau, making it the safer bet. Plants need red light, and lots of it. Red light contributes to over 90% of photosynthesis.

196. (1) Low air pressure is usually the most significant limiting factor in high mountain regions. The percentage of oxygen in the air at 3.2 km is essentially the same as at sea level (21%). However, the air pressure is 30% lower at the higher altitude due to the fact that the atmosphere is less dense—that is, the air molecules are farther apart. At high altitudes, the lower air pressure makes it more difficult for oxygen to enter our vascular systems. The result is hypoxia, or oxygen deprivation. In serious cases, pneumonia-like symptoms (pulmonary edema) due to hemorrhaging in the lungs and an abnormal accumulation of fluid around the brain (cerebral edema) develop. Pulmonary and cerebral edema usually results in death within a few days if there is not a return to normal air pressure levels. There is also an increased risk of heart failure due to the added stress placed on the lungs, heart, and arteries at high altitudes.

197. (3) The nuclear force (or nucleon–nucleon interaction or residual strong force) is the force between two or more nucleons. It is responsible for binding of protons and neutrons into atomic nuclei. The energy released causes the masses of nuclei to be less than the total mass of the protons and neutrons which form them; this is the energy used in nuclear power and nuclear weapons. The force is powerfully attractive between nucleons at distances of about 1 femtometer (fm) between their centers, but rapidly decreases to insignificance at distances beyond about 2.5 fm.

198. (4) The theory of relativity, or simply relativity, generally encompasses two theories of Albert Einstein: special relativity and general relativity. Concepts introduced by the theories of relativity include: Measurements of various quantities are relative to the velocities of observers. In particular, space and time can dilate. Space time: space and time should be considered together and in relation to each other. The speed of light is nonetheless invariant, the same for all observers.

199. (3) An orbiting satellite is a projectile in the sense that the only force acting upon an orbiting satellite is the force of gravity. A satellite is acted upon by the force of gravity and this force does accelerate it towards the Earth. In the absence of gravity a satellite would move in a straight line path tangent to the Earth. In the absence of any forces whatsoever, an object in motion (such as a satellite) would continue in motion with the same speed and in the same direction. The force of gravity acts upon a high speed satellite to deviate its trajectory from a straight-line inertial path. Indeed, a satellite is accelerating towards the Earth due to the force of gravity. As far as spoon dropped by astronaut in a satellite is concerned, it continues to follow the motion of the satellite as there is inertia of motion acting upon it.

200. (3) Colour blindness or colour vision deficiency is the inability or decreased ability to see coluor, or perceive colour differences, under normal lighting conditions. The most usual cause is a fault in the development of one or more sets of retinal cones that perceive colour in light and transmit that information to the optic nerve. This type of colour blindness is usually a sex-linked condition. Some studies conclude that colour blind people are better at penetrating certain colour camouflages. Such findings may give an evolutionary reason for the high prevalence of red–green colour blindness.

201. (1) Water expands on freezing. When liquid water is cooled, it contracts like one would expect until a temperature of approximately 4 degrees Celsius is reached. After that, it expands slightly until it reaches the freezing point, and then when it freezes it expands by approximately 9%. The fact that water expands upon freezing causes icebergs to float.

202. (2) Mass is how much stuff we are made of, and it is the same whether we are on Earth, on the moon, on Mercury, or anywhere else one can think of. We are held on Earth by gravity. Gravity pulling on mass is our weight .The amount gravity pulls on us anywhere depends on our mass and the mass of the other object (and how far apart the objects are). The moon is smaller than Earth and has a smaller mass, so the moon won't pull on us as much if we are standing on it. The moon's gravity is about 1/6 that of Earth's gravity. Weight is what we get when we stand on a scale. If we were to weigh ourselves on a scale on

earth and then could take that same scale to the moon and weigh ourselves there, the weight read on the moon would be 1/6 your earth weight.

203. (2) A mirage is a naturally occurring optical phenomenon in which light rays are bent to produce a displaced image of distant objects or the sky. Mirages can be categorized as "inferior" (meaning lower), "superior" (meaning higher) and "Fata Morgana", one kind of superior mirage consisting of a series of unusually elaborate, vertically-stacked images, which form one rapidly-changing mirage. Cold air is denser than warm air and has therefore a greater refractive index. As light passes from colder air across a sharp boundary to significantly warmer air, the light rays bend away from the direction of the temperature gradient. When light rays pass from hotter to cooler, they bend toward the direction of the gradient. If the air near the ground is warmer than that higher up, the light ray bends in a concave, upward trajectory. Once the rays reach the viewer's eye, the visual cortex interprets it as if it traces back along a perfectly straight "line of sight".

204. (1) A nuclear power plant is a facility at which energy released by the fissioning of atoms is converted to electrical energy under strictly regulated operating conditions. The major processes are the same as those in nonnuclear (conventional) power plants except that the coal or oil fired boiler is replaced by a nuclear reactor.

205. (2) A bolometer is a device for measuring the power of incident electromagnetic radiation via the heating of a material with a temperature-dependent electrical resistance. It was invented in 1878 by the American astronomer Samuel Pierpont Langley. A bolometer consists of an absorptive element, such as a thin layer of metal, connected to a thermal reservoir (a body of constant temperature) through a thermal link. The result is that any radiation impinging on the absorptive element raises its temperature above that of the reservoir — the greater the absorbed power, the higher the temperature.

206. (1) An automated teller machine or automatic teller machine (ATM) is a computerized telecommuni-cations device that provides the clients of a financial institution with access to financial transactions in a public space without the need for a cashier, human clerk or bank teller. ATMs are known by various other names including ATM machine, automated banking machine, "cash dispenser" (Germany) and various regional variants derived from trademarks on ATM systems held by particular banks.

207. (3) Newton's third law states that "For every action, there is an equal and opposite reaction." The statement means that in every interaction, there is a pair of forces acting on the two interacting objects. The size of the forces on the first object equals the size of the force on the second object. The direction of the force on the first object is opposite to the direction of the force on the second object. So harder the stone is kicked, the harder will be its effect on the hitter.

208. (2) In electronics and electrical engineering, a fuse is a type of low resistance resistor that acts as a sacrificial device to provide over-current protection, of either the load or source circuit. It's essential component is a metal wire or strip that melts when too much current flows, which interrupts the circuit in which it is connected. Short circuit, overloading, mismatched loads or device failure are the prime reasons for excessive current. A fuse interrupts excessive current (blows) so that further damage by overheating or fire is prevented.

209. (2) A cantilever is a beam anchored at only one end. The beam carries the load to the support where it is resisted by moment and shear stress. Cantilever construction allows for overhanging structures without external bracing. Cantilevers can also be constructed with trusses or slabs. This is in contrast to a simply supported beam such as those found in a post and lintel system. A simply supported beam is supported at both ends with loads applied between the supports. Cantilevers are widely found in construction, notably in cantilever bridges.

210. (1) On a mountain top the air pressure is a little lower. At higher elevations, water boils at a little lower temp than 100 degrees C. On a mountain top cooking takes longer, because it is like cooking on medium heat, instead of leaving the burner on high. Either way it will cook, one will take longer than the other. The boiling point of water in mountainous areas is lower because of a decreased air pressure (compared to sea level) at higher altitudes.

211. (3) A dynamo is an electrical generator that produces direct current with the use of a commutator. Dynamos were the first electrical generators capable of delivering power for industry, and the foundation upon which many other later electric-power conversion devices were based, including the electric motor, the alternating-current alternator, and the rotary converter. Today, the simpler alternator dominates large scale power generation, for efficiency, reliability and cost reasons. A dynamo has the disadvantages of a mechanical commutator. Also, converting alternating to direct current using power rectification devices (vacuum tube or more recently solid state) is effective and usually economic.

212. (3) The iridescent colours of soap bubbles are caused by interfering of (internally and externally) reflected light waves and are determined by the thickness of the film. This phenomenon is not the same as the origin of rainbow colours (caused by the refraction of internally reflected light), but rather are the same as the phenomenon causing the colours in an oil slick on a wet road. As light impinges on the film some of it reflects off of the outer surface, some of it enters the film and reemerges after reflecting off the second surface, some of it enters the film and reemerges after bouncing back and forth between the two surfaces from 1 to n times. The total reflection observed is determined by the interference of all these reflections.

213. (1) A telescope assists the eye chiefly in two way by enlarging the visual angle under which a distant object is seen, and thus magnifying that object; and, secondly, by collecting, and conveying to the eye, a larger beam of light than would enter the naked organ, thus rendering objects distinct and visible which would otherwise be indistinct and or invisible. It's essential parts are the object glass, or concave mirror, which collects the beam of light, and forms an image of the object, and the eyeglass, which is a microscope, by which the image is magnified. Terrestrial telescope is a telescope whose eyepiece has one or two lenses more than the astronomical, for the purpose of inverting the image and exhibiting objects erect. The terrestrial telescope is also known as the spyglass.

214. (4) Global warming is the rise in the average temperature of Earth's atmosphere and oceans since the late 19th century and its projected continuation. Since the early 20th century, Earth's mean surface temperature has increased by about 0.8 °C (1.4 °F), with about two-thirds of the increase occurring since 1980. The effects of an increase in global temperature include a rise in sea levels and a change in the amount and pattern of precipitation, as well a probable expansion of subtropical deserts. Other likely effects of the warming include a more frequent occurrence of extreme-weather events including heat waves, droughts and heavy rainfall, ocean acidification and species extinctions due to shifting temperature regimes. Effects significant to humans include the threat to food security from decreasing crop yields and the loss of habitat from inundation.

215. (3) Gasoline or petrol is a transparent, petroleum-derived liquid that is used primarily as a fuel in internal combustion engines. It consists mostly of organic compounds obtained by the fractional distillation of petroleum, enhanced with a variety of additives. The specific gravity (or relative density) of gasoline ranges from 0.71–0.77 kg/l (719.7 kg/m^3 ; 0.026 lb/in^3; 6.073 lb/US gal; 7.29 lb/imp gal), higher densities having a greater volume of aromatics. Gasoline floats on water; water cannot generally be used to extinguish a gasoline fire, unless used in a fine mist.

216. (4) Magnetic refrigeration is a cooling technology based on the magneto-caloric effect. This technique can be used to attain extremely low temperatures, as well as the ranges used in common refrigerators, depending on the design of the system. The magneto-caloric effect (MCE, from magnet and calorie) is a magneto-thermodynamic phenomenon in which a change in temperature of a suitable material is caused by exposing the material to a changing magnetic field. This is also known by low temperature physicists as adiabatic demagnetization, due to the application of the process specifically to create a temperature drop.

217. (4) Photoelectric cell or photocell, device whose electrical characteristics (e.g., current, voltage, or resistance) vary when light is incident upon it. The most common type consists of two electrodes separated by a light-sensitive semiconductor material. A battery or other voltage source connected to the electrodes sets up a current even in the absence of light; when light strikes the semiconductor section of the photocell, the current in the circuit increases by an amount proportional to the intensity of the light

218. (3) Both stones at the same time. The initial speed is 0 for both stones, and the only acceleration working in that system would be g (Gravity acceleration). So, as the distance is the same, the final speed will be the same time. The only reason which could change this result is a difference in the shape of the stones. While they fall to the ground, they must "open" a way across the air. The shape of the falling object will decide the force needed to open that way. This is called the "Air resistance". Depending on the shape of the object, the resistance force will be bigger or smaller. As this force works counter to g, the falling time will decrease. Between a feather and a plumb ball, the falling time will be the same in vacuum, but inside air, the resistance force for the feather has almost the same value than gravity, while for the ball, the resistance is very much weaker than gravity.

219. (2) Ozone layer, that is, the layer of life-protecting ozone found at the top of the stratosphere. Ozone is formed in the earth's stratosphere and is critical to life on earth as we know it. There is compelling scientific evidence that ozone is destroyed in the stratosphere and that some human-released chemicals are speeding up the breakdown of ozone in the atmosphere. The appearance of a hole in the earth's ozone layer over Antarctica, first detected in 1976, was so unexpected that scientists didn't pay attention to what their instruments were telling them; they thought their instruments were malfunctioning.

220. (2) A voltage regulator is designed to automatically maintain a constant voltage level. A voltage regulator may be a simple "feed-forward" design or may include negative feedback control loops. It may use an electromechanical mechanism, or electronic components. Depending on the design, it may be used to regulate one or more AC or DC voltages. Electronic voltage regulators are found in devices such as computer power supplies where they stabilize the DC voltages used by the processor and other elements.

221. (2) Fog is a collection of liquid water droplets or ice crystals suspended in the air at or near the Earth's surface. While fog is a type of stratus cloud, the term "fog" is typically distinguished from the more generic term "cloud" in that fog is low-lying, and the moisture in the fog is often generated locally (such as from a nearby body of water, like a lake or the ocean, or from nearby moist ground or marshes). Fog is distinguished from mist only by its density, as expressed in the resulting decrease in visibility.

222. (2) Concave lens possesses at least one surface that curves inwards. It is a diverging lens, spreading out those light rays that have been refracted through it. A concave lens is thinner at its centre than at its edges, and is used to correct short-sightedness (myopia). After light rays have passed through the lens, they appear to come from a point called the principal focus. The image formed by a concave lens is virtual, upright, and smaller than the object, and it cannot be projected onto a screen.

223. (3) In materials science, shear modulus or modulus of rigidity, denoted by G, or sometimes S , is defined as the ratio of shear stress to the shear strain. The shear modulus describes the material's response to shearing strains (like cutting it with dull scissors).The shear modulus is concerned with the deformation of a solid when it experiences a force parallel to one of its surfaces while its opposite face experiences an opposing force (such as friction). In the case of an object that's shaped like a rectangular prism, it will deform into a parallelepiped.

224. (1) Sound is a mechanical wave that is an oscillation of pressure transmitted through a solid, liquid, or gas, composed of frequencies within the range of hearing. During propagation, waves can be reflected, refracted, or attenuated by the medium. Sound is transmitted through gases, plasma, and liquids as longitudinal waves, also called compression waves. Through solids, however, it can be transmitted as both longitudinal waves and transverse waves. Longitudinal sound waves are waves of alternating pressure deviations from the equilibrium pressure, causing local regions of compression and rarefaction, while transverse waves (in solids) are waves of alternating shear stress at right angle to the direction of propagation.

225. (1) Heavy water, formally called deuterium oxide or $2H_2O$ or D_2O, is a form of water that contains the hydrogen isotope deuterium, rather than the common protium isotope. The colloquial term heavy water is often also used to refer a highly enriched water mixture that contains mostly deuterium oxide but also contains some ordinary water molecules as well: for instance heavy water used in CANDU reactors is 99.75% enriched by hydrogen atom-fraction. In comparison, in ordinary water, there are only about 156 deuterium atoms per million hydrogen atoms). In its pure form, it has a density about 11% greater than water, but otherwise, is physically and chemically similar. Heavy water is 10.6% denser than ordinary water, a difference which is not immediately obvious.

226. (1) Cellular respiration is the set of the metabolic reactions and processes that take place in the cells of organisms to convert biochemical energy from nutrients into adenosine triphosphate (ATP), and then release waste products. The reactions involved in respiration are catabolic reactions, which break large molecules into smaller ones, releasing energy in the process as they break high-energy bonds. Respiration is one of the key ways a cell gains useful energy to fuel cellular activity. Chemically, cellular respiration is considered an exothermic redox reaction.

227. (4) The frequency of a full-wave rectifier is double that of the input, if the input is a sine wave. A full-wave rectifier converts the whole of the input waveform to one of constant polarity (positive or negative) at its output. Full-wave rectification converts both polarities of the input waveform to DC (direct current), and yields a higher mean output voltage. Two diodes and a centre tapped transformer, or four diodes in a bridge configuration and any AC source (including a transformer without center tap), are needed. Single semiconductor diodes, double diodes with common cathode or common anode, and four-diode bridges, are manufactured as single components.

228. (4) Convection transfers heat vertically into the atmosphere. In order for heat to be transferred to other regions, it must be transferred horizontally by the wind. The horizontal transfer of heat by the wind is called advection. Advection is a transport mechanism of a substance or conserved property by a fluid due to the fluid's bulk motion. An example of advection is the transport of pollutants or silt in a river by bulk water flow downstream.

229. (4) The decibel (dB) is a logarithmic unit that indicates the ratio of a physical quantity (usually power or intensity) relative to a specified or implied reference level. A ratio in decibels is ten times the logarithm to base 10 of the ratio of two power quantities.

230. (4) Bats use echolocation to navigate and forage, often in total darkness. They generally emerge from their roosts in caves, attics, or trees at dusk and hunt for insects into the night. Their use of echolocation allows them to occupy a niche where there are often many insects (that come out at night since there are fewer predators then) and where there is less competition for food, and where there are fewer other species that may prey on the bats themselves. Microbats generate ultrasound via the larynx and emit the sound through the open mouth or, much more rarely, the nose.

231. (3) Fresh water cooled to zero (0) degree Celsius and subjected to additional loss of heat energy normally will freeze. A mixture of fresh water and ice has an equilibrium temperature of zero (0) degree Celsius. Adding heat to the mixture causes ice to melt whereas removing heat causes water to freeze. For that reason, 0 (zero) degree Celsius is called the freezing point of fresh water. Cloud droplets can cool well below the usual freezing point while remaining liquid. Such cloud droplets are composed of super cooled water.

232. (2) In physics and materials science, the Curie temperature (Tc), or Curie point, is the temperature at which a ferromagnetic or a ferromagnetic material becomes paramagnetic on heating; the effect is reversible. A magnet will lose its magnetism if heated above the Curie temperature. The term is also used in piezoelectric materials to refer to the temperature at which spontaneous polarization is lost on heating.

233. (1) The angle of repose or the critical angle of repose, of a granular material is the steepest angle of descent or dip of the slope relative to the horizontal plane when material on the slope face is on the verge of sliding. This angle is in the range 0°–90°.When bulk granular materials are poured onto a horizontal surface, a conical pile will form. The internal angle between the surface of the pile and the horizontal surface is known as the angle of repose and is related to the density, surface area and shapes of the particles, and the coefficient of friction of the material. For certain applications it is more useful to define static friction in terms of the maximum angle before which one of the items will begin sliding. This is called the angle of friction or friction angle. The tangent of the angle of friction is equal to the coefficient of friction. Angle of friction is equal to the angle of repose.

234. (3) If a person throws a ball vertically upwards in a moving train, it comes back to his hand. The moment the ball was thrown, the ball was also in motion alone with the person who had thrown the ball and the train. This is due to inertia of motion. So when the ball remains in the air, both the person and the ball move ahead by the same distance. This makes the ball to come back to his hand on its return.

235. (1) A perfect sphere of spherically uniform density (density varies solely with distance from centre) would produce a gravitational field of uniform magnitude at all points on its surface, always pointing directly towards the sphere's centre. However, the Earth deviates slightly from this ideal, and there are consequently slight deviations in both the magnitude and direction of gravity across its surface. Furthermore, the net force exerted on an object due to the Earth, called "effective gravity" or "apparent gravity", varies due to the presence of other factors, such as inertial response to the Earth's rotation. A scale or plumb bob measures only this effective gravity. The major reason for the difference in gravity at different latitudes is that the Earth's equatorial bulge (itself also caused by inertia) causes objects at the Equator to be farther from the planet's centre than objects at the poles. Because the force due to gravitational attraction between two bodies (the Earth and the object being weighed) varies inversely with the square of the distance between them, an object at the Equator experiences a weaker gravitational pull than an object at the poles.

236. (1) A spoke is one of some number of rods radiating from the center of a wheel (the hub where the axle connects), connecting the hub with the round traction surface. Since bicycle and wheelchair wheel spokes are only in tension, flexible and strong materials such as synthetic fibers, are also occasionally used. Metal spokes used in bicycles also increase the moment of inertia.

237. (2) A transformer is a power converter that transfers electrical energy from one circuit to another through inductively coupled conductors—the transformer's coils. A varying current in the primary winding creates a varying magnetic flux in the transformer's core and thus a varying magnetic field through the secondary winding. This varying magnetic field induces a varying electromotive force (EMF), or "voltage", in the secondary winding. This effect is called inductive coupling. The transformer is based on principle of mutual induction in which, firstly, that an electric current can produce a magnetic field (electromagnetism) and second that a changing magnetic field within a coil of wire induces a voltage across the ends of the coil (electromagnetic induction). Changing the current in the primary coil changes the magnetic flux that is developed. The changing magnetic flux induces a voltage in the secondary coil.

238. (3) Diffuse sky radiation is solar radiation reaching the Earth's surface after having been scattered from the direct solar beam by molecules in the atmosphere. Of the total light removed from the direct solar beam by scattering in the atmosphere (approximately 25% of the incident radiation when the sun is high in the sky, depending on the amount of dust and haze in the atmosphere), about two-thirds ultimately reaches the earth as diffuse sky radiation. The sunlit sky is blue because air scatters short-wavelength light more than longer wavelengths. Since blue light is at the short wavelength end of the visible spectrum, it is more strongly scattered in the atmosphere than long wavelength red light. The result is that the human eye perceives blue when looking toward parts of the sky other than the sun.

239. (1) On average, seawater in the world's oceans has a salinity of about 3.5% (35 g/L, or 599 mM). Seawater is denser than both fresh water and pure water (density 1.0 g/ml) because the dissolved salts add mass without contributing significantly to the volume. The density of sea water is high due to impurities and salts compared to river water as a result; the upthurst produced by the sea water on the ship is more than that of river water. When a ship enters a sea from a river ,the ship is elevated or uplifted due to the density of sea water and during the buoyant motion of the ship, as it would gain both potential and kinetic energy when rising in the fluid.

240. (3) Galileo's experiment showed that if two bodies of unequal masses are dropped from the same height, the time required by them to reach the ground are equal. If they are thrown vertically upwards with the same initial velocity, then the ratio of the time required to reach the ground is equal to unity. This means that both of them will reach the same height.

241. (2) Electric power is the rate at which electric energy is transferred by an electric circuit. The SI unit of power is the watt, one joule per second. Watt is named after the Scottish engineer James Watt who invented the Newcomen Steam Engine.

242. (3) Radio is the transmission of signals through free space by electromagnetic radiation of a frequency significantly below that of visible light, in the radio frequency range, from about 30 kHz to 300 GHz. These waves are called radio waves. Experiments were undertaken by Thomas Edison and his employees of Menlo Park. Edison applied in 1885 to the U.S. Patent Office for a patent on an electrostatic coupling system between elevated terminals. The patent was granted as U.S. Patent 465,971 on December 29, 1891. The Marconi Company would later purchase rights to the Edison patent to protect them legally from lawsuits.

243. (1) Running is a means of terrestrial locomotion allowing humans and other animals to move rapidly on foot. It is simply defined in athletics terms as a gait in which at regular points during the running cycle both feet are off the ground. This is in contrast to walking, where one foot is always in contact with the ground, the legs are kept mostly straight and the center of gravity vaults over the legs in an inverted pendulum fashion. A characteristic feature of a running body from the viewpoint of spring-mass mechanics is that changes in kinetic and potential energy within a stride occur simultaneously, with energy storage accomplished by springy tendons and passive muscle elasticity.

244. (3) It is because the night side of Earth will radiate infra-red radiation (heat) back into space. When there is cloud cover, the clouds act like a blanket and trap the heat close to the ground just like a blanket traps heat close to our body.

245. (1) Assuming the disc is uniform and isotropic (the same in different directions), the hole will expand in the same ratio as the metal. It is because the thermal expansion equation applies to all lengths associated with the metal, including the circumference of the hole, since the edge of the hole is made out of metal. And if the circumference of the hole expands, so does the diameter.

246. (3) A geosynchronous satellite is a satellite in geosynchronous orbit, with an orbital period the same as the Earth's rotation period. Such a satellite returns to the same position in the sky after each sidereal day, and over the course of a day traces out a path in the sky. A special case of geosynchronous satellite is the geostationary satellite, which has a geostationary orbit – a circular geosynchronous orbit directly above the Earth's equator.

247. (4) When a piece of paper and a cricket ball are dropped from the same height, they reach the surface at different time because the shape of the paper is more flat and it behaves like a parachute causing more air resistance acting on it with respect to the ball. But, in order to reach the surface at the same time by both the articles, they must be dropped in vacuum. It is because in vacuum there is no other force other than force of gravity occurring on them and this leads to a conclusion that both the article reaches at the same time.

248. (3) Ultrasound is a cyclic sound pressure wave with a frequency greater than the upper limit of the human hearing range. Ultrasound is thus not separated from "normal" (audible) sound based on differences in physical properties, only the fact that humans cannot hear it. Although this limit varies from person to person, it is approximately 20 kilohertz (20,000 hertz) in healthy, young adults. Ultrasound devices operate with frequencies from 20 kHz up to several gigahertz.

249. (2) Radiation is one of the byproducts of radioactive decay of unstable atomic nuclei. Nuclear fission is the process on which the operation of most nuclear power plants is based. When certain nuclei (for example that of uranium-235) are bombarded with neutrons, the nucleus splits into two smaller nuclei of roughly (though not exactly) equal sizes. Because of the binding characteristics of the neutrons and protons in the original and resultant nuclei (and also the famous mass-energy relation that Einstein discovered), the result of this split is the liberation of a large amount of energy, manifested in the kinetic energy of the resultant nuclei.

250. (4) An optical fiber (or optical fibre) is a flexible, transparent fiber made of glass (silica) or plastic, slightly thicker than a human hair. It functions as a waveguide, or "light pipe", to transmit light between the two ends of the fiber. Optical fibers typically include a transparent core surrounded by a transparent cladding material with a lower index of refraction. Light is kept in the core by total internal reflection. This causes the fiber to act as a waveguide. Total internal reflection is an optical phenomenon that happens when a ray of light strikes a medium boundary at an angle larger than a particular critical angle with respect to the normal to the surface. If the refractive index is lower on the other side of the boundary and the incident angle is greater than the critical angle, no light can pass through and all of the light is reflected.

251. (3) A mirage is a naturally occurring optical phenomenon in which light rays are bent to produce a displaced image of distant objects or the sky. In contrast to a hallucination, a mirage is a real optical phenomenon which can be captured on camera, since light rays actually are refracted to form the false image at the observer's location. As light passes from colder air across a sharp boundary to significantly warmer air, the light rays bend away from the direction of the temperature gradient. When light rays pass from hotter to cooler, they bend toward the direction of the gradient. If the air near the ground is warmer than that higher up, the light ray bends in a concave, upward trajectory. Once the rays reach the viewer's eye, the visual cortex interprets it as if it traces back along a perfectly straight "line of sight". This line is however at a tangent to the path the ray takes at the point it reaches the eye.

252. (4) During daylight, the sky appears to be blue because air scatters blue sunlight more than it scatters red. At night, the sky appears to be a mostly dark surface or region scattered with stars. Except for light that comes directly from the sun, most of the light in the day sky is a result of scattering, which is dominated by a small-particle limit called Rayleigh scattering. The scattering due to molecule sized particles (as in air) is greater in the forward and backward directions than it is in the lateral direction. Scattering is significant for light at all visible wavelengths, but it is stronger at the shorter (bluer) end of the visible spectrum, meaning that that the scattered light is more blue than its source, the sun.

253. (2) Flint glass is optical glass that has relatively high refractive index and low Abbe number (high dispersion). A concave lens of flint glass is commonly combined with a convex lens of crown glass to produce an achromatic doublet lens because of their compensating optical properties, which reduces chromatic aberration (colour defects).

254. (4) Since the pendulum rate will increase with an increase in gravity, and local gravity varies with latitude and elevation on Earth, pendulum clocks must be readjusted to keep time after a move. For example, a pendulum clock moved from sea level to 4000 feet will lose 16 seconds per day. Even moving a clock to the top of a tall building will cause it to lose measurable time due to lower gravity. Time period of a pendulum taken to the moon will be longer than the period of the same pendulum on earth.

255. (1) The atmosphere is an ocean of air held in place by gravity, extending from the surface to an altitude of hundreds of kilometers, the edge of space. Energy from the sun heating the air and land surface to different degrees, drives atmospheric circulation. Patterns of circulation are also influenced by Earth's

rotation, latitude and the distribution of land, ocean and ice. Surface gravity, the force that holds down an atmosphere, differs significantly among the planets. For example, the large gravitational force of the giant planet Jupiter is able to retain light gases such as hydrogen and helium that escape from lower gravity objects.

256. (2) A ball bearing is a type of rolling-element bearing that uses balls to maintain the separation between the bearing races. The purpose of a ball bearing is to reduce rotational friction and support radial and axial loads. In general, it's main function is to convert kinetic friction into rolling friction. It achieves this by using at least two races to contain the balls and transmit the loads through the balls.

257. (3) A shock absorber is a mechanical device designed to smooth out or damp shock impulse, and dissipate kinetic energy. Steel is an alloy made by combining iron and other elements, the most common of these being carbon. When carbon is used, its content in the steel is between 0.2% and 2.1% by weight, depending on the grade. Varying the amount of alloying elements and the form of their presence in the steel (solute elements, precipitated phase) controls qualities such as the higher elasticity, hardness, ductility, and tensile strength of the resulting steel.

258. (1) The speed of sound is the distance travelled during a unit of time by a sound wave propagating through an elastic medium. In dry air at 20 °C (68 °F), the speed of sound is 343.2 metres per second (1,126 ft/s). the speed of sound varies from substance to substance. Sound travels faster in liquids and non-porous solids than it does in air. It travels about 4.3 times as fast in water (1,484 m/s), and nearly 15 times as fast in iron (5,120 m/s), than in air at 20 degrees Celsius. Sound waves in solids are composed of compression waves (just as in gases and liquids), but also exhibit a different type of sound wave called a shear wave, which occurs only in solids.

259. (4) In optics, Lambert's cosine law says that the radiant intensity or luminous intensity observed from an ideal diffusely reflecting surface or ideal diffuse radiator is directly proportional to the cosine of the angle between the observer's line of sight and the surface normal. The law is also known as the cosine emission law or Lambert's emission law. A surface which obeys Lambert's law is said to be Lambertian, and exhibits Lambertian reflectance. Such a surface has the same radiance when viewed from any angle. This means, for example, that to the human eye it has the same apparent brightness (or luminance).

260. (4) Telescope and Microscope are two scientific instruments that serve their purposes differently. One of the main differences between a telescope and a microscope is that a telescope is used to view things that are far whereas a microscope is used to view things that are very near. Another important difference between telescope and microscope is that the focal length or the distance from the focal point to the lens is different in these two scientific instruments. As a result of this the focal point in the case of a telescope may be at a far off place. On the other hand the focal point in the case of a microscope is just a fraction of an inch off. The difference in the diameter of the lens used in the two instruments also matter a lot when it comes to the difference between them. The lens diameter or the aperture is much larger in a telescope. This is to ensure that the aperture allows tiny amount of natural light at the focal point .On the other hand only artificial illumination is used in a microscope.

261. (4) Although bats use echolocation to detect their prey, and find their way around in the dark, the sounds which they emit are 'ultrasonic', which is another way of saying they are beyond the range of normal human hearing. Ultrasound is a cyclic sound pressure wave with a frequency greater than the upper limit of the human hearing range. Ultrasound is thus not separated from "normal" (audible) sound based on differences in physical properties, only the fact that humans cannot hear it. Although this limit varies from person to person, it is approximately 20 kilohertz (20,000 hertz) in healthy, young adults. Ultrasound devices operate with frequencies from 20 kHz up to several gigahertz.

262. (4) The poles remains same whether the magnet is cut into two equal half or more and also pole strength remains same but magnetic moment reduces due to decrease in the length of the magnet. If a bar magnet is suspended by a thread, it will come to rest in a position close to the north-south direction. The end of the magnetic toward the north is called north pole (N-pole) of the magnet and the other end the south pole (S-pole). The poles of a magnet cannot be separated. If a bar magnet is broken into two parts, each part will be a complete magnet with the poles at its ends. No matter how many times a magnet is broken; each piece will contain N-pole at one end and S-pole at the other.

263. (2) Virtual reality (VR) is a term that applies to computer-simulated environments that can simulate physical presence in places in the real world, as well as in imaginary worlds. Most current virtual reality environments are primarily visual experiences, displayed either on a computer screen or through special stereoscopic displays, but some simulations include additional sensory information, such as sound through speakers or headphones. Some advanced, haptic systems now include tactile information, generally known as force feedback, in medical and gaming applications.

264. (1) An electrostatic precipitator (ESP), or electrostatic air cleaner is a particulate collection device that removes particles from a flowing gas (such as air) using the force of an induced electrostatic charge. Electrostatic precipitators are highly efficient filtration devices that minimally impede the flow of gases through the device, and can easily remove fine particulate matter such as dust and smoke from the air stream. In contrast to wet scrubbers which apply energy directly to the flowing fluid medium, an ESP applies energy only to the particulate matter being collected and therefore is very efficient in its consumption of energy (in the form of electricity).

265. (2) A seconds pendulum is a pendulum whose period is precisely two seconds; one second for a swing in one direction and one second for the return swing, a frequency of 1/2 Hz. At standard gravity its length is 0.994 m.

266. (3) Lake ice cover is seasonal and occurs where average daily temperature is below the freezing point. Once formed the lake ice thickens over the course of the winter as the temperature gets colder. The lakes thermal structure prepares for ice with 0 (zero) degrees Celsius water at the surface and denser 4 degrees Celsius at the bottom. Once meteorological conditions provide colder air, relative to warmer water, the water does not get colder - instead ice forms.

267. (1) Image quality is a characteristic of an image that measures the perceived image degradation (typically, compared to an ideal or perfect image). Imaging systems may introduce some amounts of distortion or artifacts in the signal, so the quality assessment is an important problem. Sharpness determines the amount of detail an image can convey. System sharpness is affected by the lens (design and manufacturing quality, focal length, aperture, and distance from the image center) and sensor (pixel count and anti-aliasing filter).

268. (4) Magnetic resonance imaging (MRI), nuclear magnetic resonance imaging (NMRI), or magnetic resonance tomography (MRT) is a medical imaging technique used in radiology to visualize internal structures of the body in detail. MRI makes use of the property of nuclear magnetic resonance (NMR) to image nuclei of atoms inside the body. An MRI scanner is a device in which the patient lies within a large, powerful magnet where the magnetic field is used to align the magnetization of some atomic nuclei in the body, and radio frequency fields to systematically alter the alignment of this magnetization. This causes the nuclei to produce a rotating magnetic field detectable by the scanner—and this information is recorded to construct an image of the scanned area of the body.

269. (1) For a hyper-metropic eye ,the near points shift away from the eye i.e. farther away from the normal near point (25cm). In a hypermetropic eye, the light is not bent sufficiently so that it focuses at a point behind the retina. Here a person sees well for distance but near vision is difficult and causes strain. Hence hypermetropic people are called long-sighted. To correct the hypermetropic eye, a plus lens is required so that the light can now focus on the retina.

270. (1) Humidity is the amount of water vapor in the air. Water vapor is the gas phase of water and is invisible. Humidity indicates the likelihood of precipitation, dew, or fog. Higher humidity reduces the effectiveness of sweating in cooling the body by reducing the rate of evaporation of moisture from the skin. This effect is calculated in a heat index table, used during summer weather. There are three main measurements of humidity: absolute, relative and specific.

271. (3) The source of the sun's fuel is hydrogen and helium gases. Through a special chemical reaction, called nuclear fusion, the hydrogen gas is "burned" releasing an enormous amount of energy in the form of light and heat. In nuclear physics, nuclear fusion is a nuclear reaction in which two or more atomic nuclei join together, or "fuse", to form a single heavier nucleus. During this process, matter is not conserved because some of the mass of the fusing nuclei is converted to energy which is released. Fusion is the process that powers active stars. The fusion of two nuclei with lower masses than iron (which, along with nickel, has the largest binding energy per nucleon) generally releases energy, while the fusion of nuclei heavier than iron absorbs energy. The opposite is true for the reverse process, nuclear fission.

272. (2) The density of steel usually ranges between 7.75 and 8.05 g/cm3 and the density of mercury is 13.534 g/cm3. Mercury is denser than steel this will mean that the buoyant force is large enough to float the steel ball. Different materials usually have different densities, so density is an important concept regarding buoyancy, purity and packaging. Osmium and iridium are the densest known elements at standard conditions for temperature and pressure but not the densest materials. Less dense fluids float on more dense fluids if they do not mix.

273. (1) An audio frequency is characterized as a periodic vibration whose frequency is audible to the average human. It is the property of sound that most determines pitch and is measured in hertz (Hz).The generally accepted standard range of audible frequencies is 20 to 20,000 Hz, although the range of frequencies individuals hear is greatly influenced by environmental factors. Frequencies below 20 Hz are generally felt rather than heard, assuming the amplitude of the vibration is great enough. Frequencies above 20,000 Hz can sometimes be sensed by young people.

274. (3) An eclipse is an astronomical event that occurs when an astronomical object is temporarily obscured, either by passing into the shadow of another body or by having another body pass between it and the viewer. Rectilinear propagation is a wave property which states that waves propagate (move or spread out) in straight lines. This property applies to both transverse and longitudinal as well as an Electromagnetic wave. Even though a wave front may be bent (the waves created by a rock hitting a pond) the individual waves are moving in straight lines.

275. (1) Pure water is a covalent compound. It exists as simple discrete molecules and have a simple molecular structure. Hence, it does not exist as ions. Therefore, pure water cannot conduct electricity due to the absence of mobile ions and electrons. One instance that water can conduct electricity is when there are dissolved substance in it. Only then will water dissociate into hydrogen ions and hydroxide ions. The presence of mobile ions enables it to conduct electricity.

276. (3) Gamma radiation, also known as gamma rays or hyphenated as gamma-rays and denoted as y, is electromagnetic radiation of high frequency and therefore high energy. Gamma rays are ionizing radiation and are thus biologically hazardous. They are classically produced by the decay from high energy states of atomic nuclei (gamma decay), but are also created by other processes. X-radiation (composed of X-rays) is a form of electromagnetic radiation. X-rays

have a wavelength in the range of 0.01 to 10 nanometers, corresponding to frequencies in the range 30 petahertz to 30 exahertz (3×1016 Hz to 3×1019 Hz) and energies in the range 100 eV to 100 keV. They are shorter in wavelength than UV rays and longer than gamma rays.

277. (3) The ozone layer is a layer in Earth's atmosphere containing relatively high concentrations of ozone (O3). The ozone layer absorbs 97–99% of the Sun's medium-frequency ultraviolet light (from about 200 nm to 315 nm wavelength), which potentially damages exposed life forms on Earth. Although the concentration of the ozone in the ozone layer is very small, it is vitally important to life because it absorbs biologically harmful ultraviolet (UV) radiation coming from the sun. Extremely short or vacuum UV (10-100 nm) is screened out by nitrogen.

278. (4) An incandescent light bulb, incandescent lamp or incandescent light globe is an electric light which produces light with a filament wire heated to a high temperature by an electric current passing through it, until it glows. Tungsten, also known as wolfram, is a chemical element. Tungsten's many alloys have numerous applications, most notably in incandescent light bulb filaments, X-ray tubes (as both the filament and target), electrodes in TIG welding, and super-alloys.

279. (3) The tendency of one object to force another adjoining or interconnected object into vibrational motion is referred to as a forced vibration. In the case of the guitar string mounted to the sound box, the fact that the surface area of the sound box is greater than the surface area of the string means that more surrounding air particles will be forced into vibration. This causes an increase in the amplitude and thus loudness of the sound. This same principle of a forced vibration is often demonstrated in a Physics classroom using a tuning fork. If the tuning fork is held in hand and hit with a rubber mallet, a sound is produced as the tines of the tuning fork set surrounding air particles into vibrational motion. The sound produced by the tuning fork is barely audible to students in the back rows of the room. However, if the tuning fork is set upon the whiteboard panel or the glass panel of the overhead projector, the panel begins vibrating at the same natural frequency of the tuning fork.

280. (4) A lighthouse is a tower, building, or other type of structure designed to emit light from a system of lamps and lenses and used as an aid to navigation for maritime pilots at sea or on inland waterways. Lighthouses mark dangerous coastlines, hazardous shoals, reefs, safe entries to harbors, and can also assist in aerial navigation. Once widely used, the number of operational lighthouses has declined due to the expense of maintenance and replacement by modern electronic navigational systems.

281. (2) According to the Archimedes' principle, a floating object will experience an upthrust force from water, equal to the weight of water displaced (pushed aside). It will sink into the water until it reaches the point where the weight of the water pushed aside equals its own weight. For an object that is floating, the mass of the material equals the mass of water that is displaced by the object (1 kg = 1 L of water). Dense objects cannot displace enough water to provide an upthrust force to counterbalance their weight, so they plummet below the surface. Objects made of material denser than water (e.g. a boat made of iron) can still float if they contain air so that the mean density is less than that of water. The upthrust is often called the loss in weight of the object. Upthrust = apparent loss of weight of object = weight in air - weight in liquid.

282. (3) Persistence of vision is the phenomenon of the eye by which an afterimage is thought to persist for approximately one twenty-fifth of a second on the retina. Persistence of vision is still the accepted term for this phenomenon in the realm of cinema history and theory. In the early days of film innovation, it was scientifically determined that a frame rate of less than 16 frames per second (frame/s) caused the mind to see flashing images.

283. (2) Many contemporary uses of uranium exploit its unique nuclear properties. Uranium-235 has the distinction of being the only naturally occurring fissile isotope. Uranium-238 is fissionable by fast neutrons, and is fertile, meaning it can be transmuted to fissile plutonium-239 in a nuclear reactor. Another fissile isotope, uranium-233, can be produced from natural thorium and is also important in nuclear technology.

284. (1) The mass density of a material varies with temperature and pressure. Increasing the temperature of a substance (with some exceptions) decreases its density by increasing the volume of that substance. In most materials, heating the bottom of a fluid results in convection of the heat from bottom to top of the fluid due to the decrease of the density of the heated fluid.

285. (4) A node is a point along a standing wave where the wave has minimal amplitude. The opposite of a node is an anti-node, a point where the amplitude of the standing wave is a maximum. The distance between a node and anti-node is 1/2 of a wavelength; since a wavelength is from one node to another (or any point to its next "identical" point). So if w is the wavelength,

then $\frac{1}{2}$ = 30. So, w = 30 × 2 = 60 cm

286. (1) A fuse or fusable link works by opening an electrical circuit when the current becomes too high. As the current increases, the temperature of the wire increases. So a fuse wire should have a low melting point and should be connected in series with the appliance. Besides, it should have a comparatively high resistance.

287. (4) The volume of materials changes depending on current temperature. Usually heat makes them expand, and cold leads them to contract. There have to be gaps to avoid strain on the tracks. The same applies in many other fields of engineering, i.e. bridge building.

288. (3) Under-inflated tyres create more friction with the road, increasing fuel consumption by up to ten per cent and are prone to skidding on either wet or slippery surfaces. Low pressures also lead to premature wear and risk of tyre blowout or bulging.

289. (2) Bacteria thrive in warm, moist conditions. Refrigeration allows the temperature to be lowered so far that food can be stored for days or even months. Keeping food cold (at or below 4°C) slows down bacterial growth which helps reduce the risk of food-borne illness.

290. (2) An air cooler works on the simple principle of evaporation. It does not yield good results when humidity is high. On the contrary, the temperature of dry air can be dropped significantly through the phase transition of liquid water to water vapor (evaporation), which can cool air using much less energy than refrigeration.

291. (2) Transformers have made long-distance transmission of electric power a practical reality, as AC voltage can be "stepped up" and current "stepped down" for reduced wire resistance power losses along power lines connecting generating stations with loads. At either end (both the generator and at the loads), voltage levels are reduced by transformers for safer operation and less expensive equipment.

292. (2) If the poured liquid is relatively hotter or colder in comparison to the tumbler, it will break. When hot water is poured into a tumbler there is an uneven increase in the thermal expansion of the walls of the vessel. If the expansion is uneven enough and the strength of the glass is not strong enough, the tumbler breaks. However, if the poured water is colder in comparison to the tumbler, it breaks due to contraction and unequal temperature difference between the layers.

293. (2) Long distance means higher wastage of energy. So High-voltage direct-current (HVDC) technology is used for greater efficiency in very long distances. Electricity is transmitted at high voltages (110 kV or above) to reduce the energy lost in long-distance transmission.

294. (3) A transistor is a semiconductor device used to amplify and switch electronic signals and electrical power. The first transistors were made from germanium (Ge). Silicon (Si) types currently predominate but certain advanced microwave and high performance versions now employ the compound semiconductor material gallium arsenide (GaAs) and the semiconductor alloy silicon germanium (SiGe).

295. (1) When a metal plate with a circular hole at its centre is heated, definitely along with the areal expansion of the plate the diameter of the circular hole also increases. Using the differential equations of coefficients of expansions, we find that the hole radius increases at the same linear rate as the metal.

296. (4) Assuming air to be an ideal gas, the speed of sound c depends on temperature only, not on the pressure or density. As air temperature increases, so does the speed of sound and vice versa. This is due to the individual air particles having extra kinetic energy at higher temperatures and lesser at lower temperatures.

297. (1) A solid conductive metal contains mobile, or free electrons, originating in the conduction electrons. When a metal wire is connected across the two terminals of a DC voltage source such as a battery, the source places an electric field across the conductor. The moment contact is made, the free electrons of the conductor are forced to drift toward the positive terminal under the influence of this field. The free electrons are therefore the charge carrier in a typical solid conductor.

298. (3) A microphone converts sound energy to electrical energy this energy level is used as an output using same energy level amplified or it could be used to record those same energy output and pattern too be played again. Sound waves strike a plastic or thin metal diaphragm, causing in to move an attached coil within a strong magnetic field. The induced current duplicates the frequency of the sound wave.

299. (4) Ultraviolet radiation is used to kill microorganisms, molds and fungus in various environmental applications. UV sterilization is used for air-purification systems, water purification, aquarium and pond maintenance, laboratory hygiene and food and beverage protection.

300. (2) The houses made of mud and thatched roofs are cool in summer and warm in winter as the thatched roof contains large amount of trapped air and also mud is a bad conductor of heat. In summer, the outside heat cannot enter the house and in winter, inside heat cannot flow outside.

301. (3) At high operating temperatures, tungsten evaporates from the filament and gradually forms a gray film on the inside of the bulb. The inert gas atoms collide with the evaporating tungsten, causing some of the tungsten atoms to return to the filament. Eventually, however, a thin spot develops in the filament. When this happens, the filament will break and the bulb fails.

302. (4) In automobiles, a bumper is the front-most or rear-most part, ostensibly designed to allow the car to sustain an impact without damage to the vehicle's safety systems. They are not capable of reducing injury to vehicle occupants in high-speed impacts, but are increasingly being designed to mitigate injury to pedestrians struck by cars.

303. (1) Density of water is approx 1g/ml; Density of Ice is approx 0.93g/ml; and Density of 100% pure ethanol is 0.79g/ml. So the density of ice cubes is lesser than water, but higher than alcohol. So it will float in water, but sink in alcohol. This can also be put as: The ice cube will float higher in water as compared to alcohol.

304. (2) A concave lens is used to correct short-sightedness (myopia). In myopia, images are formed in front of the retina, resulting in a blurred image. This occurs when the eye is relatively too long or the refractive powers of the cornea and lens of the eye are relatively too strong.

305. (2) The upward-pushing force that keeps things afloat is called buoyancy. For an object to float it must be able to equal its own weight by displacing enough water. A life jacket is mainly filled with gas which has a very low mass. As such when worn by a person, it acts to significantly increase their volume for only a very small increase in their mass. This means that they have a lower density than normal which increases their buoyancy and helps them to float.

306. (1) Myopia or near-sightedness is condition of the eye where the light that comes in does not directly focus on the retina but in front of it. This causes the image that one sees when looking at a distant object to be out of focus but in focus when looking at a close object. It is corrected by using concave lenses.

307. (3) Radiation is a process in which energetic particles or energetic waves travel through vacuum, or through matter-containing media that are not required for their propagation. The sun's rays reach us in the form of electromagnetic radiation. This type of radiation covers a wide spectrum (that is a wide range of frequencies), but those from the sun are mainly infra-red, visible, and ultra-violet.

308. (2) The velocity of the sphere at the bottom depends only on height and acceleration due to gravity. Both these values are constants. Therefore, the velocity at the bottom remains the same whichever inclined plane the sphere is rolled. However, the sphere will take longer time to reach the bottom of the inclined plane having the smaller inclination. The kinetic energy will be the same. What will differ is time taken to reach the bottom.

309. (1) Anything in a tight skin or shell can explode in a microwave because the water inside can expand and burst through. It is for this very reason that before microwaving, the skin of potatoes should be pricked, winter squash and similar vegetables should be cut in half, eggs should be taken out of shells and holes should be poked in the plastic wrap or sealed pouches of frozen packaged foods.

310. (2) Vacuum cleaners work by creating a lower pressure just inside the opening which touches the floor. By creating a low pressure inside the machine, higher air pressure in the room pushes its way into the vacuum cleaner, taking the dirt with it. Because there is no, or very little, atmosphere on the moon, we can't create a lower or higher gas pressure inside and outside the machine, so dirt cannot be sucked up from the ground. Nothing happens when a vacuum cleaner is turned on the moon.

311. (3) The image formed by a plane mirror is always virtual (meaning that the light rays do not actually come from the image), upright, and of the same shape and size as the object it is reflecting. A virtual image is a copy of an object formed at the location from which the light rays appear to come. However, the image is a laterally-inverted "mirror image" of the object. So we will get the word AMBULANCE after reflection.

312. (3) The potential energy of a body when raised through height h is given by mgh. Each time, a normal rubber ball hits the floor, it loses one-fifth of its total energy and the rebound height is proportional to energy, so each bounce will rebound to four-fifth of the previous bounce. But, the question states that there is no loss of energy/velocity after rebounding. So the height of 2 metres will be maintained.

313. (2) When a pail of water is swung in a vertical circle, the water does not fall out at the top of the loop when the speed is great enough. At every point in the circle the water tries to fall vertically out due to the force of gravity g but also tries to move in a straight line due to its circular motion. If the velocity is large enough the water will not drop out of the bucket far enough before it is moved round the circle. The value of g does not depend upon the object's mass.

314. (2) Kepler's laws of planetary motion are three scientific laws describing orbital motion, each giving a description of the motion of planets around the Sun. The laws are: the orbit of every planet is an ellipse with the Sun at one of the two foci; a line joining a planet and the Sun sweeps out equal areas during equal intervals of time; and the square of the orbital period of a planet is directly proportional to the cube of the semi-major axis of its orbit.

315. (4) The parts of the electromagnetic spectrum, arranged from highest energy to lowest, are gamma rays, X-rays, ultraviolet light, visible light, infrared light, microwaves, and radio waves.

316. (4) The specific heat is the amount of heat per unit mass required to raise the temperature by one degree Celsius. The specific heat of water is 1 calorie/gram °C = 4.186 joule/gram °C which is higher than any other common substance. As a result, water plays a very important role in temperature regulation. The specific heat per gram for water is much higher than that for a metal.

317. (3) A microscope is an instrument that produces a clear magnified image of an object viewed through it. A basic microscope is made up of two converging lenses. The first lens creates a real image which serves as the object for the second lens, and the image created by the second lens is the one a viewer sees. The final image is virtual and is inverted compared to the original object.

318. (3) Sound travels at different speeds depending on what it is traveling through. Of the three mediums (gas, liquid, and solid) sound waves travel the slowest through gases, faster through liquids, and fastest through solids. They travel over 17 times faster through steel than through air.

319. (2) The magnifying power (M) of astronomical telescope is given by $M = \frac{\text{focal length of objective}}{\text{focal length of eye piece}}$. This expression shows that in order to obtain high magnification, focal length of object must be large and that of eye piece should be small. Similarly, for decreased magnification, focal length of eye piece should be increased.

320. (2) A small solar electric or photovoltaic (PV) converts solar energy into electrical energy. Solar cells consist of semiconductor materials which work on photoelectric effect. Silicon remains the most popular material for solar cells.

321. (2) General Theory of Relativity: a theory of gravitation developed by Einstein in the years 1907–1915; Quantum Theory of Max Planck: 1900; Transmission of wireless signal by Marconi: first Atlantic wireless transmission on December 11, 1901; and Madame Curie becoming the first woman Nobel Prize winner: shared her 1903 Nobel Prize in Physics with her husband Pierre Curie.

322. (2) In analogue television, the sound portion of a broadcast is invariably modulated separately from the video. Most commonly, the audio and video are combined at the transmitter before being presented to the antenna, but in some cases separate aural and visual antennas can be used. In almost all cases, standard wideband frequency modulation is used.

323. (1) Red is the international colour of stop signs and stop lights on highways and intersections because it is scattered the least by air molecules. The effect of scattering is inversely related to the fourth power of the wavelength of a colour. Red has the highest wavelength of all the colours and is able to travel the longest distance through fog, rain, and the alike.

324. (2) It is just because woolen clothes have fibres and between those fibres air is trapped which reduces heat loss. It reduces heat loss because it is an insulator or poor conductor of heat.

325. (2) Because of their eyes, an owl can see much better in the dark than we can. Owls have very large eyes which maximize light gathering in conditions of minimum light, thereby enabling them to see at night. The orbs of their eyes are directed forward, giving them binocular vision. They are able to see their prey in a three-dimensional manner. However, an owl's eye cannot rotate.

326. (2) The spin dryer is probably the most familiar centrifuge. The spin dryer of a washing machine removes excess water from the clothing by rotating at a high speed. The high speed of rotation creates a high centrifugal force for the water in the clothing which causes it to be pulled to the outside of the spinning portion of the washing machine and away from the clothes.

327. (3) When passed through a prism violet colour of light shows maximum deviation. As white light passes through a prism, the voilet component, having the minimum wave length observes the maximum refractive index for the prism and, thus, gets deviated to the maximum extent.

328. (2) The cassette tape contains a magnetic strip wound around two spools. Tiny magnetic particles are randomly scattered throughout the tape. A tape recorder should not be kept near a magnet as the latter can cause the magnetic material to be pushed and pulled out of place. Rearranging the magnetic particles erases the sound.

329. (2) In Simple Harmonic Motion, the frequency of the oscillation (f) is the number of oscillations per second which is expressed as $f = \frac{1}{T}$ where T is the time period (the time for the oscillator to complete one cycle). Now, when a person sitting on a swing stands up on the swing, the effective length of the swing decreases. When length decreases, the time period also decreases. Since frequency of oscillation is inversely proportion to time period, it increases in the present case of man standing up on the swing.

330. (2) Infrared is used in night vision equipment when there is insufficient visible light to see. Night vision devices operate through a process involving the conversion of ambient light photons into electrons which are then amplified by a chemical and electrical process and then converted back into visible light.

331. (1) Almost all sunlight that enters the ocean is absorbed, except very close to the coast. The red, yellow, and green wavelengths of sunlight are absorbed by water molecules in the ocean. The reason the ocean is blue is due to the absorption and scattering of light. The blue wavelengths of light are scattered, similar to the scattering of blue light in the sky but absorption is a much larger factor than scattering for the clear ocean water. In seawater, absorption is strong in the red and weak in the blue, thus red light is absorbed quickly in the ocean leaving blue.

332. (4) Good conductors of heat are good conductors of electricity. Mica is an exception which although being a good conductor of heat and a bad conductor of electricity. It is commonly used in insulation of electricity between high heat generating transistors and their heat sink and or chassis to prevent grounding out of component and to assist in the transfer of the generated heat to the heat sink or chassis for dissipation.

333. (1) It happens because of gravity. A key feature of super maneuvering aircrafts is a high thrust-to-weight ratio; that is, the comparison of the force produced by the engines to the aircraft's weight, which is the force of gravity on the aircraft. A thrust-to-weight ratio greater than 1:1 is a critical threshold, as it allows the aircraft to maintain and even gain velocity in a nose-up attitude; such a climb is based on sheer engine power, without any lift provided by the wings to counter gravity, and has become crucial to aerobatic maneuvers in the vertical loop.

334. (2) A photocopier uses electrostatic charge to produce a copy. The original document is placed onto a sheet of glass. An image of this page is projected onto a positively charged drum. The drum has a coating which conducts electricity when light falls on it. The parts of the drum which are lit by the projected image lose their electrostatic charge when they start to conduct.

335. (2) It is because steam releases its latent heat as it condenses, which is substantial. The heat of vaporization of steam is over 2000 J per gram. And when it releases that it's then 100 degree water, the same as boiling water.

336. (3) Radar, which stands for radio detection and ranging, is a system that uses reflected radio waves to detect objects and measure their distance and speed. For example, police use radar to calculate the speed of cars.

337. (3) Fans make the air more comfortable for two reasons: (a) by moving the air, they blow away body heat and evaporate sweat, cooling the body, and (b) they also mix the cooler air near the floor with the warmer air by people's faces.

338. (1) Old postcards, books, signs, photos and other paper products made before the late 1930s rarely glow under a black light. Chemical bleaches and dyes used in modern papers will fluoresce under ultraviolet light. Knowing this helps to detect forged documents and distinguish reproductions in all types of ephemera.

339. (2) In optics, a prism is a transparent optical element with flat, polished surfaces that refract light. In a rainbow, raindrops in the air act as tiny prisms. Light enters the raindrop, reflects off of the side of the drop and exits. In the process, it is broken into a spectrum just like it is in a triangular glass prism.

340. (3) Capillary action is the result of adhesion and surface tension. Adhesion of water to the walls of a vessel will cause an upward force on the liquid at the edges and result in a meniscus which turns upward. The surface tension acts to hold the surface intact, so instead of just the edges moving upward, the whole liquid surface is dragged upward.

341. (2) Lightning is a discharge of electrical energy that builds up within a storm. The charges develop because a storm causes air to move around which rubs against itself to generate electrical charges. Eventually the charge increases to a point where the electricity can flow through the air. Once an electric discharge starts it provides a better path for more electrical flow than normal air due to ionization which results in a sudden, large and fast discharge.

342. (1) Bernoulli's principle states that as the speed of a moving fluid (liquid or gas) increases, the pressure within the liquid decreases. In the case of a sprayer, when the plunger is pushed in, the air flows at a high velocity through a nozzle, creating a region of low pressure above the metal tube. The higher pressure of the atmospheric air causes the liquid to rise up to the metal tube and come out as spray.

343. (2) A transistor transfers a signal from a low resistance to high resistance. It has two PN-junctions: one junction is forward biased and other junction is reverse biased having low resistance path and high resistance path respectively. The weak signal is introduced in the low resistance, circuit and output is taken from the high resistance circuit.

344. (3) Electricity travels from a place of high voltage to low voltage, just as water travels from high elevation to low elevation. A bird, or any living thing, that touches a wire (where electricity is moving from high voltage to low voltage) and also touches the ground (a place with no voltage) creates a path that allows the electricity to travel through that body and into the place with no voltage. When electricity travels through a body in this fashion, electrocution takes place, and the bird can die.

345. (2) Dams are built broader at the base for two reasons. The first is because it needs to be stable enough to support the dam, and two, the bottom of the dam needs to be able to deal with the increased pressure of the water, as you get further down. Particular to dams, at the lower part of the structure the lower levels of water are at higher pressure than the upper levels of the water.

346. (4) Copper ; 9% less conductive than silver; aluminium is 10% less conductive than copper; while steel is the least conductive among the given options. The most electrically conductive metal is silver.

347. (1) Informally, viscosity is the quantity that describes a fluid's resistance to flow. It is dependent on temperature. Viscosity of the different fluids (in cP) is as follows: Edible Oil: 20 to 60; Milk: approximately 1.0; Water: 0.894; and Petrol: around 0.82 to 0.95 cP.

348. (1) Radioactivity is caused by unstable nuclei trying to become stable by emitting particles and or energy. The nuclei of radioactive substances are unstable due to an unstable ratio of protons to neutrons.

349. (3) The motion of a rocket is an application of Newton's third law of motion and law of conservation of linear momentum. The operation of a rocket illustrates the conservation of momentum. Just before launching, the momentum of the rocket is zero. When the rocket is fired, it forces a jet of hot gases with a high velocity through the nozzle. The jet of gases acquires a momentum downwards. Hence, the rocket acquires a momentum of equal magnitude in opposite direction. Thus the rocket moves upwards.

350. (3) When the buckets containing equal amount of water are held in both hands, weight is spaced out more evenly than it would be if one had to carry a single bucket. For balancing the weight, the centre of gravity and the centre of equilibrium should fall, in the present case, within the feet.

351. (2) In the solid and liquid phase, water molecules are bonded to each other by virtue of an interaction between hydrogen atoms on one molecule and the oxygen atom of another — the process is referred to as "hydrogen bonding." The result is a kind of "skin" on liquid water's surface. When Soaps and detergents are added to water, they weaken the strength of the skin by interfering with hydrogen bonding between water molecules because the polar end of the soap or detergent is also attracted to the water.

352. (2) The compressor is the motor (or engine) of the cooling system. It is normally at the bottom of the refrigerator in the back. The compressor runs whenever the refrigerator thermostat calls for cooling.

353. (4) A mirage is a naturally occurring optical illusion or phenomenon in which light rays are bent due to refraction in layers of air of varying density. The image usually is upside down, enhancing the illusion that the sky image seen in the distance is really a water or oil puddle acting as a mirror.

354. (1) An athlete does so to build up forward momentum so that when he jumps he already has a forward motion that would be greater than that of a jump made from standing in one spot. He needs forward momentum to get a good long jump and the best way is to have a running start. In this way, he gets advantage in terms of inertia of motion which is the tendency of an object to resist a change in motion.

355. (2) Any object which allows light to pass through it is known as a transparent object. The colour of any transparent object is the colour of the light transmitted by it. A red rose appears red in white light because it absorbs all colours except red. However, when seen in green light, it looks black because the red colour of the rose is absorbed by the green light.

356. (1) Diamonds sparkle because of the total internal reflection of light. Diamonds have a very high refractive index, meaning they slow light down much more than glass; and if cut in the right manner, the angles of incidence can be made so that light seems to get 'trapped' within the diamond giving it it's sparkly appearance.

357. (1) Heat is transferred by convection in numerous examples of naturally occurring fluid flow, such as: wind, oceanic currents, and movements within the Earth's atmosphere. Winds and ocean currents are examples of convection currents. Convection serves to transfer heat from the surplus to deficit heat zones and set the oceanic circulation in motion.

358. (3) There is a direct relationship between the amount of resistance encountered by charge and the length of wire it must traverse. After all, if resistance occurs as the result of collisions between charge carriers and the atoms of the wire, then there is likely to be

more collisions in a longer wire. An object of uniform cross section has a resistance proportional to its resistivity and length and inversely proportional to its cross-sectional area.

359. (3) Diesel engines use the heat of compressed air to ignite the fuel (intakes air, compresses it, then injects fuel). Diesel engines need high compression ratios to generate the high temperatures required for fuel auto ignition.

360. (3) Wireless communication is the transfer of information between two or more points that are not connected by an electrical conductor. With radio waves distances can be short, such as a few metres for television remote control, or as far as thousands or even millions of kilometres for deep-space radio communications.

361. (3) The phenomenon of rise or fall of liquid in a capillary tube is called capillarity. Oil rises through a wick due to capillarity. The narrow pores in the threads of a wick act like tiny capillaries, through which oil rises. Capillary action is the result of adhesion and surface tension.

362. (2) The primary radiation that is initially produced within a fluorescent lamp is analogous to that emitted by a low pressure mercury lamp. Fluorescent lamps produce UV radiation by ionizing low-pressure mercury vapour. A phosphorescent coating on the inside of the tubes absorbs the UV and converts it to visible light.

363. (2) A four-stroke engine (also known as four-cycle) is an internal combustion engine in which the piston completes four separate strokes—intake, compression, power, and exhaust—during two separate revolutions of the engine's crankshaft, and one single thermodynamic cycle. The earliest of these to be developed is the Otto cycle engine developed in 1876 by Nikolaus August Otto in Cologne, Germany, after the operation principle described by Alphonse Beau de Rochas in 1861.

364. (2) The solar radiation that reaches the surface of Earth ranges from ultraviolet (UV) radiation at wavelengths longer than 290 nm to radio waves in the meter range. The tissues in the eye transmit a substantial part of the radiation between 380 and 1400 nm to the light-sensitive retina at the back of the eye. The concern over improper viewing of the Sun during an eclipse is for the development of "eclipse blindness" or retinal burns.

365. (2) Sound is a mechanical wave that is created by vibrating objects and propagated through a medium from one location to another. Because mechanical waves rely on particle interaction in order to transport their energy, they cannot travel through regions of space that are void of particles. That is, mechanical waves cannot travel through a vacuum.

366. (3) The volume of materials changes depending on current temperature. Usually heat makes them expand, and cold leads them to contract. To a first approximation, the change in length measurements of an object ("linear dimension" as opposed to, e.g., volumetric dimension) due to thermal expansion is related to temperature change by a "linear expansion coefficient". It is the fractional change in length per degree of temperature change.

367. (1) The rise or fall of liquid due to capillarity in a beaker of water depends upon the radius of the bore of the tube (s) which is/are dipped into it. The narrower the bore of the tube, the greater is the rise or fall of the liquid in the tube. So in this case, water will rise in both the glass tube and the glass capillary tube.

368. (1) Pascal's law states that when there is an increase in pressure at any point in a confined fluid, there is an equal increase at every other point in the container. According to Pascal's principle, in a hydraulic system a pressure exerted on a piston produces an equal increase in pressure on another piston in the system. If the second piston has an area 10 times that of the first, the force on the second piston is 10 times greater, though the pressure is the same as that on the first piston. This effect is exemplified by the hydraulic press, based on Pascal's principle, which is used in such applications as hydraulic brakes.

369. (1) The movement of air (sometimes called turbulence) in the atmosphere of Earth causes a series of refractions which makes the starlight to get slightly bent as it travels from the distant star through the atmosphere down to us on the ground. This means that some of the light reaches us directly and some gets bent slightly away. To our eyes, this makes the star seem to twinkle.

370. (3) According to Newton's first law, an object that is at rest will stay at rest unless an unbalanced force acts upon it and an object that is in motion will not change its velocity unless an unbalanced force acts upon it. So the bomb carries the inertia of the aircraft and so has to be launched before the target so that it can hit it on time. Assuming the plane continues to fly straight forward, the plane will be directly over the target when the bomb hits.

371. (1) A parabolic reflector (mirror) transforms an incoming plane wave traveling along the axis into a spherical wave converging toward the focus. Since the principles of reflection are reversible, parabolic reflectors can also be used to project energy of a source at its focus outward in a parallel beam, used in devices such as spotlights and car headlights.

372. (2) The effect of scattering is inversely related to the fourth power of the wavelength of a colour. Red has the highest wavelength of all the colours and is able to travel the longest distance through fog, rain, and the alike.

373. (2) The reason that bats use ultrasound is because it has such a high frequency and it has a low diffraction or it bends less. They use this sound to do a couple of things like to catch their prey and also just to get around. The method of doing such tasks is called echolocation. They make a sound and wait for it to bounce back to hear it. If they hear it come faster in a particular area than the rest of the sounds then they know that something is near.

374. (*) The level of current passing through the human body is directly related to the resistance of its path through the body. Under dry conditions, the resistance offered by the human body may be as high as 100,000 Ohms. Wet or broken skin may drop the body's resistance to 1,000 Ohms.

(Source: The Guide to Photovoltaic System Installation by Gregory Fletcher)

375. (3) Resolution is an umbrella term that describes the detail an image holds. The term applies to raster digital images, film images, and other types of images. The display resolution of a digital television, computer monitor or display device is the number of distinct pixels in each dimension that can be displayed.

376. (4) Surface tension is responsible for the shape of liquid droplets. Although easily deformed, droplets of water tend to be pulled into a spherical shape by the cohesive forces of the surface layer. In the absence of other forces, including gravity, drops of virtually all liquids would be perfectly spherical. The spherical shape minimizes the necessary "wall tension" of the surface layer according to Laplace's law.

377. (3) A basic microscope is made up of two converging lenses. The first lens creates a real image which serves as the object for the second lens, and the image created by the second lens is the one a viewer sees. The final image is magnified, virtual and is inverted compared to the original object.

378. (1) When a body is placed in water, the upthrust or buoyant force acting on it depends upon the following factors: (i) Volume of the body submerged in the liquid - (V), or volume of the liquid displaced - (V); (ii) Density of the liquid - (d); and (iii) Acceleration due to gravity In-line. Since in the present question, we can assume g to be a constant and know that steel and copper have different densities, the only case in which they can have similar upthrust will be because of their volumes.

379. (4) A single fixed pulley is used to lift a load upwards by applying efforts downwards. The load and effort move equal distance but in opposite directions. This is convenient as to apply effort in downward direction. They are used on flag-poles and to draw water from a well.

380. (3) A light-year is a unit of length equal to just under 10 trillion kilometres (or about 6 trillion miles). As defined by the International Astronomical Union (IAU), a light-year is the distance that light travels in a vacuum in one Julian year. Note that the light-year is a measure of distance (rather than, as is sometimes misunderstood, a measure of time).

381. (2) A fuse places a limit on the amount of current that can be drawn by an electric circuit by opening (blowing or melting) when the current exceeds a preset limit. This protects the circuit and the surroundings from fire or damage in the case of an overload or short circuit.

382. (4) It can be corrected with convex lenses in eyeglasses or contact lenses. Convex lenses have a positive dioptric value, which causes the light to focus closer than its normal range.

383. (2) The stars' light must travel through the Earth's multi-layered atmosphere, and as it does so it is refracted (bent) multiple times and in random directions. The phenomenon of random refraction appears to make the star wink as though it is in motion. It is this action that our eyes translate as twinkling. When the light itself enters the air – or atmosphere – it is scattered, with the scattering depending on the air temperature with warm air causing less bends and colder air causing more.

384. (1) The speed of sound in air depends on the density of air and the density of air depends on the temperature. The speed of sound is unaffected by pressure. If the atmospheric pressure changes, the speed of sound in air remains constant.

385. (2) In telecommunications and signal processing, frequency modulation (FM) conveys information over a carrier wave by varying its instantaneous frequency. This contrasts with amplitude modulation, in which the amplitude of the carrier is varied while its frequency remains constant. In analogue television, the sound portion of a broadcast is invariably modulated separately from the video. Most commonly, the audio and video are combined at the transmitter before being presented to the antenna, but in some cases separate aural and visual antennas can be used.

386. (2) In a spherical mirror, one of the two curved surfaces is coated with a thin layer of silver followed by a coating of red lead oxide paint. Thus, one side of the spherical mirror is opaque and the other side is a highly polished reflecting surface.

387. (1) In an explosion, an internal impulse acts in order to propel the parts of a system (often a single object) into a variety of directions. After the explosion, the individual parts of the system (that is often a collection of fragments from the original object) have momentum. If the vector sum of all individual parts of the system could be added together to determine the total momentum after the explosion, then it should be the same as the total momentum before the explosion. Just like in collisions, total system momentum is conserved.

388. (1) An optically plane surface reflects a beam of light as a parallel beam in one direction. The set of incident rays are reflected as a set of rays. In other words, a beam of light is reflected as a beam of light if the mirror is plane and its reflecting surface is smooth. This type of reflection of a set of rays is called Specular Reflection.

389. (1) A plot of velocity-time is used to determine the acceleration of an object (the slope). If the acceleration is zero, then the velocity-time graph is a horizontal line (i.e., the slope is zero). If the acceleration is positive, then the line is an upward sloping line (i.e., the slope is positive). If the acceleration is negative, then the velocity-time graph is a downward sloping line (i.e., the slope is negative).

390. (2) Earth wire prevents Electric shocks. It is connected to the electrical cable of an appliance to prevent electric shocks. Actually it has very low resistance and allows current to pass through it easily.

391. (3) Water is used in car radiators because the Specific heat capacity of water is high as a result of which it takes away the heat from engine better compared to other liquids. This is a form of coolant used in the radiator. If the radiator was to overheat the car would come to a stop.

392. (2) When water at 0 degree Celsius freezes, each gram of water gives off 80 calories. The temperature of the water stays at 0 degree C until every drop has frozen. When ice at 0 degree Celsius melts, it absorbs an equal amount of heat—80 calories for each gram of ice—and its temperature remains unchanged until it has completely melted.

393. (1) The rifle and bullet have zero momentum and zero kinetic energy to start with. When the trigger is pulled, the bullet gains some momentum in the forward direction, but this is canceled by the rifle's backward momentum, so the total momentum is still zero. The kinetic energies of the gun and bullet are both positive scalars, however, and do not cancel. The total kinetic energy is allowed to increase, because kinetic energy is being traded for other forms of energy. Some of the initial chemical energy of the gun powder, for example, is transformed into thermal energy and sound energy. From the relationship between kinetic energy and momentum, we know that if a massive particle and a light particle have the same momentum, the light one will have a lot more kinetic energy. If a light particle and a heavy one have the same velocity, the heavy one has more kinetic energy. Since the momentum of the gun and the bullet is same, the bullet which has a lower mass has a higher kinetic energy.

394. (2) Latent heat is the heat released or absorbed by a body or a thermodynamic system during a process that occurs without a change in temperature. A typical example is a change of state of matter, meaning a phase transition such as the melting of ice or the boiling of water. So water vapor which is the end product of evaporated water has latent heat.

395. (3) The ionosphere is a part of the upper atmosphere and is ionized by solar radiation. It plays an important part in atmospheric electricity and forms the inner edge of the magnetosphere. It has practical importance because, among other functions, it influences radio propagation to distant places on the Earth.

396. (1) Voltage gain, input impedance, output impedance, bandwidth etc. are few important characteristics of an amplifier. These parameters are more or less constant for a given amplifier. Quite often, the values of these parameters are required to be controlled. This can be conveniently achieved by employing a technique, called the feedback. Some of the advantages of negative feedback include: gain stability; reduced non-linear distortion, reduced noise, increased bandwidth, increased input impedance and reduced output impedance.

397. (1) Using water for putting out electric fires is risky, as the firemen can be electrocuted by the water jet. Water is a good conductor of electricity, and, the electric current flows through the water-jet directly into the hands of the person who is holding the water-hose, resulting in immediate electrocution.

398. (2) Total internal reflection (TIR) is the phenomenon that involves the reflection of the entire incident light off the boundary. Glass prisms can be shaped to produce total internal reflection and as such are employed in binoculars, periscopes, telescopes, and other optical instruments. For the prism used in periscope, the light rays hit the inside surface at an angle greater than the critical angle of 42 and hence they are internally reflected.

399. (1) When a metal plate with a circular hole at its centre is heated, definitely along with the areal expansion of the plate the diameter (sum of two radii) of the circular hole also increases.

400. (3) The kind of mirror used in the rear-view mirror must be convex mirrors, because it creates smaller, yet still upright images. Concave mirrors would create an inverted image and the cars you see are not upside down. Convex mirrors make everything smaller so this allows the driver to see a greater range of things behind him.

401. (4) The basic units or blocks of a microprocessor are ALU, an array of registers and control unit. A minimal hypothetical microprocessor might only include an arithmetic logic unit (ALU) and a control logic section. Each operation of the ALU sets one or more flags in a status register, which indicate the results of the last operation (zero value, negative number, overflow or others).

402. (2) An anemometer is a device for measuring wind speed, and is a common weather station instrument. The first known description of an anemometer was given by Leon Battista Alberti around 1450.

403. (4) The specific heat of water is 1 calorie/gram °C = 4.186 joule/gram °C which is higher than any other common substance. As a result, water plays a very important role in temperature regulation.

404. (1) Sonar (originally an acronym for SOund Navigation And Ranging) is a technique that uses sound propagation (usually underwater, as in submarine navigation) to navigate, communicate with or detect objects on or under the surface of the water, such as other vessels. Sonar may be used as a means of acoustic location and of measurement of the echo characteristics of "targets" in the water.

405. (3) Copper ; 9% less conductive than silver; aluminium is 10% less conductive than copper; while steel is the least conductive among the given options. The most electrically conductive metal is silver.

406. (2) Ordinary evaporation is a surface phenomenon - since the vapor pressure is low and since the pressure inside the liquid is equal to atmospheric pressure plus the liquid pressure, bubbles of water vapor cannot form. But at the boiling point, the saturated vapor pressure is equal to atmospheric pressure, bubbles form, and the vaporization becomes a volume phenomena.

407. (3) Heavy water is used in certain types of nuclear reactors where it acts as a neutron moderator to slow down neutrons so that they are more likely to react with the fissile uranium-235 than with uranium-238 which captures neutrons without fissioning. Because they do not require uranium enrichment, heavy water reactors are of concern in regards to nuclear proliferation.

408. (2) Tear gas is a compound. Each molecule of tear gas contains one atom of chlorine. The compound 2-chlorobenzalmalononitrile, a cyanocarbon, is the defining component of a "tear gas" commonly referred to as CS gas, which is used as a riot control agent.

409. (3) Water boils at a lower temperature on top of a mountain because there is less air pressure on the molecules. Water boils when the vapor pressure of water exceeds atmospheric pressure. Because the boiling temperature is lower at high elevations foods that are cooked by boiling take a little longer to cook at high elevation.

410. (3) The avian respiratory system delivers oxygen from the air to the tissues and also removes carbon dioxide. In addition, the respiratory system plays an important role in thermoregulation (maintaining normal body temperature). The avian respiratory system is different from that of other vertebrates, with birds having relatively small lungs plus nine air sacs that play an important role in respiration (but are not directly involved in the exchange of gases).

411. (2) If C is the temperature in Celsius and F is the temperature in Fahrenheit then, $\frac{C}{S} = \frac{F-32}{9}$ They are equal at -40° (minus 40 degrees), because if we convert the readings of Celsius and Fahrenheit, we will have: Celsius to Fahrenheit (-40°C x 9/5) +32 = -72 + 32 = -40°F. Fahrenheit to Celsius (-40°F - 32°) x 5/9 = (-72) x 5/9 = -40°C.

412. (1) The kilowatt hour, or kilowatt-hour, is a unit of energy equal to 1000 watt hours or 3.6 mega-joules For constant power, energy in watt hours is the product of power in watts and time in hours. The kilowatt hour is most commonly known as a billing unit for energy delivered to consumers by electric utilities.

413. (3) The cornea represents the strongest part of the refracting power of the eye, providing about 80% of the power of the system. The index of refraction of the cornea is about 1.376. Rays pass from the cornea into the watery fluid known as the aqueous humor which has an index of refraction of about 1.336. The lens provides perhaps 20% of the refracting power of the eye with a refractive index of 1.386-1.406. the refractive Index of Vitreous Humor is 1.33.

414. (4) Thermoelectric generators convert thermal energy into electricity by using heat from the body — or any object with a temperature gradient — as their energy source. At the heart of every thermoelectric generator is an array of thermocouples that are responsible for converting thermal energy into electricity. Bismuth telluride and its alloys are commonly used in thermocouples.

415. (4) The ballpoint pen is one of the most simple and yet ubiquitous devices whose function depends on surface tension. With a pen held upright, gravity and surface tension act in concert to get ink onto the ball.

416. (2) The man suffers from myopia, a vision condition in which close objects are seen clearly, but objects farther away appear blurred. Nearsightedness occurs if the eyeball is too long or the cornea, the clear front cover of the eye, has too much curvature. As a result, the light entering the eye isn't focused correctly and distant objects look blurred.

417. (2) The extraction of cream happens because of the work of centrifugal force which works outward. The separation of cream from milk is based on the fact that when liquids of different specific gravities revolve around the same centre at the same distance with the same angular velocity, a greater centrifugal force is exerted on the heavier liquid than on the lighter one. Milk can be regarded as two liquids of different specific gravities, the serum and the fat.

418. (1) An electric charge always produces an electric field, regardless of speed, and a moving charge generates a magnetic field. An electric current passing through a conductor produces a magnetic field because it has many charges in motion.

419. (2) The SI unit of quantity of electric charge is the coulomb, which is equivalent to about 6.242×10^{18} e (e is the charge of a proton). Hence, the charge of an electron is approximately -1.602×10^{-19} C. The coulomb is defined as the quantity of charge that has passed through the cross section of an electrical conductor carrying one ampere within one second.

420. (4) Laser light is very different from normal light. It is very directional, has a very tight beam and is very strong and concentrated. The light released is monochromatic. It contains one specific wavelength of light (one specific colour).

421. (1) As per the norm, the permissible noise level in residential areas is 45 db during night time, 55 db during day and in commercial areas it is 55 db during night and 65 db during day.

422. (2) Reflected waves are simply those waves that are neither transmitted nor absorbed, but are reflected from the surface of the medium they encounter. The amount of incident-wave energy that is reflected from a surface depends on the nature of the surface and the angle at which the wave strikes the surface. The amount of wave energy reflected increases as the angle of incidence increases. The reflection of energy is the greatest when the wave is nearly parallel to the reflecting surface.

423. (3) The angle of deviation, by which the light of a particular wavelength gets deviated on passing through a medium, depends upon the refractive index of the medium, as encountered by that light wavelength. The smaller the wavelength of the passing light, the greater is the refractive index observed. As white light passes through a prism, the violet component, having the minimum wavelength observes the maximum refractive index for the prism and, thus, gets deviated to the maximum extent.

424. (4) Iron has a very large magnetic response: it greatly amplifies an applied magnetic field. The transformer's ability to transfer energy depends on the strength of the magnetic field, so it is very helpful if the field is amplified. The input energy can then be lower while still having the same effect.

425. (2) Voltages and currents for AC circuits are generally expressed as rms (root mean square) values. For a sine wave, the relationship between the peak and the rms average is: rms value = 0.707 peak value

426. (2) When a light wave is reflected from an object, it changes not only its amplitude but also its phase according to the properties of the object at a particular point. The velocity and momentum are just reversed in another direction.

427. (1) Nuclear Fusion Reaction is the process which is responsible for the sun to radiate energy in the form of light and heat commonly known as solar energy. Fusion occurs when hydrogen atoms fuse together under extreme heat and pressure to create a denser helium atom releasing, in the process, colossal amounts of energy.

428. (4) The total width of the depletion region is a function of applied reverse-bias and impurity concentration. Forward bias decreases the depletion region width whilst reverse bias increases it.

429. (1) A black body is an idealized physical body that absorbs all incident electromagnetic radiation, regardless of frequency or angle of incidence. Another property is roughness. Sand is rough and black and so it is a good absorber.

430. (2) The fuse wire is based on the Joules law of heating which says that when the electric current is allowed to pass through a conductor, the conductor heats up and is proportional to the square of current. The main object of using fuse wire in electric circuit is to provide protection against short circuit or overload current. For this purpose the material used as fuse wire should have high resistance and low melting point.

431. (4) The formula for kinetic energy in terms of momentum for fundamental particles is basically just a quantized version of the classical formula, $KE = \frac{p^2}{2m}$, where KE is kinetic energy, p is momentum and m is the particle's mass. In our case, Kinetic energy is constant, therefore $p^2 = 2m$ meaning that momentum is directly propor-tional to mass. The mass of particles in ascending order is: alpha, proton and electron. So Alpha particle will have the maximum momentum.

432. (3) When the bottle of soda water is grasped by the neck and swung briskly in a vertical circle, the bubbles collect at the top of the bottle which is its neck. What flows in a carbonated drink is carbon dioxide gas. A carbonated beverage forms form bubbles when the dissolved carbon dioxide is depressurized to form emulsions at the top.

433. (2) In plants, the transpiration stream is the uninterrupted stream of water, and other, which is taken up by the roots and, via the xylem vessels, transported to the leaves where it will eventually evaporate into the air/apoplast-interface of the substomatal cavity. It is driven in by capillary action and in some plants root pressure. The main driving factor is the difference in water potential between the soil and the substomatal cavity caused by transpiration.

434. (2) This has to do with the equation of a parabola or trajectory which is $z = (\tan\theta)x - \frac{\theta}{2(\cos\theta)}x^2$. We can see that if the ball is fired at a 45 degree angle from the ground, the horizontal distance will be a maximum.

435. (2) In theory, 2 satellites in diametrically opposite geosyn-chronous orbits could cover the planet. In order for the satellites to communicate, a minimum of 3 would be needed, each at a 60 degree angle to the others. At this point, the strength and quality of coverage increases proportionally to the number of satellites.

436. (4) Copper: 9% less conductive than silver; aluminium is 10% less conductive than copper; while steel is the least conductive among the given options. The most electrically conductive metal is silver.

437. (3) A flight data recorder (FDR) is an electronic device employed to record any instructions sent to any electronic systems on an aircraft. Another kind of flight recorder is the cockpit voice recorder which records conversation in the cockpit, radio communications between the cockpit crew and others (including conversation with air traffic control personnel), as well as ambient sounds. Popularly referred to as a "black box" by the media, the data recorded by the FDR is used for accident investigation as well as for analyzing air safety issues, material degradation and engine performance.

438. (2) Car head lights have concave mirrors because it collects and focuses as much as possible of the light from the bulb and send it out as a fairly tight beam in one direction only. The bulb of the head light is placed at the focal point. The reflected light is parallel and gives more visibility to the driver at night.

439. (1) A geostationary orbit is a circular orbit 35,786 kilometres above the Earth's equator and following the direction of the Earth's rotation. Communications satellites and weather satellites are often given geostationary orbits, so that the satellite antennas that communicate with them do not have to move to track them, but can be pointed permanently at the position in the sky where they stay.

440. (3) The decibel (dB) is a logarithmic unit that indicates the ratio of a physical quantity (usually power or intensity) relative to a specified or implied reference level. A ratio in decibels is ten times the logarithm to base 10 of the ratio of two power quantities.

441. (3) The acceleration due to gravity of earth is the rate of increase of velocity of a body falling freely towards the earth. At a given place, the value of acceleration due to gravity is constant but it varies from one place to another place on the earth surface. It is due to this fact that earth is not a perfect sphere. It is flattened at the poles and bulges out at the equator. The value of 'g' is minimum at the equator and maximum at the poles.

442. (2) Concave mirrors are used in makeup or shaving mirrors. When shaving or applying makeup, a person holds the mirror close to her face. This allows him to see an enlarged image of him face, which is helpful for applying makeup or shaving correctly.

443. (3) A magnifying glass is a convex lens that is used to produce a magnified image of an object. The magnification of a magnifying glass depends upon where it is placed between the user's eye and the object being viewed, and the total distance between them.

444. (3) If the relative humidity is 100 percent, water will not evaporate as the air is already saturated with moisture. When relative humidity approaches 100 percent, condensation can occur. The lower the relative humidity, the easier it is for moisture to evaporate.

445. (4) The cathode ray tube (CRT) is a vacuum tube containing an electron gun (a source of electrons or electron emitter) and a fluorescent screen used to view images. Colour tubes use three different phosphors which emit red, green, and blue light respectively. They are packed together in stripes (as in aperture grille designs) or clusters called "triads" (as in shadow mask CRTs).

446. (3) Railway tracks are banked on curves so that necessary centripetal force may be obtained from the horizontal component of the weight of the train. It helps the train to stay on the track as it negotiates the curve. The raised track provides required centripetal force to enable it to move round the curve.

447. (1) Pitch is a perceptual property that allows the ordering of sounds on a frequency-related scale. Pitch may be quantified as a frequency, but pitch is not a purely objective physical property; it is a subjective psycho-acoustical attribute of sound. When the frequency is high, the wavelength of the sound is shorter.

448. (3) Pure water is actually an extremely poor conductor, but saturated salt water is a good conductor. The saltier the water, the better the conductance. The reason it conducts electricity is because the NaCl (sodium chloride) breaks apart into a positively charged Na^+ and a negatively charged Chlorine Cl^-. When current is applied, it is easily conducted by the highly charged ions.

449. (1) The operation of a rocket illustrates the conservation of momentum. Just before launching, the momentum of the rocket is zero. When the rocket is fired, it forces a jet of hot gases with a high velocity through the nozzle. The jet of gases acquires a momentum downwards. Hence, the rocket acquires a momentum of equal magnitude in opposite direction. Thus the rocket moves upwards.

450. (2) Electric fuse wire is an alloy made of tin (63 % & lead 37 %. The cross sectional area determines the melting point at a certain current. Alloys (e.g. tin/ lead) are used due to their 'eutectic' action -i.e. the resulting combination of good conductivity (due to the tin) with a low melting point due to the lead).

451. (4) Geothermal energy is thermal energy generated and stored in the Earth. The Geothermal energy of the Earth's crust originates from the original formation of the planet (20%) and from radioactive decay of minerals (80%).Current worldwide installed capacity is 10,715 megawatts (MW), with the largest capacity in the United States (3,086 MW), Philippines, and Indonesia.

452. (3) In the boiler of a steam engine, there is a firebox where coal is shoveled into. The coal is kept burning at a very high temperature, and is used to heat the boiler to boil water producing a high pressure steam. The high-pressure steam expands and exits the boiler via steam pipes into the steam reservoir, the steam is then controlled by a slide valve to move into a cylinder to push the piston. The pressure of the steam energy pushing the piston turns the drive wheel in a circle, creating motion for the locomotive.

453. (2) A hygrometer is an instrument used for measuring the moisture content in the environment. Humidity measurement instruments usually rely on measurements of some other quantity such as temperature, pressure, mass or a mechanical or electrical change in a substance as moisture is absorbed.

454. (4) The separation of fat from milk is based on the fact that when liquids of different specific gravities revolve around the same centre at the same distance with the same angular velocity, a greater centrifugal force is exerted on the heavier liquid than on the lighter one

455. (1) Transformer, a device that transfers electric energy from one circuit to another, usually with a change in voltage. Transformers work only with a varying electric current, such as alternating current (AC). Transformers are important in the distribution of electric power.

456. (4) If the mass of the body is m, the force of attraction of the earth, or the weight w of the body, is given by the Newton's law of gravitation as w = mg, with acceleration due to gravity $g = \frac{GM}{R^2}$ where M and R are the mass and radius of the Earth respectively. Since weight of the body is directly proportional to g, the weight of the body is maximum at the centre of the earth and zero at the centre of the earth.

457. (1) Remote sensing is the acquisition of information about an object or phenomenon without making physical contact with the object. In modern usage, the term generally refers to the use of aerial sensor technologies to detect and classify objects on Earth by means of propagated signals (e.g. electromagnetic radiation emitted from aircraft or satellites).

458. (1) A head mirror is mostly used for examination of the ear, nose & throat. It comprises a circular concave mirror, with a small hole in the middle, and is attached to a head band. The mirror is worn over the physician's eye of choice, with the concave mirror surface facing outwards and the hole directly over the physician's eye, providing illumination like a ring light.

459. (2) A solar cell (also called a photovoltaic cell) is an electrical device that converts the energy of light directly into electricity by the photovoltaic effect. It is a form of photoelectric cell (in that its electrical characteristics—e.g. current, voltage, or resistance—vary when light is incident upon it) which, when exposed to light, can generate and support an electric current without being attached to any external voltage source.

460. (1) Earth attracts all bodies towards its centre. The acceleration produced in the body due to attraction force of earth on it is called the acceleration due to gravity. A astronaut in a satellite experiences weightlessness because two forces act on him: gravitational pull and centrifugal force which cancel out each other with the resultant force acting on him being zero.

461. (2) When Soaps and detergents are added to water, they weaken the strength of the skin on the water's surface due to surface tension by interfering with hydrogen bonding between water molecules. It happens because the polar end of the soap or detergent is also attracted to the water, thereby decreasing the surface tension.

462. (3) The ozone layer is a layer in Earth's atmosphere containing relatively high concentrations of ozone (O_3). The layer absorbs 97–99% of the Sun's medium-frequency ultraviolet light (from about 200 nm to 315 nm wavelength), which potentially damages exposed life forms on Earth.

463. (2) The coolness and warmth associated with clothes is because of their reflective or absorptive capacities. White clothes are good reflectors of light, thereby keeping the body cool. The opposite is the case with black clothes.

464. (1) There are three primary colours of Red, Green and Blue (RGB). As these are mixed they form lighter colours, and when all three are mixed together they appear as white. Artists and graphic designers, who work with paintings and illustrations more than they do with photographs, often refer to Red, Yellow and Blue as the primary colours.

465. (2) Concave lens always form the virtual and erect image and the image is always diminished. Convex lens forms real image as well as virtual image. It forms both enlarged image and the diminished image.

466. (3) The blue colour of the sky is caused by the scattering of sunlight off the molecules of the atmosphere. This scattering, called Rayleigh scattering is more effective at short wavelengths (the blue end of the visible spectrum). Therefore the light scattered down to the earth at a large angle with respect to the direction of the sun's light is predominantly in the blue end of the spectrum.

467. (2) Wood is a bad conductor of heat due to the arrangement of its molecules. As the molecules of wood are far from each other, they cannot pass heat through them.

468. (2) The Ozone layer absorbs 97–99% of the Sun's medium-frequency ultraviolet light (from about 200 nm to 315 nm wavelength), which potentially damages exposed life forms on Earth.

469. (2) According to Newton's first law, an object that is at rest will stay at rest unless an unbalanced force acts upon it and an object that is in motion will not change its velocity unless an unbalanced force acts upon it. So this law is known as the law of inertia.

470. (2) The pressure exerted by a static fluid depends only upon the depth of the fluid, the density of the fluid, and the acceleration of gravity. The pressure in a static fluid arises from the weight of the fluid and is given by the expression $P_{static\ fluid}$ = dgh, where d= fluid density, g= acceleration due to gravity and h= depth of fluid. Static fluid pressure does not depend on the shape, total mass, or surface area of the liquid.

471. (2) In winter, the outside temperature is lower than that of water flowing out of the pump, and therefore, the water is warm. Whereas in summer, the outside temperature is higher than the water of the pump, and therefore, it feels cold.

472. (4) This phenomenon is because of refraction of light. The lines of sight intersect at a higher position than where the actual rays originated. This causes the water to appear shallower than it really is. The depth that the water appears to be when viewed from above is known as the apparent depth.

473. (3) Total internal reflection is an optical phenomenon that happens when a ray of light strikes a medium boundary at an angle larger than a particular critical angle with respect to the normal to the surface. This can only occur where light travels from a medium with a higher [n_1=higher refractive index] to one with a lower refractive index [n_2=lower refractive index]. Total internal reflection can be seen at the air-water boundary.

474. (3) When an object reaches the ground it has its maximum value of kinetic energy just before touching the ground. Since kinetic energy + potential energy= Constant; so on reaching ground the potential energy of an object becomes zero (0). The kinetic energy on reaching ground becomes maximum.

475. (4) A black body is a theoretical object that absorbs 100% of the radiation that hits it. Therefore it reflects no radiation and appears perfectly black. At a particular temperature the black body would emit the maximum amount of energy possible for that temperature. This value is known as the black body radiation. It would emit at every wavelength of light as it must be able to absorb every wavelength to be sure of absorbing all incoming radiation.

476. (3) Hydraulic Machinery refer to machines and equipment which use high pressure fluid to accomplish any work in industrial fields. These machines work on the basis of Pascal's Law which says "The pressure, in a static hydraulic fluid in a closed system is everywhere the same".

477. (2) According to Newton's first law, an object that is at rest will stay at rest unless an unbalanced force acts upon it and an object that is in motion will not change its velocity unless an unbalanced force acts upon it. So this law is known as the law of inertia.

478. (2) The pressure exerted by a static fluid depends only upon the depth of the fluid, the density of the fluid, and the acceleration of gravity. Static fluid pressure does not depend on the shape, total mass, or surface area of the liquid.

479. (2) In winter, the outside temperature is lower than that of water flowing out of the pump, and therefore, the water is warm. Whereas in summer, the outside temperature is higher than the water of the pump, and therefore, it feels cold.

480. (4) This phenomenon is because of refraction of light. The lines of sight intersect at a higher position than where the actual rays originated. This causes the water to appear shallower than it really is.

481. (4) The ozone layer is a layer in Earth's atmosphere containing relatively high concentrations of ozone (O_3) which absorbs 97–99% of the Sun's medium-frequency ultraviolet light.

482. (3) The specific heat is the amount of heat per unit mass required to raise the temperature by one degree Celsius. The specific heat of water is 1 calorie/gram °C = 4.186 joule/gram °C which is higher than any other common substance. As a result, water plays a very important role in temperature regulation

483. (2) The separation of oil and water is caused due to the difference in surface tension of the two liquids. The water molecules stick together tightly and does not mix with the oil because water molecules are attracted to each other very strongly, forming an invisible "skin" of surface tension around each drop.

484. (1) An important physical property of non metals is that they are brittle and hence cannot be beaten into sheets or drawn into wires. In other words, non-metals are non-malleable and non-ductile. Where stress is applied on non-metals, they shatter into pieces.

485. (*) Evaporation: the process by which water is converted from its liquid form to its vapor form (gas); Sublimation: the transition of a substance directly from the solid phase to the gas phase without passing through an intermediate liquid phase; Freezing: a phase transition in which a liquid turns into a solid when its temperature is lowered below its freezing point; and Melting: the process of heating a solid substance to a liquid.

486. (4) An Electrostatic precipitator is a particulate collection device that removes particles from a flowing gas (such as air) using the force of an induced electrostatic charge. They are useful in controlling air pollutants in particulate form. They are highly efficient filtration devices that minimally impede the flow of gases through the device, and can easily remove fine particulate matter such as dust and smoke from the air stream.

487. (3) 1 micron = 0.001 millimeters. A micrometre (micron) is one-millionth of a metre (or one-thousandth of a millimetre, 0.001 mm). Its unit symbol in the International System of Units (SI) is μm. It is a common unit of measurement for wavelengths of infrared radiation as well as sizes of cells and bacteria.

488. (2) A concave lens is used to correct short-sightedness (myopia). In myopia, images are formed in front of the retina, resulting in a blurred image. This occurs when the eye is relatively too long or the refractive powers of the cornea and lens of the eye are relatively too strong.

489. (2) As defined by the International Astronomical Union (IAU), a light-year is the distance that light travels in a vacuum in one Julian year. It is a measure of distance (rather than, as is sometimes misunderstood, a measure of time).

490. (4) Earthquakes generate seismic waves which can be detected with a sensitive instrument called a seismograph. The earliest seismograph was invented in China A.D. 136 by a man named Choko.

491. (3) Assuming air to be an ideal gas, the speed of sound depends on temperature only. As air temperature increases, so does the speed of sound and vice versa. The speed of sound is completely independent of air pressure because the air pressure and air density are proportional to each other at the same temperature. The speed of sound in air depends on the density of air which in turn depends on the temperature. The speed of a sound wave in air depends upon the properties of the air, mostly the temperature, and to a lesser degree, the humidity.

492. (1) A dynamo converts mechanical energy into electrical energy by taking advantage of a phenomenon known as electromagnetic induction. It is an electric generator that is similar to those that provide electricity to our homes.

493. (3) Conversion of sound energy into electrical energy is done by microphone.

494. (1) A small gap is left at the joints of rails in a railway track to provide space for the expansion of rail pieces when the temperature rises during summer.

495. (3) A metal to be used as a cooking material should have less thermal conductivity.

496. (2) Least audible sound for most of the human ear is 2×10^{-5} pascal. The generally accepted standard range of audible frequencies is 20 to 20,000 Hz.

497. (3) The relative humidity of air at a given temperature is the ratio of mass of water vapour actually present in a certain volume of air to the mass of water vapour required to saturate the same volume of air at the same temperature, miltiplied by 100.

Absolute Humidity refers to the amount of water vapour present in unit volume of air, expressed in grams per cubic metre.

498. (3) When a running car stops suddenly, the passengers tend to lean forward due to inertia of motion.

Inertia is that property of a body due to which it resists a change in its state of rest or of uniform motion.

499. (1) Mica is a good conductor of heat but bad conductor of electricity.

500. (3) Nichrome has high resistance and it is called a resistor.

501. (3) A solid needle placed horizontally on the surface of water floats due to surface tension of water.

502. (1) When hot liquid is poured into a thick glass tumbler, it cracks because glass is a bad conductor of heat so only inner surface expands.

503. (4) Hydro-electric power is a renewable natural resource.

504. (1) The oil in the wick of an oil lamp rises up due to capillary action.

505. (2) A drop of liquid assumes spherical shape because a sphere has the least surface area for a given volume.

506. (1) The density of pure fresh milk being on the average 1.032, while the density of fat globules is about 0.86. It follows that the removal of cream will increase the density, while the addition of water will decrease it.

507. (3) It is because image formed by an convex mirror is always virtual, erect and smaller than the object.

508. (3) Higher water pressure on the base of the dam needs greater strength to hold it back.

509. (1) A compact fluorescent lamp (CFL) is a fluorescent lamp designed to replace an incandescent lamp; some types fit into light fixtures formerly used for incandescent lamps.

510. (3) The property of conductor due to which it opposes the flow of current through it is called Resistance. It is numerically equal to the ratio of potential difference across its ends to the current flowing through it. The SI unit of resistance is ohm.

511. (3) Microwave electromagnetic radiation is used for satellite communication.

512. (1) Solar cells work on the principle of photovoltaic effect.

513. (1) Materials for rain proof coats and tents owe their water proof properties to Surface Tension.

The surface of a liquid behaves like an elastic membrane and therefore, has a tendency to contract. This property of liquid is called Surface Tension.

514. (3) X-rays region lies between Gamma rays and ultraviolet region.

515. (3) A star appears twinkling in the sky because of refraction of light by atmosphere. Light bends when it passes obliquely from one medium to another. This is called refraction of light.

516. (1) When two ice cubes are pressed together, they join to form one cube due to hydrogen bond.

517. (1) Microphone is a device which transforms the sound signal into current signal.

518. (3) In pressure cooker boiling point of water increases due to high pressure.

519. (1) When a strong beam of light is passed through a colloidal solution, the light will be scattered.

520. (1) mechanical energy into electrical energy

521. (2) the density of sea water is more than the density of river water

522. (4) All electromagnetic waves used are infrared.

523. (4) A spectrometer is an istrument used to measure properties of light over a specific portion of the electromagnetic spectrum.

Cathode ray oscilloscope is an electronic display device containing cathode-ray tube (CRT) that generates an electron beam that is used to produce visible patterns or graphs on a phosphorescent screen.

A sonometer is an apparatus made of hollow box having two holes. A string is attached to it by which the transverse vibrations of strings can be studied.

524. (3) A wire carrying current is neutral.

525. (4) If the angle of incidence of light ray in the denser medium is greater than the critical angle of the concerned media pair, the light is not at all reflected in to the rarer medium but is totally reflected. This is known as 'total internal reflection'.

526. (3) Heat is a form of energy. An important property of heat is that it flows from a body at higher temperature to another body at lower temperature.

527. (1) Hammering a rod will either allow it to become slightly magnetic if laid along a magnetic field (i.e.North - South) or demagnetise it if laid across the field lines (i.e. East-West).

A current passing through a coil will produce a magnetic field.

528. (1) The specific heat of water is higher than all other common substances. Hence, water is used for heating purposes (as in hot water bottles) and for cooling purposes (as in radiators of cars). Off all the liquids, mercury has the lowest specific heat due to which it is used as a thermometric liquid .

529. (3) The energy possessed by a body by virtue of its motion is called kinetic energy. Potential Energy is the energy possessed by virtue of its position or configuration.

When a body falls from an aeroplane, there is increase in its acceleration.

530. (1) In a water lifting electric pump, we convert electrical energy into potential energy. In hydraulic pump mechanical energy in converted into potential energy.

531. (4) Convex mirrors are used as rear view mirrors in automobiles to see the traffic on the rear side. A convex mirror always produces an erect image of the objects. The image formed in a convex mirror is highly diminished than the object, due to which a convex mirror gives a wide field of view of the traffic behind.

532. (3) X-rays – smaller than 10 nano metre
gamma- rays – 0.0005 to 0.1 nano metre
alpha-rays – 125 nano metre

533. (3) The earth's surface radiates as a black body, since it aborts and radiates with nearly 100 percent efficiency for its temperatures. Gases, on the contrary, are selective absorbers and radiators.

534. (4) Magnetic keepers are pieces of soft iron that are placed across the poles of a bar magnet or a horseshoe magnet. They help prevent the loss of magnetism.

535. (3) Archimedes' Principle states that upward buoyant force exerted on a body immersed in a fluid is equal to the weight of the fluid the body displaces.

536. (1) The motion of a body that repeats itself after a regular interval of time is called 'Periodic Motion'. Simple Harmonic Motion is a type of periodic motion where the restoring force is directly proportional to the displacement.

537. (1) Gamma-rays do not carry any charge. These rays do not have any mass and hence can not be considered to be made up of particles.

538. (3) The bar is a non-SI unit of pressure. It is defined by the IUPAC as exactly equal to 100,000 Pa or 10^5 Pa.

539. (1) Specific gravity is the ratio of the density of a substance to the density (mass of the same unit volume) of a reference substance. The reference substance is nearly always water for liquids or air for gases.

540. (1) As the pump removes the air from the bell jar the pressure obviously reduces around the barometer. The reduction in pressure around the barometer leads it to expand. As the pump removes air from the jar, the mercury level rises.

541. (2) According to Wien's displacement law, when the temperature of a blackbody radiator increases, the overall radiated energy increases. Wavelength of maximum emission from a blackbody is inversely proportional to its temperature. Shorter-wavelength (higher-frequency) light corresponds to higher-energy photons.

542. (4) The frequencies at which a human being can perceive sound vary between 20 Hertz and 20,000 Hertz. It is within these frequency ranges that people can communicate to each other and listen to music.

543. (1) Superconductors are materials that carry electrical current with little or no resistance when cooled below a certain temperature. While conventional superconductors need to be cooled close to absolute zero (-273.15 °C) before they superconduct, high temperature superconductors do so above the boiling point of liquid nitrogen (-196 °C).

544. (1) As per the question, the rubber ball rebounds while the metal ball does not. So if m and v be the mass and velocity respectively, the change in momentum of rubber ball = 2 mv (in magnitude)

However, the change in momentum of the metal ball = mv

The rubber ball suffers almost twice the change in momentum as experienced by the metal ball.

545. (2) The oil in the wick of lamp rises due to phenomenon of capillarity. This phenomenon is called molecular property of matter.

546. (3) Kepler's law of planetary motion states that the square of the time period is proportional to the cube of the semi-major axis.

547. (3) Radioactive elements can be traced out in living cell through a technique called Autoradiography.

548. (4) In digital logic, an inverter or NOT gate is a logic gate which implements logical negation. An inverter circuit outputs a voltage representing the opposite logic-level to its input. Inverters can be constructed using a single NMOS transistor or a single PMOS transistor coupled with a resistor.

549. (2) Persistence of vision is the phenomenon of the eye by which an afterimage is thought to persist for approximately one twenty-fifth of a second on the retina. In the early days of cinema, it was scientifically determined that a frame rate of less than 16 frames per second (frame/s) caused the mind to see flashing images. Audiences still interpret motion at rates as low as ten frames per second or slower, but the flicker caused by the shutter of a film projector is distracting below the 16-frame threshold.

550. (1) In photography, shutter speed or exposure time is the effective length of time a camera's shutter is open. The total exposure is proportional to this exposure time, or duration of light reaching the film or image sensor. The correct exposure for a particular object depends on the brightness of the object to be photographed.

551. (2) Normal speech is about 60 dB (decibels). A dangerous sound is anything that is 80 dB or higher which can lead to hearing loss. At 70 dB or lower, the risk of harm to healthy ears is negligible. Listening to sound above 80 decibels can cause profound deafness.

552. (3) A Newton Disc can be created by painting a disc with the seven different colours. A combination of red, green and blue in the circular disc will yield the same result. This is due to the phenomenon called persistence of vision.

553. (1) The dimensions of Force are M (mass), L (length) and T^{-2} (time). It can also be expressed as [newton] = [kilogram] [metre] [second]$^{-2}$.

554. (4) The use of a long strand of plastic (or other material such as glass) to pipe light from one end of the medium to the other is the basis for modern day use of optical fibers. Since total internal reflection takes place within the fibers, no incident energy is ever lost due to the transmission of light across the boundary.

555. (1) The Farad is the SI derived unit of capacitance. It is named after the English physicist Michael Faraday.

556. (3) Elasticity is the capability of an object to return to its former shape once a load inducing strain is removed. Young Modulus or elastic modulus [tendency to be deformed elastically (i.e., non-permanently) when a force is applied to it]of steel is more than that of rubber.

557. (3) Semiconductors are insulators at low temperatures and reasonably good conductors at higher temperatures. As temperature increases, the semiconductor material becomes a better and better conductor.

558. (1) A television channel is a physical or virtual channel over which a television station or television network is distributed. Channel numbers represent actual frequencies used to broadcast the television signal. For example, in North America, "channel 2" refers to the broadcast or cable band of 54 to 60 MHz, with carrier frequencies of 55.25 MHz for NTSC analog video (VSB) and 59.75 MHz for analog audio (FM), or 55.31 MHz for digital ATSC (8VSB).

559. (2) Water never has an absolute density because its density varies with temperature. Water has its maximum density of $1 g/cm^3$ at 4 degrees Celsius. When the temperature changes from either greater or less than 4 degrees, the density will become less than 1 g/cm^3. Water has the maximum density of 1 g/cm^3 only when it is pure water.

560. (3) The lower atmosphere is more or less transparent to radio waves. However, the ionosphere reflects back the radio waves. Thus, a signal emitted by an antenna from a certain place can be received at another place on the surface of Earth in the following two ways: ground wave propagation and sky wave propagation.

561. (4) The outside surface of a utensil used for heating is coated black so that it may absorb more heat and make heating quicker. This is because black surface is a good absorber of heat.

562. (3) The sunlit sky is blue because air scatters short-wavelength light more than longer wavelengths. Since blue light is at the short wavelength end of the visible spectrum, it is more strongly scattered in the atmosphere than long wavelength red light. The result is that the human eye perceives blue when looking toward parts of the sky other than the sun.

563. (2) A compound microscope is a microscope which uses multiple lenses to collect light from the sample and then a separate set of lenses to focus the light into the eye or camera. The objective lens provides the primary magnification which is compounded (multiplied) by the ocular lens (eyepiece).

564. (2) The human eye is sensible to light wave which wavelength is roughly between 400 nm and 700 nm. When illumination is enough (in daylight) the maximum sensitivity is in the green region at 555 nm.

565. (1) Speed of light (in Media) = Speed of Light (in Vacuum) / Refreactive Index of Material. Speed of light in air as taken generally is 3 X 10 power 8 meter per second.

566. (4) A photon is an elementary particle, the quantum of light and all other forms of electromagnetic radiation. The modern photon concept was developed gradually by Albert Einstein.

567. (3) It happens because of viscosity. The viscosity of a fluid is a measure of its resistance to gradual deformation by shear stress or tensile stress. It is due to friction between neighboring parcels of the fluid that are moving at different velocities.

568. (4) A White Hole is a hypothetical hole in outer space from which energy, stars, and other celestial matter emerge or explode. It is a theoretical celestial object into which matter is funneled from a black hole.

569. (1) Light scattering in colloidal solutions or particles in suspension is known as Tyndall Effect. It is similar to Rayleigh scattering, in that the intensity of the scattered light depends on the fourth power of the frequency, so blue light is scattered much more strongly than red light.

570. (4) Reactors are industrial processing tanks for the treatment of wastewater. The tanks have a "flow through" system, with raw wastewater (influent) coming in at one end and treated water (effluent) flowing out the other. While one tank is in settle/ decant mode the other is aerating and filling.

571. (2) Electrons carry current in a good conductor of electricity and they are negatively charged. This makes a good electrical conductor negatively charged.

572. (3) Bragg Spectrometer is an instrument used to analyze crystal structure by using X-rays. In it, a beam of collimated X-rays strikes the crystal, and a detector measures the angles and intensities of the reflected beam.

573. (3) Alpha particles consist of two protons and two neutrons bound together into a particle identical to a helium nucleus, which is generally produced in the process of alpha decay.

574. (3) Light is made up of photons, so it has some particle properties. In the photoelectric effect, light hits some material which absorbs it, and then ejects incident electrons. The reason that the photoelectric effect is evidence for the particle nature of light has to do with how materials absorb that light energy and then eject it in the form of electrons.

575. (4) The Electromagnetic spectrum in order of decreasing energy, thus increasing wavelength : Gamma Rays–wavelength: 0.01 nm ; X-rays –1 nm ; Ultra-violet Rays-0.1 micrometres ; Visible Light-Red light : 0.7 micrometres, Violet Light : 0.4 micrometres ; Infrared Radiation–0.01 mm ; Microwaves -less than 10 cm, usually 1cm ; Radiowaves- Long, Medium and Short Waves : 2 km-10 m ; and Very High Frequency (VHF) and Ultra High Frequency (UHF): 10 m–10 cm.

576. (4) A Sonometer is a device for demonstrating the relationship between the frequency of the sound produced by a plucked string, and the tension, length and mass per unit length of the string. These relationships are usually called Mersenne's laws after Marin Mersenne (1588-1648), who investigated and codified them.

577. (4) A neuron is a nerve cell that is the basic building block of the nervous system. Neurons are specialized to transmit infor-mation throughout the body. These highly specialized nerve cells are responsible for communicating information in both chemical and electrical forms.

578. (3) The twinkling of stars and variation in size of the Sun are due to atmospheric refraction of light. Besides, refraction is also responsible for the sun to look during sunset and sunrise. It is also responsible for the sun becoming two or three minutes before actual sunrise. The sun appears higher or lower in the sky due to the changing position of the Earth relative to the Sun.

579. (1) In mechanics, matter waves or de Broglie waves reflects the wave–particle duality of matter. The de Broglie relations show that the wavelength is inversely proportional to the momentum of a particle and is also called de Broglie wavelength.

580. (4) The separation of cream from milk is based on the fact that when liquids of different specific gravity revolve around the same centre at the same distance with the same velocity, a greater centrifugal force is exerted on the heavier liquid than on the lighter one. Milk consists of two liquids of different specific gravity: fat and milk serum.

581. (1) Gases are more sensitive to the temperature than liquids (such as mercury). That means gas expands more than the mercury for the same increase of temperature. Hence the gas thermometer is more sensitive than liquid (mercury) thermo-meter.

582. (1) The stone which is throws upward will have the same velocity of u at the point of its original position when it is falling down. Another stone is thrown downwards with u. So the velocity of both the stones is equal at the original point. Hence both stone will hit the ground with same velocity. So the ratio between the speeds of two stones will be 1:1

583. (1) A dioptre or diopter, is a unit of measurement of the optical power of a lens or curved mirror, which is equal to the reciprocal of the focal length measured in metres (that is, 1/metres). It is thus a unit of reciprocal length.

584. (2) The waves produced on the surface of water in the pond is an example of transverse waves as particles of the medium do not move along with the wave. Only the disturbance is carried forward. Another example of such waves is the vibrations of a string.

585. (2) When electricity is passed through the filament, the filament gets hot. Depending on the temperature of the filament, radiation is emitted from the filament. The filament's temperature is very high, generally over 2,000°C. At this high temperature of 2,000°C, about 5 percent of the electrical energy converts into visible light and rest of it is emitted as heat or infrared radiation.

586. (2) Shiny surfaces are poor absorbers of heat radiation and the best reflectors of heat radiation. Black surfaces are the best emitters and best absorber of heat radiation.

587. (4) According to the Principle of Flotation, when a body is immersed in a fluid, two forces act on it: (1) The weight of the body acting vertically downward through the centre of gravity of the body, and (2) The upthrust of the fluid acting vertically upward through the centre of gravity of the fluid displaced, i.e., centre of buoyancy. The upthrust is also termed as buoyant force.

588. (3) P-n junction is a device which flows current in one direction when it is forward biased and when it is reverse biased it doesn't flow any current through it. So it acts as an rectifier device to convert sinusoidal current to uni-direction. A rectifier is an electrical device that converts alternating current (AC), which periodically reverses direction, to direct current (DC), which flows in only one direction.

589. (3) Mass is the quantity of matter possessed by a body. It will be the same even if the lift goes up with acceleration.

590. (2) Ohm's law states that the current through a **conductor** between two points is directly proportional to the potential difference across the two points. It defines the relationship between the three fundamental electrical quantities: current, voltage, and resistance.

591. (2) Laser, an acronym for Light Amplification by Stimulated Emission of Radiation, creates a radiation beam that is coherent (in-phase). In a coherent light source, the amplitude of the radiated waves is added and results in a radiation beam of great intensity. It normally produces only one or two wavelengths. The single wavelength is called monochromatic radiation.

592. (4) There is one point on the Fahrenheit and Celsius scales where the temperatures in degrees are equal. That is -400 Celsius or Fahrenheit.

593. (4) Universal Constant of Gravitation is represented by G and is derived from Newton's law of gravitation. Dimensional Formula of Universal Constant of

$$\text{Gravitation} = \frac{M^1L^1T^{-2} \times L^2}{M^1 \times M^1} = M^{-1}L^3T^{-2}$$

594. (1) The modern science of spaceflight and rockets rest on Newton's Three Laws of Motion, a set of ideas and equations developed in the 1600s. In particular, the Third Law, which relates the action and reaction of forces, is essential to explain how a rocket accelerates. To make a rocket move forward, its engines point rearward. The action of the engine thrust produces a reaction on the rocket, accelerating it.

595. (1) The centre of gravity of a collection of masses is the point where all the weight of the object can be considered to be concentrated. The entire weight acts through the center of gravity instead of acting through the individual masses. In a uniform gravitational field (like the field close to the surface of the Earth) the Centres of Gravity and Mass are in exactly the same place.

596. (4) In a Type 2 Lever, the load is between the pivot (fulcrum) and the effort. Examples of common tools that use a type 2 lever include: stapler, bottle opener, wheel barrow, nail clippers and nut cracker.

597. (3) Magnets have a tendency to lose their magnetism when their poles are left bare. This is called self-demagnetization. Magnets are, therefore, protected by keeping them in magnetic keepers.

598. (4) A surface that absorbs all colours, reflecting none, is said to be black. Black is not a colour; it absorbs all the colours of the visible spectrum and reflects none of them to the eyes. White is a colour.

599. (1) The growth or movement of a plant part in response to a source of light is called phototropism. It is most often observed in plants, but can also occur in other organisms such as fungi.

600. (4) Dispersion is used to separate a beam of white light into its constituent spectrum of colours. This phenomenon leads to rainbow.

601. (2) Surface tension of oil is smaller than that of water. When oil is dropped on the surface of water, the force stretches the oil drops on all sides. Hence the oil spreads over the surface of water.

602. (3) The speed of sound varies depending on the temperature, pressure, and density of the medium through which the sound waves travel. In most of the cases, it is density which matters. Sound travels faster through denser air (or other material). The density of air is affected by atmospheric pressure, temperature, and altitude.

603. (1) Uniform circular motion occurs when a body moves in a circular path with constant velocity. The acceleration of a body experiencing uniform circular motion is always directed toward the center of the circle (centripetal acceleration or $a_c = \frac{v^2}{r}$.

where v is the body's velocity, and r is the radius of the circle. This acceleration is constant in magnitude but changes in direction, so, it is variable at every point of the circular path.

604. (3) A current carrying conductor, such as a metal wire, will produce a magnetic field around it because of the motion of charge within the wire itself. This motion produces or sets up a magnetic field around the wire in the form of concentric circles. This electromagnetic effect is described in physics by the Biot-Savart Law, an experimentally deduced inverse-square law. The effect is also described by Ampere's Law, which is derived from the Biot-Savart Law.

605. (3) The greenhouse effect refers to circumstances where the short wavelengths of visible light from the sun pass through a transparent medium and are absorbed, but the longer wavelengths of the infrared re-radiation from the heated objects are unable to pass through that medium. The trapping of the long wavelength radiation leads to more heating and a higher resultant temperature.

606. (4) If v is the wave velocity and f is the frequency, wavelength (?) is given by:

$$\lambda = \frac{v}{f}$$

So as per the question,

$\lambda = 360/500 = 0.72$

The path difference between two points is given by

$$\frac{\lambda}{2\pi} \times \phi = \frac{0.72}{360^\circ} \times 120^\circ = 0.24\text{m} = 24\text{m}$$

607. (2) The key to why clouds float is that the density of the same volume of cloud material is less than the density of the same amount of dry air. Just as oil floats on water because it is less dense, clouds float on air because the moist air in clouds is less dense than dry air.

608. (3) The photoelectric effect is the emission of electrons by substances, especially metals, when light falls on their surfaces. The photoelectric effect will not occur when the frequency of the incident light is less than the threshold frequency as the electrons are unable to gain sufficient energy to overcome the electrostatic barrier of the work function of the metal.

609. (4) The tesla (symbol T) is the SI derived unit used to measure magnetic fields. Tesla can be measured in different ways; for example, one tesla is equal to one Weber per square meter. The tesla was first defined in 1960 by the General Conference on Weights and Measures (CGPM). It was named in honor of the physicist, electrical engineer, and inventor, Nikola Tesla.

610. (1) In the case of damage to human body due to radiation, the most important factor is the amount of the dose - the amount of energy actually deposited in the body. The absorbed radiation dose, the amount of energy absorbed per gram of body tissue, is usually measured in units called rads. Another unit of radation is the rem, or roentgen equivalent in man. For practical purposes, 1 rad (absorbed dose) = 1 rem or 1000 mrem (dose equivalent) (Source: United States Nuclear Regulatory Commission).

611. (4) Transition metal ions have an incomplete set of 3d electrons. Changes in the energy of these electrons correspond to the energy of visible light. The absorption of visible light by these ions lend colour to gems.

612. (2) A flywheel is a rotating mechanical device that is used to store rotational energy. Flywheels have a significant moment of inertia and thus resist changes in rotational speed, enabling the engine to run at a constant, uniform motion. In the Industrial Revolution, James Watt contributed to the development of the flywheel in the steam engine.

613. (4) The freezing point of water is the temperature at which water changes phase from a liquid to a solid. Under normal conditions, ordinary water freezes at 0°C, or 32°F. The temperature may be lower if supercooling occurs or if there are impurities present in the water which could cause freezing point depression to occur.

614. (1) Noise pollution refers to any unpleasant, damaging or irritating noise that has the potential to harm people, wildlife or the environment. The decibel (dB) is the main unit used to measure the intensity or loudness of sounds. A sound can also be measured by its pitch, which is the frequency of sound vibrations per second.

615. (3) Relative humidity is the amount of moisture in the air compared to what the air can "hold" at that temperature. It signifies the mass of water vapour present in the air expressed as a percentage of the mass that would be present in an equal volume of saturated air at the same temperature. So Relative humidity is normally expressed as a percentage.

616. (2) Real gases approximate ideal gases when their pressure is relatively low, and their temperature reasonably high. A real gas deviates increasingly from ideality as it is compressed and cooled to near the point at which it will condense into a liquid. Compressing forces the molecules closer together so that intermolecular forces become stronger, and cooling reduces the kinetic energy of the molecules, so that they are more easily held by these forces.

617. (1) According to the Special Theory of Relativity, the mass of a moving object measures more as its velocity increases until, at the speed of light, it becomes infinite. This is because as an object gains speed, it gains more (kinetic) energy.

618. (3) There are four basic types of motion in mechanical systems: Rotary, Linear, Reciprocating and Oscillating motion. Rotatory motion is turning round in a circle, such as a wheel turning. While the wheel is moving, the mechanism transfers translational motion into rotary motion. As a matter of fact, translatory motion and rotatory motion occur at the same time.

619. (3) Purity of a metal can be determined with the help of Archimedes Principle which makes use of the densities and buoyancy of metals. Finding the density of a metal sample can help to determine its purity. It is most commonly used in the checking the purity of gold.

620. (2) If m be the mass and v be the velocity, then Kinetic Energy is given by KE

$$= \frac{1}{2}\left(mv^2\right) = \frac{1}{2}\left(2m \times 4v^2\right)$$

$$= \frac{8}{2}mv^2 = 4mv^2$$

So, if both mass and velocity are doubled, the kinetic energy increases by 4 times.

621. (4) Gravitational force

$$F = G \times \frac{m_1 m_2}{d^2}$$

where F is the gravitational force, m_1 and m_2 are the masses of two objects, G is the universal gravitational constant and d is the distance between the two objects.

Since the gravitational force is inversely proportional to the square of the distance, if the distance between the two bodies is doubled, the force of gravity is reduced to **one-fourth** its original value.

622. (4) Stationary or standing waves are formed in a medium when two waves having equal amplitude and frequency moving in opposite directions along the same line, interfere in a confined space. Generally, such waves are formed by the superposition of a forward wave and the reflected wave. Both longitudinal and transverse types of waves can form a stationary wave.

623. (4) Work done by the string of the simple pendulum during one complete oscillation is zero. Tension in the string exactly cancels the component parallel to the string. This leaves a net restoring force back toward the equilibrium position as equal to zero.

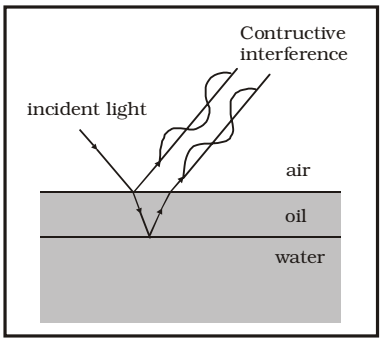
624. (2) When the resultant of all forces acting on a particle is zero, the particle is in equilibrium. The equilibrium of a particle to which a single force is applied may be maintained by the application of a second force that is equal in magnitude and direction, but opposite in sense, to the first force. This second force, which restores equilibrium, is called the equilibrant. Hence, the minimum number of forces to keep a particle in equilibrium is two.

625. (1) Basic conditions to execute simple harmonic motion are: (i) There must be an elastic restoring force acting on the system, (ii) the system must have inertia, and (iii) the acceleration of the system should be directly proportional to its displacement and is always directed to mean position.

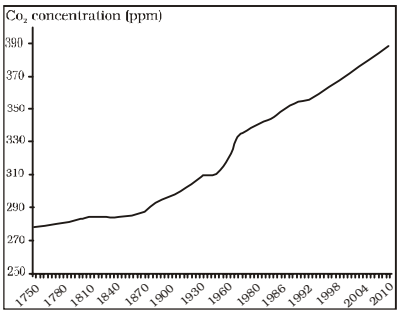
626. (1) The pin or needle floats because of an invisible elastic skin on the surface of the water. This elastic skin is called surface tension. Surface tension of the water leads to forces strong enough to support the needle's weight.

627. (1) A superconductor is a material that can conduct electricity or transport electrons from one atom to another with no resistance. No heat, sound or any other form of energy is released from the material when it reaches the temperature at which it becomes superconductive.

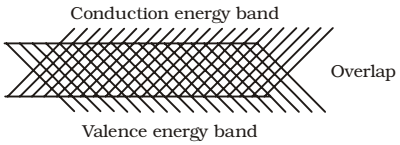
628. (2) A thin oil film on a water surface appears coloured because of thin-film interference which involves the interference of light waves reflecting off the top surface of a film with the waves reflecting from the bottom surface. The refractive index of oil is larger than that of water, therefore the reflection on the back side occurs.



629. (4) Carbon dioxide is the primary greenhouse gas that is contributing to recent climate change, 72% of the totally emitted greenhouse gases is carbon dioxide (CO_2), 18% Methane and 9% Nitrous oxide (NOx). Carbon dioxide emissions therefore are the most important cause of global warming.



630. (4) In the case of a conductor, there is no forbidden energy gap. The conduction and valence energy bands overlap each other. Obviously, the electrons from the valence band can freely enter the conduction energy band.



631. (2) Moment of inertia is the mass property of a rigid body that determines the torque needed for a desired angular acceleration about an axis of rotation. Moment of inertia depends on the shape of the body and the amount and distribution of its mass. It can be found through the sum of moments of inertia of the masses making up the whole object, under the same conditions.

632. (4) Since Torque = force x distance, to open a door easily, the handle should be fixed at the greatest distance from the hinges. If we pull with same force on a handle that is 2 feet away from the hinges, we will provide twice the torque, so it will be twice as easy to open.

633. (4) An Optical Fiber works on the principle of Total Internal Reflection. Light rays are reflected and guided down the length of an optical fiber. The acceptance angle of the fiber determines which light rays will be guided down the fiber.

634. (1) The colour of a star tells about its temperature, and the temperature depends on some combination of the star's mass and evolutionary phase.

635. (1) The blue colour of the sky is due to Rayleigh scattering. As light moves through the atmosphere, most of the longer wavelengths pass straight through. Little of the red, orange and yellow light is affected by the air. However, much of the shorter wavelength light is absorbed by the gas molecules. The absorbed blue light is then radiated in different directions. It gets scattered all around the sky.

636. (4) When a particle is moving in a uniform circular motion with constant speed and radius. the acceleration of the particle is given by v^2/r. The particle will exhibit centripetal acceleration.

637. (4) Based on the thermoelectric effect, the thermopile can be used as a heat sensor to measure thermal radiation. A thermopile is made of thermocouple junction pairs connected electrically in series. Thermocouples near the ground measures radiant energy.

638. (3) When the angle of incidence is greater than the critical angle, no refraction occurs. Instead, the incident beam is reflected, obeying the Law of Reflection. This is called Total internal reflection. In the formation of a rainbow, Total Internal Reflection occurs at the rear of the raindrop - the water-to-air interface.

639. (2) The period of oscillation of 3 cm microwaves is 1 x 10^{-10} (*Physics, Volume 1, by Halliday*). The period of oscillation is the smallest interval of time in which a system undergoing oscillation returns to the state it was in at the beginning of the oscillation.

640. (1) Sunlight is converted into electricity using photovoltaics (PV). A photovoltaic system employs solar panels composed of a number of solar cells to supply usable solar power.

641. (3) A light-year is a unit of length used informally to express astronomical distances. It is equal to just under 10 trillion kilometres.

642. (2) Insolation is the solar radiation that reaches the earth's surface. It is measured by the amount of solar energy received per square centimeter per minute. Insolation affects temperature. The more the insolation, the higher is the temperature.

643. (4) While ascending a hill Gear Ratio should be "Either equal to or greater than 1?. Gear Ratio is the ratio between angular velocity of input gear to the angular velocity of output gear. It prevents the vehicle from stalling.

644. (4) Since R is directly proportional to length of the wire, when wire is cut into equal parts, then Resistance of each part = R/n

When the wires are connected in parallel, then the equivalent resistance of combination is

$1/R_2 = n/R + n/R + n/R$ ....n times

or, $1/R_2 = n^2R$

or, $R_2 = R/n^2$

645. (4) As we know

$$E_i = \frac{1}{2}mu^2, E_f = \frac{1}{2}mv^2$$

Fraction of energy lost = $\frac{E_i - E_f}{E_i}$

$$= 1 - \left(\frac{v}{u}\right)^2 = 1 - \left(\frac{m-4m}{m+4m}\right)^2 = 1 - \frac{5}{29} = \frac{16}{25}$$

646. (4) It is possible to transform unpolarized light into polarized light. A light wave that is vibrating in more than one plane is referred to as unpolarized light. Polarized light waves are light waves in which the vibrations occur in a single plane. The process of transforming unpolarized light into polarized light is known as polarization.

647. (1) The Planck constant has dimensions of physical action; these are the same as those of angular momentum, i.e., energy multiplied by time, or momentum multiplied by distance. In SI units, the Planck constant is expressed in joule seconds (J·s) or (N·m·s).

648. (1) Let the original length be L; area of cross-section be A; and the resistivity be ?.

So, R = ?L/A

When the wire is melted and length is made half, i.e. L/ = L/2, the area of cross-section A/ is such that,

AL = A/L/ (volume of the wire remains constant)

=> AL = A/(L/2)

=> A/ = 2A

Now, the new resistance is,

R/ = ?L//A/ = ?(L/2)/(2A)

=> R/ = R/4

Thus, the new resistance is one-fourth of the original resistance.

649. (3) When a ray of light falls on sea shell, its small amount gets refracted (slightly polarized) and rest almost gets reflected back (fully polarized). So it gets a golden view because of polarization.

650. (4) When an object covers distance which is directly proportional to the square of the time, its acceleration is constant. This is seen in the cases of falling objects. This connection between time and distance was first observed by Galileo.

651. (2) Equation of projectile :

$$y = x\tan\theta - \frac{gx^2}{2u^2\cos^2\theta}$$

$$\frac{u^2\sin^2\theta}{g} = 4 \times \frac{u^2\sin^2\theta}{2g}$$

$$2\sin\theta\cos\theta = 2\sin^2\theta$$

$$\tan\theta = 1$$

$$\theta = 45°$$

652. (4) A rainbow is an optical phenomenon that is caused by both reflection and refraction of light in water droplets resulting in a spectrum of light appearing in the sky. It is caused by light being refracted (bent) when entering a droplet of water, then reflected inside on the back of the droplet and refracted again when leaving it.

653. (2) At higher altitudes, the air pressure is decreased, which forces water's boiling point to lower. The air pressure decreases with altitude because of the decrease in the density of air. The lowered boiling point of water requires an increase in cooking times or temperature.

654. (3) The SI unit of work is the Newton-metre or joule (J). A Newton meter is also the SI unit of torque (also called "moment" or "moment of force").

655. (1)

$$n_2 = n_1\left(\frac{M_1}{M_2}\right)\left(\frac{L_1}{L_2}\right)\left(\frac{T_1}{T_2}\right)^{-2}$$

$$= 1\left(\frac{10^3 g}{10 g}\right)\left(\frac{10^2 cm}{10\ cm}\right)\left(\frac{1s}{0.1s}\right)^{-2} = 10$$

Thus if the new unit of force is
10 X = 1 N or X = 0.1

656. (4) Light year is a unit of length used informally to express astronomical distances. It is most often used when expressing distances to stars and other distances on a galactic scale. It is equal to just under 10 trillion kilometres.

657. (3) Loudness depends on the amplitude of the sound wave. The larger the amplitude the more energy the sound wave contains therefore the louder the sound. The pitch of a note depends on the frequency of the source of the sound.

658. (1) If no air resistance is present, the rate of descent depends only on how far the object has fallen, no matter how heavy the object is. This means that two objects will reach the ground at the same time if they are dropped simultaneously from the same height. This statement follows from the law of conservation of energy.

659. (1) $M L^{-1} T^{-2}$ is the dimension of any quantity that is force per unit area such as Pressure or Stress, Young's Modulus, Bulk Modulus, Modulus of Rigidity, Energy Density. The Modulus of Elasticity is the ratio of the stress applied to a body or substance to the resulting strain within the elastic limit.

660. (3) The micrometer or micron, is an SI derived unit of length equaling 1×10^{-6} of a metre, i.e., one millionth of a metre. It is a common unit of measurement for wavelengths of infrared radiation as well as sizes of cells and bacteria and is commonly used in plastics manufacturing.

661. (1) The formula of frequency is: f = c / ë = wave speed c (m/s) / wavelength ë (m), where f: frequency, c: wave speed, and ë: wavelength.

As per the question, f = 300/0.3 = 1000 cycles/seconds = 1000 Hz = 1 KHz

Sound waves with frequencies above 20 KHz are called Ultrasonic; those below 20 Hz are called Infrasonic. Sound waves with frequencies between 20 Hz to 20,000 Hz are called audible waves.

662. (3) The maximum density of water occurs at 4 °C because at this temperature two opposing effects are in balance. Water is an exceptional compound that has a lower density in the solid phase than the liquid phase (i.e., ice floats on water). This is actually due to the ion nature of water in the liquid phase, which packs the molecules tightly together.

663. (4) A body moving with a constant speed in a circle is an example of uniform circular motion. The velocity vector is constant in magnitude but changing in direction. Since velocity is a vector quantity that has both magnitude and direction, a change in either the magnitude or the direction constitutes a change in the velocity which leads to change in acceleration.

664. (4) Sonography is an ultrasound-based diagnostic imaging technique used for visualizing internal body structures including tendons, muscles, joints, vessels and internal organs for possible pathology or lesions. In physics, 'ultrasound' refers to sound waves with a frequency too high for humans to hear.

665. (4) The electrostatic potential at any point in an electric field is defined as the work done in bringing a unit positive charge from infinity to that point against the electric force of the field. It is given by, V = W/q, where V is the potential, W is work done, and q the charge. Because work and charge both are scalar quantity, electrostatic potential is also a scalar quantity

666. (1) Speed is a scalar quantity that refers to "how fast an object is moving." Speed can be thought of as the rate at which an object covers distance. It does not keep track of direction. In contrast, velocity is a vector quantity as it is direction aware.

667. (1) Acceleration is defined as the rate at which an object changes its velocity. An object is accelerating if it is changing its velocity. An object with constant speed will have no acceleration as the speed is uniform.

668. (3) In the reference frame of the platform the ball has initial horizontal velocity equal to the velocity of the train. The vertical direction is the same observed on the train because both observers agree that gravity is acting on the ball causing an acceleration g. But, in the platform's reference frame it already had x-velocity, and the resultant path is a parabola.

669. (3) Permanent hardness is caused by dissolved calcium sulfate (which is not removed by boiling). Hard water contains dissolved magnesium and calcium ions. These make it more difficult for the water to form lather with soap. Temporary hardness is caused by dissolved calcium hydrogen carbonate (which is removed by boiling)

670. (2) An electron microscope is a microscope that uses a beam of accelerated electrons as a source of illumination. Because the wavelength of an electron can be up to 100,000 times shorter than that of visible light photons, the electron microscope has a higher resolving power than a light microscope and can reveal the structure of smaller objects.

671. (4) The first law of thennodynamics is a version of the law of conservation of energy for thermodynamic systems. It states that the change in the internal energy of a system is equal to the heat added to the system plus the work done on the system.

672. (2) For total internal reflection to occur the light must travel from a dense medium to a less dense medium (e.g. glass to air or water to air). It will not happen for light traveling from water (n=1.333) towards glass (n=1.52).

673. (2) Hertz (symbol Hz) is the unit of frequency of waves in the International System of Units (SI). It is defined as one cycle per second. It is named for Heinrich Rudolf Hertz, the first person to provide conclusive proof of the existence of electromagnetic waves.

674. (2) Convex mirror is used in rear view mirror of vehicles; so that the driver can see the traffic coming from behind. The field of view is widest in case of a convex mirror, which enables it to show a wider area from behind.

675. (4) The rice can be cooked faster in a pressure cooker since the boiling point of water increases with pressure. In general, the higher the temperature of the water, the faster the food will cook. The temperature of the water in a pressure cooker is higher than temperature of the water in an open pot.

676. (3) It is easy to burst a gas-filled balloon with a needle than with a nail because the needle applies more pressure than nail. Besides, the application of the pressure is on a small surface area than in the case of nail. In the case of needle, it is a very tiny area at the tip of the needle, so only a little force gives a lot of pressure (pressure = force/area).

677. (2) Ice needs to absorb heat energy to melt and become water (called latent heat of fusion). Since sawdust is a poor conductor of heat, it takes more time for the ice to absorb the required heat energy. This allows ice to remain in solid state for more time when packed in saw dust.

678. (4) Dynamo is a device for converting mechanical energy into electrical energy, especially one that produces direct current. It uses electromagnetic principles to convert mechanical rotation into a pulsing direct electric current through the use of a commutator.

679. (4) A fuse is a type of **low resistance** resistor that acts as a sacrificial device to provide over current protection, of either the load or source circuit. Low resistance causes the fuse wire to melt if a current more than the safe current for the appliance starts flowing through the circuit. Besides, the wire of fuse has very **low melting point**. When high current flows through the circuit due to overloading or a short circuit, the wires gets heated and melts. As a result, the circuit is broken and current stops flowing.

680. (2) When water changes into steam, it absorbs latent heat, and when steam condenses to form water, it gives out an equal amount of latent heat. Bums caused by steam are much more severe than those caused by boiling water, simply because steam contains more heat (in the form of latent heat) than boiling water.

681. (2) Incoming heat being absorbed by the Earth, and outgoing heat escaping the Earth in the form of radiation are both perfectly balanced. If they were not balanced, then Earth would be getting either progressively warmer or progressively cooler with each passing year. This balance between incoming and outgoing heat is known as Earth's heat budget.

682. (2) The choke primarily serves to limit current flow to the correct level for the tube. It also can be used during startup to provide an inductive 'kick' forming a momentary higher-voltage pulse to start the lamp.

683. (1) The light in sodium vapour lamp and mercury vapour lamp is, because of electron emission. In case of Sodium Lamps, filaments of the lamp sputter fast moving electrons, which hit the sodium atoms (vapour) causing the valence electrons of the sodium atoms to excite to higher energy levels and the electrons thus excited relax by emitting the characteristic monochromatic bright yellow light. The mechanism in mercury vapour lamp is more involved and sequential. The sputtered electrons from the filaments, after having been accelerated by high voltage, hit the mercury atoms. Here also, the excited electrons of mercury atoms relax by emitting characteristic but ultraviolet light.

684. (2) The acceleration due to the gravitational field of moon (g' = 1.62631 ms^{-2}) is one-sixth of the acceleration due to gravity on the Earth. So the weight of the same body is also 1/6th on moon in comparison to that on the surface of the earth. It is due to this reason; a man can jump six times higher on moon than on earth.

685. (4) In refracting media like glass prism, water, etc., lights of different colors travel with different speeds. The speed of violet colour is the least, while the speed of red colour is the largest in prism. As a result, the refractive index of glass is largest for violet colour and least for red colour. So the violet colour is deviated the most, while red colour is deviated least on passing through the prism.

686. (4) Hydraulic brake works on Pascal's law which states that pressure exerted anywhere in a confined incompressible fluid is transmitted equally in all directions throughout the fluid such that the pressure variations remain the same. The wheel cylinder of hydraulic drum brakes acts as a double hydraulic press, multiplying the force on the fluid by the ratio of the area of the cylinder to the area of the supply line. Besides the muliplication of force achieved, Pascal's principle guarantees that the pressure is transmitted equally to all parts of the enclosed fluid system.

687. (4) Indifference curves are usually convex to the origin. In other words, the indifference curve is relatively flatter in its right-hand portion and relatively steeper in its left-hand portion. The degree of convexity of an indifference curve depends on the rate of fall in the marginal rate of substitution.

688. (4) If the lift accelerates downwards with acceleration a, then the apparent weight of the man standing in the lift will be less than the true weight of the man by an amount ma. On the contrary, if the lift accelerates upwards with acceleration, then the apparent weight of the man will be greater than his true weight.

689. (2) When the light rays from the Sun are incident on water drops hanging in the atmosphere; these rays are dispersed into seven colours of white light and internally reflected by the drops. This dispersion and internal reflection results in production of colour arcs which appear hanging in the sky and known as rainbow. So the solar rays incident on the rain drops are refracted, internally reflected and transmitted to form the rainbow.

690. (2) The speed of sound in a medium is inversely proportional to the square root of its density. Higher is the humidity in the air, greater will be the velocity of sound. Therefore, the speed of sound in moist air is more than that in dry air. This is why the sirens of mills, whistle of trains and others are heard up to longer distances on a rainy day than on a dry day.

691. (3) Like gamma rays and neutrons, X-rays are electrically neutral. They have neither a positive nor a negative charge. They cannot be accelerated or made to change direction by a magnet or electrical field. In contrast, charged subatomic particles comprise light charged particles (electrons and positrons) and heavy charged particles (protons, alpha particles and heavier ions).

692. (3) A vehicle moving at a fast speed on a straight rail/road has a large inertia, i.e. tendency to keep moving in the same direction at the same speed. When it takes a circular turn on a curved rail/road, it experiences an additional force, termed as centripetal force, acting towards the centre of the circle. While rounding the curve as the vehicle has tendency to leave curved path and regain straight line path, force of friction between wheels and ground provides necessary centripetal force. In order that the vehicle can go round the curved track at a reasonable speed without skidding, the sufficient centripetal force is managed for it by banking the rail/road.

693. (3) We feel comfortable sitting under a fan when we are perspiring because a fan increases the rate of evaporation of sweat (or moisture) from our body and makes us feel cool and comfortable.

694. (3) The average kinetic energy of gas molecules is directly proportional to absolute temperature only. This implies that all molecular motion ceases if the temperature is reduced to absolute zero.

695. (2) A dimensionless quantity is simply a quantity that has no units and therefore no dimensions. A ratio between two numbers is a non-dimensional or dimensionless quantity. Strain which is defined as change in dimension over original dimension has no dimensional formula. So it is a dimensionless quantity.

696. (1) Water at ordinary temperatures contracts and increases in density as it is cooled, like most substances. But at about 4°C it reaches a maximum density and then decreases in density as it approaches the freezing point. This is referred to as anomalous property of water.

697. (4) The wavelength of sound changes with temperature. This is because the speed of sound changes with the temperature. Since the speed of sound is different at different temperature, this means the wavelength of sound at a given frequency is a variable depending on the speed of sound. For example, the wavelength of a 100 cycle tone in air at 68ºF would be 11.27 feet while the same tone in fresh water at 68ºF would have a wavelength of 48.05 feet.

698. (2) If v is the final velocity, then according to the principle of conservation of momentum,

$m_1v_1 + m_2v_2 = (m_1+m_2)v$;

or, $v = m_1v_1 + m_2v_2/(m_1+m_2)$

Using values from the question, $v = m \times a + 0/ (m + M) = ma/ (m + M)$

699. (4) In general, the intensity of a wave is proportional to the square of its amplitude. This has an important implication: relative intensity can be obtained by squaring relative amplitude.

$I \alpha a^2$

$$\therefore \quad \frac{a^2}{a^2} = \sqrt{\frac{I_2}{I_2}} = \sqrt{\frac{25}{9}} = \frac{5}{3},$$

i.e., $a_1 : a_2 = 5:3$

So if the intensity ratio is 25:9, the amplitude ratio will be 5:3.

700. (1) Self-inductance is proportional to the number of turns per unit length. The original self-inductance

(L) is given by $L = \frac{\mu_0\pi(N)^{\frac{2}{r}}}{2}$

On tripling N, the new self-inductance becomes L

$$= \frac{\mu_0\pi(3N)^{\frac{2}{r}}}{2} = 9 \times \frac{\mu_0\pi(N)^{\frac{2}{r}}}{2}$$

$= 9L$

701. (2) LHC stands for Large Hadron Collider is the world's largest and most powerful particle collider that allows scientists to further test the properties of the Higgs boson. It lies in a tunnel beneath the France–Switzerland border near Geneva, Switzerland. It is the largest, most complex experimental facility ever built, and the largest single machine in the world.

702. (2) Red light has a longer wavelength than violet light and the other colours of visible light have intermediate wavelengths. As light passes from air into glass, there is reduction of velocity. Due to longer wavelengths, red waves travel fastest and is refracted the least, while violet waves travel the slowest and is refracted the most.

703. (4) Mirage is caused by total internal reflection in deserts where due to heating of the earth, refractive index of air near the surface of earth becomes lesser than above it. A ray of light coming from a distant object gets refracted from a denser to a rarer medium. Consequently the refracted ray bends away from the normal until at a particular layer, the light is incident at an angle greater than the critical angle. At this stage the incident ray suffers total internal reflection and is reflected upwards. When this reflected beam of light enters the eyes of the observer, it creates an illusion of the water near the object.

704. (3) The phenomena of interference and diffraction of light were successful beyond doubt to prove that light is a form of wave. But they failed to decide whether light is transverse or longitudinal wave. The fact that light is a transverse wave was established only after the discovery of the phenomenon of polarization. It was Huygens who first discovered the phenomenon of polarization in 1690. The phenomenon of interference and diffraction can be exhibited by all types of waves but polarization can be exhibited by the transverse waves only. So it was the discovery of polarization of light that helped us to prove that light is a transverse wave.

705. (1) The Planck's constant (h) can be defined as a proportionality constant that relates the energy (E) of a photon to the frequency (?) of its associated electromagnetic wave. Mathematically, Planck's Constant (h) = Energy (E)/frequency (?). The Planck constant is named after Max Planck, the instigator of quantum theory, who discovered it in 1900

706. (3) When air is suddenly exhaled out into a larger volume through the narrow opening, air undergo adiabatic expansion. So blowing air is an adiabatic process. But since it is open pipe, the pressure inside and pressure outside remains same. So ultimately the process is isobaric.

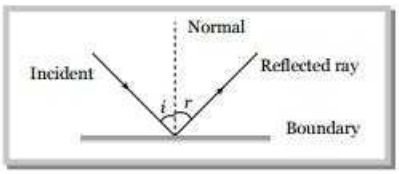
707. (2) In simple terms, mass is the amount of matter in an object, and is measured in grams. Under normal circumstances, and as long as it remains intact, an object will always have the same mass, i.e. there will always be the same amount of matter in it. A steel ball will have the same amount of steel in it - its mass will be the same - whether it is on the Earth's surface or on the Moon.

708. (2) An ohm (O) is the SI derived unit of electrical resistance. By definition, a conductor has an electrical resistance of one ohm when a constant potential difference of one volt applied between its ends produces in this conductor a current of one ampere. A volt per ampere (V/A) is the SI derived unit, which is equal to ohm by definition O = V/A.

709. (2) When a tyre bursts suddenly energy is not immediately transferred between the system and the surrounding. So the process is adiabatic. There sudden expansion of its air into the atmosphere is adiabatic and the tyre is cooled. In adiabatic process, heat neither enters the system nor leaves the system.

710. (3) In physics and chemistry, the Lyman series is a hydrogen spectral series of transitions and resulting ultraviolet emission lines of the hydrogen atom as an electron goes from n > 2 to n = 1 (where n is the principal quantum number) the lowest energy level of the electron. The first line in the spectrum of the Lyman series was discovered in 1906 by Harvard physicist Theodore Lyman, while studying the ultraviolet spectrum of electrically excited hydrogen gas. The rest of the lines of the spectrum (all in the ultraviolet) were discovered by Lyman from 1906-1914.

711. (2) When a ray of light incident on a boundary separating two media comes back into the same media, this phenomenon, is called reflection of light. After reflection velocity, wavelength and frequency of light remains same but intensity decreases.



712. (4) Myopia, also known as near-sightedness and short-sightedness, is a condition of the eye where the light that comes in does not directly focus on the retina but in front of it, causing the image that one sees when looking at a distant object to be out of focus, but in focus when looking at a close object.

713. (4) The red colour in the sky at sunset (and sunrise) is due to an effect called Rayleigh scattering. At sunrise or sunset, since the Sun is low on the horizon, the light rays must pass through more of the atmosphere – and therefore bounce off more molecules – than at other times of day. Thus, blue light gets scattered away before the light reaches your eyes. Other colors – such as red, orange and yellow –continue to pass through the atmosphere unaffected.

714. (4) The velocity of sound in a gas is given by

$$v = \sqrt{\frac{\gamma p}{\rho}} \qquad \text{....(i)}$$

Clearly, velocity v is inversely proportional to the square root of density (ρ) of the gas.

Now, let us consider two gases which are at the same pressure (P) and the same value of γ. If ρ_1 and ρ_2 be their densities, then velocity of sound in the two gases are

$$v_1 = \sqrt{\frac{\gamma p}{\rho_1}} \text{ and } v_2 = \sqrt{\frac{\gamma p}{\rho_2}}$$

$$\therefore \quad \frac{v_1}{v_2} = \sqrt{\frac{\rho_2}{\rho_1}} \qquad \text{....(ii)}$$

For example, density of oxygen is 16 times the density of hydrogen, therefore from (ii), we have

$$\frac{v_H}{v_o} = \sqrt{\frac{\rho_0}{\rho_H}} = \sqrt{\frac{16pH}{PpH}} = 4$$

or $\boxed{v_H = 4v_0}$

So the corresponding ration of velocity of sound in oxygen and hydrogen is 1:4.

715. (1) The SI unit of magnetic flux is the Weber (Wb) (in derived units: volt-seconds). It is the magnetic flux that, linking a circuit of one turn, would produce in it an electromotive force of 1 volt if it were reduced to zero at a uniform rate in 1 second. It is named after the German physicist Wilhelm Eduard Weber. The CGS unit of magnetic flux is Maxwell.

716. (4) A lightning conductor is made up of a sharp pointed

metal (usually copper metal, as it is a very good conductor) connected directly to the ground. It is placed higher than the roof so that if lightning strikes, it strikes the conductor before it can reach the house. It should be pointed because when the negative charge is discharged by the cloud, it will first strike the pointed tip of the lightning conductor and quickly travel to the earth. The discharge will be quickly over and the house and its surroundings will be saved from damage. The pointed nature of the lightning conductor helps it to acquire more number of positive charges on its tip.

717. (2) A beta ray is a high-energy, high-speed electron (negatively charged) or positron (positively charged) emitted in the radioactive decay of an atomic nucleus, such as a potassium-40 nucleus, in the process of beta decay. Two forms of beta decay, $\beta-$ and $\beta+$, respectively produce electrons and positrons. Beta radiation takes the form of either an electron or a positron being emitted from the nucleus of an atom.

718. (2) Parsec is a unit of distance used in astronomy to measure large distances to objects outside our Solar System. It is equal to about 3.26 light years (3.086×10^{13} kilometres). One parsec is the distance at which one astronomical unit subtends an angle of one arcsecond.

719. (3) Refraction is the change in direction of wave propagation due to a change in its transmission medium.Due to the change of medium, the phase velocity of the wave is changed but its frequency remains constant. Refraction of light is the most commonly observed refractive phenomenon, but any type of wave can refract when it interacts with a medium.

720. (2) Supercooling, also known as undercooling, is the process of lowering the temperature of a liquid or a gas below its freezing point without it becoming a solid. A good example of this phenomenon is clouds in high altitude that are an accumulation of supercooled droplets of water below their freezing point. Refrigeration is a popular commercial application of supercooling.

721. (1) Drinking alcohol (ethanol) and a lot of other simple alcohols are more volatile than water because they are less polar. Thus, alcohol has higher vapor pressure and a lower boiling point than water; therefore, it evaporates more quickly. Its low boiling point of 78° C is what makes it possible to distill alcohol into a much stronger solution than wine or beer.

722. (3) Data for 2013 shows that renewable electricity generation overtook natural gas to become the second largest source of electricity worldwide producing 22% of total electricity or 5,130 TWh. Some of the sources of renewable energy are: solar power, wind power, wave and tidal power, geothermal power, biomass and hydro power. Fossil fuels remained the bedrock of global electricity production with more than two-thirds (about 67%) of the total.

723. (*) More than one option is correct.
A light-year is a unit of length used informally to express astronomical distances. It is the distance that light can travel in one year which is approximately 9 trillion kilometres (or about 6 trillion miles). As defined by the International Astronomical Union (IAU), a light-year is the distance that light travels in vacuum in one Julian year (365.25 days).
Best Option: (4)

724. (1) The lux is the SI unit of illuminance and luminous emittance, measuring luminous flux per unit area. It is equal to one lumen per square metre. In photometry, this is used as a measure of the intensity, as perceived by the human eye, of light that hits or passes through a surface.

725. (2) Loudness is a subjective characteristic of a sound (as opposed to the sound-pressure level in decibels, which is objective and directly measurable). Perceived loudness of sound is a psycho-acoustic quantity that depends on sound pressure level, the frequency spectrum, and the time behavior of the sound in question. The sone is a unit of perceived loudness that was proposed by Stanley Smith Stevens in 1936.Being a unit of how loud a sound is perceived, the sone scale of loudness is based on data obtained from subjects who were asked to judge the loudness of pure tones and noise. One sone is arbitrarily set equal to the loudness of a 1,000-hertz tone at a sound level of 40 decibels (Encyclopedia Britannica).

726. (4) Stress is defined as Resisting force per unit area of an element, on which load is applied. Stress is always perpendicular to a cross-section in the element. It is neither scalar (it cannot be numerically added), nor is it a vector (it does not follow the triangle rule of vector addition). It is a tensor quantity because it describes things happening in two directions simultaneously.

727. (3) Colour is caused by the temperature of the surface of the star. A star approximates the behavior of a black body radiator. As a black body gets hotter its color changes. Small stars are cool (less than 3000°C) with a reddish appearance, whereas big heavy stars are hot (over 30,000°C), and have a bluish glow.

728. (1) In electronics, a diode is an electronic device that allows current to flow in one direction only. It is mainly used as a rectifier diode that lets electrical current flow in only one direction and is mainly used for power supply operation. Rectifier diodes are used for changing alternating current into direct current.

729. (3) Candela is the standard unit of luminous intensity, the luminous power per unit solid angle emitted by a point light source in a particular direction, in the International System of Units. The word candela means candle in Latin.

730. (2) When a non-relativistic electron and a non-relativistic proton are moving and have the same de Broglie wavelength, then they will have the same linear momentum $p = mv$. If the electron and proton have the same momentum, they cannot have the same speed because of the difference in their masses. An electron and photon can have the same wavelength since the wavelength of electron can be changed by changing its velocity.

731. (2) According to Newton's law of cooling, the rate of loss of heat of a body is directly proportional to the difference between the temperature of hot body and temperature of the surroundings, provided that the difference in temperature is small enough.

732. (1) Using Kepler's Third Law,

$$\frac{T^2}{T_1^2} = \left(\frac{R}{4R}\right)^3 = \frac{1}{64}$$

$\Rightarrow T_1 = 8T$

733. (2) Weight of a body is the force with which it is attracted towards the centre of earth. The weight of a body, 'w' of mass 'm' is given by: W = mg, where 'g' is the acceleration due to gravity At the centre of earth, value of 'g' is zero. Therefore, weight of a body is zero at the centre of the earth.

734. (3) When a ship enters the sea from a river, it rises a little since salt water is denser than river water. As the density of river water is less than that of the sea water, the water displaced by the ship in the river is more than that displaced in the sea. So it rises as it enters sea from river.

735. (*) Hydroscope is an optical device for enabling a person to see an object at a considerable distance below the surface of water by means of a series of mirrors enclosed in a steel tube. **Hydrophone is an instrument used for recording sound under water**. It is the underwater equivalent of a microphone that measures pressure fluctuations, and these are usually converted to sound pressure level (SPL), a logarithmic measure of the mean square acoustic pressure.

736. (2) Albedo is the fraction of solar energy (shortwave radiation) reflected from the Earth back into space. It is a measure of the reflectivity of the earth's surface. Ice, especially with snow on top of it on land, has the highest albedo. The albedo of given sources is as follows:

- Fresh snow or ice: 60-90% or 80-95%;
- Desert sand: 30-50%;
- Prairie Grasslands: 18-25% or 20%;
- Crops: = 10-25%

737. (3) According to Ohm's Law, the potential difference (V) between two terminals of a current-carrying conductor is directly proportional to the current (I), flowing through it. The proportionality constant R, is the resistance of the conductor. Thus, $V \propto I$

or $V = I \times R$

or $I = \frac{V}{R}$ or $R = \frac{V}{I}$

738. (1) According to Article 21A of Indian Constitution, theState shall provide free and compulsory education to all children of the age of six to fourteen years in such manner as the State may, by law, determine. This article was inserted in the constitution by 86th Amendment Act, 2002, also known as Right of Children to Free and Compulsory Education Act.

739. (3) Nature's most efficient means of cooling is through the evaporation of water. Desert coolers make use of evaporative cooling that works on the principle of heat absorption by moisture evaporation. As water is evaporated, energy is lost from the air, reducing the temperature. Thus, cooling effect is produced.

740. (2) When a body moves about a mean position in such a way that the acceleration is proportional to the displacement and is always directed towards the mean position, the body is said to execute a simple harmonic motion. The motion of a simple pendulum falls under this category.

741. (1) Convection is the transfer of heat from one place to another by the movement of fluids. It is usually the dominant form of heat transfer(convection) in liquids and gases. Although often discussed as a distinct method of heat transfer, convective heat transfer involves the combined processes of conduction (heat diffusion) and advection (heat transfer by bulk fluid flow).

742. (2) The first phenomenological theory of superconductivity was London theory. It was put forward by the brothers Fritz and Heinz London in 1935, shortly after the discovery that magnetic fields are expelled from superconductors. A major triumph of the equations of this theory is their ability to explain the Meissner effect, wherein a material exponentially expels all internal magnetic fields as it crosses the superconducting threshold.

743. (4) A parsec is a unit of length used to measure large distances to objects outside our Solar System. One parsec is the distance at which one astronomical unit subtends an angle of one arc second. A parsec is equal to about 3.26 light-years in length.

744. (3) An interesting property of matter is that its temperature remains constant during a phase change, assuming its surrounding pressure is constant. A liquid changes into gaseous state at a constant temperature called its boiling point. For example, when water is converted into vapors (gaseous state) at 100°C and so 100°C is its boiling point. The temperature remains constant at 100°C. The temperature of water increases only after all the water is evaporated. Likewise, once the temperature of a liquid is lowered to its freezing point, the temperature does not decrease until all the liquid has changed its phase to become a solid.

745. (3) When liquid is placed on a smooth surface like glass plate, the relative strengths of the cohesive and adhesive forces acting on that liquid determine the shape it will take (and whether or not it will wet the surface). If the adhesive forces between a liquid and a surface are stronger, they will pull the liquid down, causing it to wet the surface. However, if they cohesive forces among the liquid itself are stronger, they will resist such adhesion and cause the liquid to retain a spherical shape and bead the surface. Mercury drop remains spherical on a plate of glass because its cohesive force is greater than its adhesive force with glass.

746. (4) Insulators are materials that do not allow the transfer or that slow the transfer of heat or electricity. Some of the examples of insulators are: glass, plastic, rubber, porcelain, wood, ceramic, dry air, etc.

747. (1) Effervescence is the escape of gas from an aqueous solution and the foaming or fizzing that results from a release of the gas. It leads to the formation of

gas bubbles in a liquid. For example, when opening a bottle of champagne, beer or carbonated beverages such as soft drinks, the visible bubbles are produced by the escape from solution of the dissolved gas.

748. (1) The boiling point corresponds of water to the temperature at which its vapour pressure equals the surrounding environmental pressure. So it is dependent on theatmospheric pressure. For example, at higher altitudes, the atmospheric pressure decreases. As this pressure decreases, the boiling point of the water also decreases.

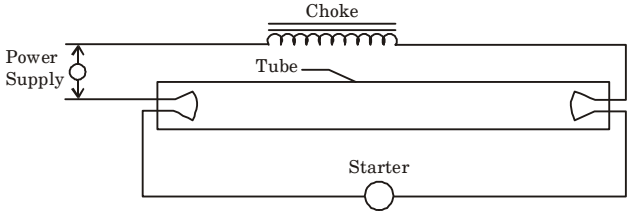
749. (4) The phenomena which proves the transverse nature of light is polarization. Since the intensity of polarized light on passing through a tourmaline crystal changes, with the relative orientation of its crystallographic axes with that of the polarizer, therefore light must consist of transverse waves. Transverse waves are waves that are oscillating perpendicularly to the direction of propagation

750. (3) A rectifier is an electrical device that converts alternating current (AC), which periodically reverses direction, to direct current (DC), which flows in only one direction. The process is known as rectification.

751. (3) Ice needs to absorb heat energy to melt and become water (called latent heat of fusion). Since sawdust is a poor conductor of heat, it takes more time for the ice to absorb the required heat energy. This allows ice to remain in solid state for more time when packed in saw dust.

752. (4) Washing machines work on the principle of centrifugation. They are based on medium sized centrifuges that put an object in rotation around a fixed axis, applying force perpendicular to the axis. It uses the sedimentation principle, where the centripetal acceleration separates substances of greater and lesser density. Besides, it also makes use of the centrifugal force generated in the "spin cycle" of washing machines that throws the water out through the little holes of perforated drum so that the washed clothes end up much drier.

753. (1) In electronics, a choke is an inductor used to block higher-frequency alternating current (AC) in an electrical circuit, while passing lower-frequency or direct current (DC). In a tubelight, the high voltage is created by suddenly interrupting the current in choke, which is connected in series with the tubelight.



754. (1) The curie (symbol Ci) is a non-SI unit of radioactivity, named 'in honour of' Pierre Curie. It was originally defined as "the quantity or mass of radium emanation in equilibrium with one gram of radium (element)", but is currently defined as: 1 Ci = 3.7 × 1010 decays per second after more accurate measurements of the activity of 226Ra.

755. (3) Solar energy, in the form of heat and light, travels from the sun to Earth through the process of radiation. This way, energy can be transferred through empty space without relying on matter. This radiation is largely visible as light to the naked eye, although it also includes ultraviolet and infrared radiation as well.

756. (2) The process of heat transfer from one place to another place without the movement of particles is called conduction Example:Heat transfer through Metal rods. On the contrary, convection is the process by which heat is transmitted through a substance from a point to another due to the bodily motion of the heated particles of the substance. The fluids (liquids and gases) are heated by this process.

757. (4) An amplifier is an electronic device that increases the voltage, current, or power of a signal.Generally transistors are active devices that can be used with discrete components to amplify voltage, power or both depending upon the configuration.

758. (1) The decibel (dB) is the unit used to measure the intensity of sound or noise level. It is given in terms of a logarithmic function of a ratio of power intensities. One decibel is one tenth of one bel, named in honor of Alexander Graham Bell who was the inventor of the telephone and phonograph.

759. (3) Modern refrigerators usually use a refrigerant called HFC-134a (1,1,1,2-Tetrafluoroethane), which does not deplete the ozone layer, instead of Freon. Freon used to be the most common refrigerant till the 1980s; however, its use has declined since the 1990s because it comes under Chlorofluorocarbon (CFC). Ammonia was also used a a common refrigerant in old refrigerators. However, Freon still remains the most commonly used refrigerant. Hydrochlorofluorocarbon (HCFC), is a type of refrigerator coolant used in newer refrigerator models. The types used today include HFC-134a, HCFC-142b and HCFC-22.

760. (3) In order to convert a Galvanometer into voltmeter, a very high resistance known as "series resistance" is connected in series with the galvanometer. The conversion is made for enabling the galvanometer to measure the potential difference across any component in a circuit.

761. (3) High Carbon Monoxide (CO) content in exhaust gas of automobiles usually indicate a fuel mixture richer than ideal (rich mixture - air fuel ratio below 14.7).High CO levels result from inadequate O_2 supply needed for complete combustion that is caused by a too rich mixture - too much fuel or not enough air. This is most seen during :

- Idle running or low idle speed;
- Improper float settings in carbureted vehicles;
- Dirty or restricted air filters;
- Excessively dirty or contaminated oil
- Improper operation of the fuel delivery system; etc.

762. (2) Least distance of distinct vision is the minimum object's distance that is able to produce a distinct image on the retina.This distance is about 25 cm from the eye. However, it varies with age. For infants the least distance of distinct vision is about 5 to 8 cm.

763. (2) A tuning capacitor or tuning condenser is a variable capacitor used in an electronic circuit of a radio. It usually connects in parallel to a loop antenna and

its capacitance may be intentionally and repeatedly changed mechanically or electronically.

764. (2) 0 degrees Kelvin is equal to -273.15 degrees Celsius. It is the lowest possible temperature, at which all molecules are have the least possible amount of kinetic energy. It refers to a state at which the enthalpy and entropy of a cooled ideal gas reaches its minimum value, taken as 0.

765. (3) The Higgs boson is an elementary particle in the Standard Model of particle physics. That is often referred to as the "God particle" in popular media outside the scientific community. The nickname comes from the title of the 1993 book on the Higgs boson and particle physics, *The God Particle: If the Universe Is the Answer, What Is the Question?* by Nobel Physics prizewinner Leon Lederman.

766. (1) In semiconductor production, doping refers to the introduction of impurities into an extremely pure intrinsic semiconductor for the purpose of modulating its electrical properties. The impurities are dependent upon the type of semiconductor and the properties that it needs to have for its intended purpose.

767. (2) Lead exhibit superconducting phase transitions at low temperatures of 7.2 Kelvin. This discovery was made in 1913. At this temperature (known as critical temperature), the electrical resistivity of lead drops to zero. The transition is so sudden and complete that it appears to be a transition to a different phase of matter; this superconducting phase is described by the BCS theory.

768. (1) Absolute zero is the lowest possible temperature where nothing could be colder and no heat energy remains in a substance. It is the point at which all motion in matter stops. By international agreement, absolute zero is defined as precisely; 0 K on the Kelvin scale, which is a thermodynamic (absolute) temperature scale; and –273.15 degrees Celsius on the Celsius scale.

769. (2) The energy of a wave is proportional to the square of its amplitude. Therefore, the intensity of a wave is also proportional to the square of its amplitude. This means that if Intensity drops off at a rate of $1/r^2$, wave amplitude drops off at a rate of $1/r$.

770. (3) The term galaxy refers to a large collection of stars, dust, and gas clouds which are held together by gravitational attraction.The smallest galaxies may contain only a few hundred thousand stars, while the largest galaxies have thousands of billions of stars. The Milky Way galaxy contains our solar system.

771. (4) Optical filters are devices that selectively transmit light in a particular range of wavelengths, that is, colors, while blocking the remainder. They are commonly used in photography (where some special effect filters are occasionally used as well as absorptive filters), fluorescence microscopy, spectroscopy, clinical chemistry, colour stage lighting, etc.

772. (4) Sky appears blue because the tiny particles of the earth's atmosphere scatter the blue colour (short wavelength) of the sunlight more dominantly than other wavelengths. A blue sky is a manifestation of Rayleigh scatter. The sky would appear black in the absence of earth's atmosphere because there would be no particles to scatter the light.

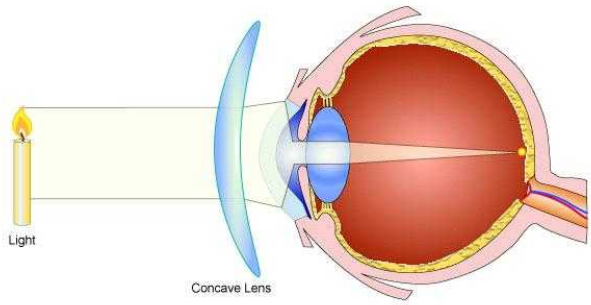
773. (2) Resistors are in parallel when each resistor is connected directly to the voltage source by connecting wires having negligible resistance. Each resistor thus has the full voltage of the source applied to it.When resistors are connected in parallel, more current flows from the source than would flow for any of them individually, so the total resistance is lower. Each resistor in parallel has the same full voltage of the source applied to it, but divide the total current amongst them.

774. (2) Due to its resistance to oxidation and stability at high temperatures, Nichrome is widely used in electric heating elements, such as in appliances and tools. Typically, nichrome is wound in coils to a certain electrical resistance, and current is passed through it to produce heat.

775. (3) Total internal reflection is responsible for glittering which occurs when the light from a denser media (liquid) tries to enter less dense media (air in bubble). This reflected light when captured by our eyes is seen as glittering.

776. (3) Total internal reflection is the basic concept behind the optical fiber. Optical fiber employs the transmission of light down fibers of plastic or glass. Because the fibers are thin, light entering one is likely to strike the inside surface at an angle greater than the critical angle and, thus, be totally reflected. In fact, most fibers have a varying refractive index to allow more light to be guided along the fiber through total internal refraction.

777. (2) Near-sightedness, also known as short-sightedness and myopia, is a condition of the eye where light focuses in front of, instead of on, the retina. This causes distant objects to be blurry while close objects appear normal. This defect can be corrected by wearing a concave (diverging) spectacle lens. The rays of light from a near object are diverged before entering the eye so that the cornea and eye lens can direct the focal point onto the retina.



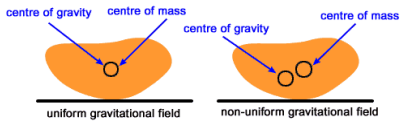
778. (4) When a fast-moving train passes a man standing on the platform at rest, the air between train and person also moves with greater speed. This rapidly moving air, by Bernoulli's principle will have a lower pressure than the still air a few feet away. The still air, having higher pressure, and being behind the man standing close will tend to push him toward the train.

779. (3) Water has the highest specific heat of any known substance except hydrogen; that is, it requires more heat to raise the temperature of water a definite number of degrees than it does to raise the temperature

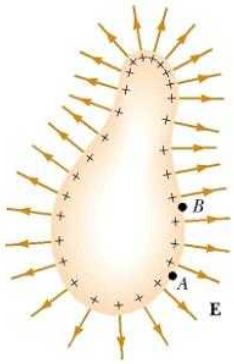
of an equal amount of any other substance the same number of degrees. Practically this same thing can be stated in another way: Water in cooling gives out more heat than any other substance in cooling through the same number of degrees. For this reason water is used in foot warmers and in hot-water bags (*General Science by Bertha Clark*).

780. (2) The formulas for converting between degree Celsius and degree Fahrenheit are: °F = °C 9/5 + 32 and °C = (°F - 32) 5/9. So in Celsius scale, 32^{o} F= 0^{o} C

781. (2) The centre of mass of a body or a system of particles is defined as a single point at which the whole mass of the body or system is imagined to be concentrated and all the applied forces acts at that point. It is that point that moves when forces are applied on the body.



782. (4) In all conductors, charges reside on the surface. The reason for this is that conductors have free electrons, that is, the electrons are loosely attached to the nucleus of the atoms in the conductors. When a solid conductor in equilibrium carries a net charge, the charge resides on the outer surface of the conductor. Besides, the electric field just outside the conductor is perpendicular to the surface and that the field inside is zero.



783. (4) The reason the ocean is blue is due to the absorption and scattering of light. The blue wavelengths of light are scattered, similar to the scattering of blue light in the sky but absorption is a much larger factor than scattering for the clear ocean water. In water, absorption is strong in the red and weak in the blue, thus red light is absorbed quickly in the ocean leaving blue. The red, yellow, and green wavelengths of sunlight are absorbed by water molecules in the ocean.

784. (1) X-rays and gamma rays are photons, i.e. high-energy light-waves. When emitted by a source, for example, radium or cobalt, located outside the body, they easily pass through the body, hence they are usually called penetrating radiation. Because X-rays are penetrating, they can be used in diagnostic medicine to image human bones or human organs made opaque by a dye.

785. (3) Any object moving in a circle (or along a circular path) experiences a centripetal force. It is this physical force that pushes or pulls the object towards the center of the circle. In the case of a car moving along a curve, as it makes a turn, the force of friction acting upon the turned wheels of the car provides centripetal force required for circular motion. The net force on a car travelling around a curve is the centripetal force, Fc = m v^2 / r, directed toward the center of the curve.

786. (1) Reflection of sound waves off of surfaces lead to one of two phenomena - an echo or a reverberation.The echo is produced due to hitting of the sound waves with the obstacles which makes the sound to reflect back.Echoes occur when a reflected sound wave reaches the ear more than 0.1 seconds after the original sound wave was heard.

787. (3) Silver has the best thermal conductivity of 429 W/mK at RT (295K). It is followed by copper, gold and aluminium. Metals generally have very good electrical conductivity, that leads to high thermal conductivity. There is a rule governing the relation between electrical conductivity and thermal conductivity, called Wiedemann-Franz Law.

788. (4) Solar, wind and hydro power are examples of cleanest energy sources. According to a new US study, Greenhouse gases produced over the lifetime of a wind turbine are less than that of fossil-fuel based energy sources and most other renewables. Only ocean energy (wave and tidal) and hydropower have lower emissions than wind. As a clean, fuel-free source of energy, wind turbines create energy without generating the damaging pollutants.

789. (4) Ohmic conductors are conductors that obey Ohm's law, that is Voltage/Current ratio is constant; in other words, the equation Resistance = Voltage/Current is obeyed. An Ohmic conductor's resistance does not change with varying current. Metallic conductors such as silver are Ohmic conductors.

790. (2) A spring scale or spring balance or Newton meter is a type of weighing scale. It consists of spring fixed at one end with a hook to attach an object at the other. It works by Hooke's Law, which states that the force needed to extend a spring is proportional to the distance that spring is extended from its rest position.

791. (4) If there is no gravity, there will not be any upward thrust to keep a liquid buoyant. Whenever a body is placed in a fluid, the fluid applies resultant up ward directional force on the body and it is called up thrust. It's numerical value which is the product of volume of the fluid displaced, density of the fluid and acceleration due to gravity at the given place. Up thrust increases with increase in acceleration due to gravity and vice versa.

792. (4) According to Rayleigh's law, the intensity of scattered light varies inversely as the fourth power of its wavelength. Sunlight consists of seven colours. Of these, red has the maximum wavelength. During sunrise and sunset, the rays have to travel a larger part of the atmosphere because they are very close to the horizon. Therefore, light other than red is mostly scat-

tered away. Most of the red light, which is the least scattered, enters our eyes. Hence, the sun and the sky appear red.

793. (2) The boiling point is the temperature at which the vapour pressure of the liquid equals the environmental pressure surrounding the liquid. Atmospheric pressure is due to air above any given point. The atmospheric pressure at high altitudes like hill station is less than at the sea level.Thus, vapour pressure will equal atmospheric pressure at a comparatively low temperature. Thus, the boiling point of water is reduced less than at sea level.

794. (1) The retina is the thin light-sensitive membrane lining the inner eyeball-towards the back of the eye. As our eye lens are convex in nature, they form mostly real and inverted images on the retina. When the images formed are real and inverted, the message sent by the optic nerve are chemical impulses which turn them into erect images that we see.

795. (4) Kinetic energy is the energy associated with the movement of objects. The amount of kinetic energy that an object has depends upon two variables: the mass (m) of the object and the speed (v) of the object. The following equation is used to represent the kinetic energy (KE) of an object:

$$KE = \frac{1}{2} + mv^2$$

796. (2) Temperature is used as a measure for heat in an object by measuring the amount of kinetic energy in the molecules that make up the object. It is a measure of the average kinetic energy of the random molecular motion. Heat is a form of energy that can be transferred from the heat source to the molecules, and it can also change its form from heat to movement. The molecules that gain extra energy will have a higher tendency to move more than the molecules that have not gained the extra energy. Energy of motion is called kinetic energy. When the molecules move or vibrate more, they have a higher kinetic energy, and this is recorded as an increase in temperature. In nutshell, as a body gains or loses kinetic energy its temperature will increase or decrease.

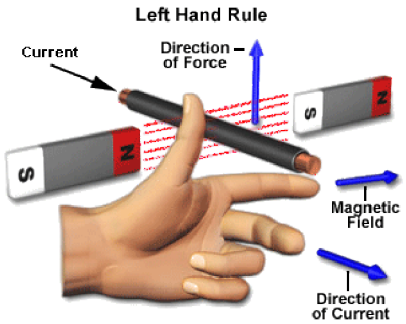
797. (2) When ice floating on water in a vessel melts, the water level in the vessel does not change. This is because when floating, the ice displaces an amount of water equal to its mass, and when melted, it becomes an amount of water equal to its mass. It is accordance with Archimedes Principle, which states that the mass of the liquid displaced by a floating object is equivalent to the mass of the object.

798. (2) In order to convert a Galvanometer into voltmeter, a very high resistance known as "series resistance" is connected in series with the galvanometer. The conversion is made for enabling the galvanometer to measure the potential difference across any component in a circuit.

799. (1) Direct Current (DC) refers to power systems that use only one polarity of voltage or current, and to refer to the constant, zero-frequency, or slowly varying local mean value of a voltage or current. It is the unidirectional flow of electric charge. Direct current is produced by sources such as batteries, power supplies, thermocouples, solar cells, or dynamos.

800. (3) The photoelectric effect is the propensity of high-energy electromagnetic radiation to eject electrons from a given material. The photoelectric effect has been utilized in devices called photocells, consisting of two electrodes in a sealed vacuum tube. By coating one electrode (the photocathode) with a alkali metal of low work function, a photo current could be generated even from visible light. Work function is the minimum energy needed to remove an electron from the surface of a material.

801. (4) Whenever, a current carrying conductor comes under a magnetic field, there will be force acting on the conductor and on the other hand, if a conductor is forcefully brought under a magnetic field, there will be an induced current in that conductor. In both of the phenomenon, there is a relation between magnetic field, current and force. This relation is directionally determined by Fleming Left Hand rule and Fleming Right Hand rule respectively.



802. (3) A brake is a mechanical device that inhibits motion by absorbing energy from a moving system. It is used for slowing or stopping a moving vehicle, wheel, axle, or to prevent its motion, most often accomplished by means of friction. When the brakes are applied, work is done by the friction force between the brakes and the wheels.

803. (*) The reason astronauts experience weightlessness which orbiting the earth in spaceships is that they are in free fall. A spacecraft in orbit is falling towards the Earth, because of gravity, but it is moving forward in its orbit fast enough that the path it follows is a curve that is a closed ellipse. Hence, the astronaut is not able to exert his mass on its surface. This condition is called weightlessness condition.If the spacecraft does not move quickly enough, it would fall prey to the effects of earth's gravitational field and fall to the earth.

Contrary to common misconception, there is no such thing as 'Zero Gravity.' Gravity is everywhere in the universe and manifests itself in black holes, celestial orbits, ocean tides, and even our own weight. The International Space Station, the space shuttle, and satellites are designed to stay in orbit, neither falling to the ground nor shooting off into space.

Best option : (4) Orbital Motion

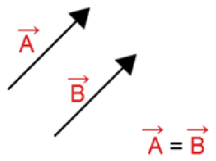
804. (3) A transistor is a semiconductor device used to amplify or switch electronic signals and electrical

power.The transistor invented in 1948 was well suited to the hearing aid application due to low power and small size; hearing aids were an early adopter of transistors. Transistors replaced the need for batteries in hearing aids.

805. (3) As per Planck's law, all objects emit electromagnetic radiation according to their temperature. Colder objects emit waves with very low frequency (such as radio or microwaves), while hot objects emit infrared rays or even ultraviolet and higher frequencies.At room temperature, most of the radiation is in the infra-red region.

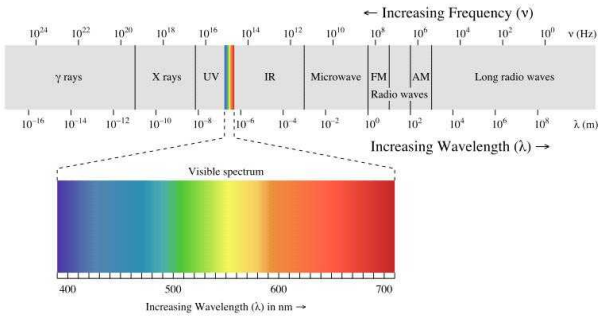
806. (1) A water turbine is a rotary machine that converts kinetic energy and potential energy of water into mechanical work.Hydroelectric power comes from water at work, water in motion. To generate electricity, water must be in motion. This is kinetic (moving) energy. When flowing water turns blades in a turbine, the form is changed to mechanical (machine) energy. The turbine turns the generator rotor which then converts this mechanical energy into another energy form — electricity.

807. (3) If the magnitude as well as direction of two vectors are equal, then they are known as equal vectors. In other words, two vectors are said to be equal, if they possess equal magnitude and are headed towards the same direction. For two equal vectors, their directed line segments must be parallel.



808. (1) The common material used as fuse wire is an alloy of tin and lead (63% tin and 37% lead). Fuse wires provide overcurrent protection of an electrical circuit including the source of power and the load. Its essential component is a metal wire or strip that melts when too much current flows through it, thereby interrupting the flow of current.

809. (1) The electromagnetic spectrum is generally divided into seven regions, in order of decreasing wavelength and increasing energy and frequency: radio waves, microwaves, infrared, visible light, ultraviolet, X-rays and gamma rays.So among the given options, visible lights has the lowest frequency, while gamma rays has the highest.



810. (3) When a fresh egg is placed in regular water, it sinks. However, when the same egg is placed in salt-water, it floats. This is because salt water is denser than the egg causing it to float.

811. (3) In physics, electromagnetic radiation (EMR) refers to the waves (or their quanta, photons) of the electromagnetic field, propagating (radiating) through space carrying electromagnetic radiant energy. It includes radio waves, microwaves, infrared, (visible) light, ultraviolet, X-, and gamma radiation.

812. (1) Graphite is a good conductor of electricity because its electrons are delocalized or free to move around. Each carbon atom in graphite is directly linked to only three carbon atoms through covalent bonds. Therefore, out of the four valence electrons in a carbon atom, only three are used for bonding and the fourth is relatively free and can move from one carbon atom to the other.

813. (3) In addition to transmitting frames directed to a single address, local area networks are capable of sending frames directed to a group of address, called a multicast address, which can be received by a group of stations.They can also send frames directed to all stations using the broadcast address. A frame sent to multicast destination address can be received by all stations configured to listen for that multicast address.

814. (3) Some components like transformers and inductors cannot be integrated into an IC except for very specialized high frequency applications. They have to be connected externally to the semiconductor pins. In general, transformers are located in circuit boards as separate components and cannot be integrated into semiconductor based integrated circuits.

815. (1) When a particle is thrown vertically upwards in space, it will experience constant acceleration towards the ground (irrespective of the direction in which it is moving in), known as acceleration due to gravity. At the highest point, it has zero velocity but has downward acceleration equal to acceleration due to gravity.

816. (4) The timbre or quality of a sound depends on its wave form, which varies with the number of overtones, or harmonics, that are present, their frequencies, and their relative intensities. In simple terms, timbre is what makes a particular musical sound have a different sound from another, even when they have the same pitch and loudness.

817. (3) Recoil is the backward momentum of a gun when it is discharged. In technical terms, the recoil caused by the gun exactly balances the forward momentum of the projectile and exhaust gases (ejecta), According to Newton's third law. In case of canons, the momentum is transferred to the ground through its mount.

818. (4) The sound will never reach Earth because there are not enough molecules or atoms of matter per cubic centimeter of space to create the pressure waves in a medium that is a sound wave. In simple words, Sound propagation needs a medium. The people on the Earth can see the flash, but no sound.

819. (2) Color blindness is the decreased ability to see color or differences in color. The most common form of colour blindness is known as red/green colour blindness and most colour blind people suffer from this. Those affected have difficulty with discriminating red and green hues due to the absence or mutation of the red or green retinal photoreceptors.

820. (4) The motion of a projectile is a two-dimensional motion—Horizontal motion and vertical motion—that

take place independent of each other. The horizontal velocity of a projectile is constant (a never changing in value). The force of gravity continuously affects the vertical component, so the vertical motion is a uniformly accelerated motion.

821. (4) Only transverse waves (such as radio, ultraviolet and infrared waves) can be polarized since their vibrations can potentially occur in all directions perpendicular to the direction of travel. It is therefore possible to confine the vibrations to a single plane. However, sound waves are longitudinal in which vibrations are parallel to the direction of travel of the wave. The vibrations of a longitudinal wave occur along a single line, it is therefore not possible to confine that to a plane. So it cannot be polarized.

822. (1) Absolute zero is the temperature at which all motion in matter stops and is thought to be unreachable. It is the point at which the fundamental particles of nature have minimal vibrational motion, retaining only quantum mechanical, zero-point energy-induced particle motion. By international agreement, absolute zero is defined as precisely; 0 K on the Kelvin scale, which is a thermodynamic (absolute) temperature scale; and –273.15 degrees Celsius on the Celsius scale.

823. (2) An electromagnet is a type of magnet in which the magnetic field is produced by an electric current. The magnetic field disappears when the current is turned off. It is made of soft iron since it has the property of losing its magnetism very quickly. The soft iron core of the electromagnet makes the magnetic field stronger.

824. (3) In circular motion, the magnitude of the velocity of the body is constant but the direction is constantly changing. This means that, even though the speed is not changing, the velocity is changing. This means that body moving in a circular is accelerating. At any instant, the direction of the velocity is a tangent to the circular path. A body moving at constant speed in a circular path experiences an acceleration directed towards the centre of the circular path. This acceleration is called a centripetal acceleration and is provided by a centripetal force. Overall, the displacement, velocity and acceleration are vector quantities. They change; but kinetic energy remains constant because the speed is constant.

825. (1) The Sun is a main-sequence star, and thus generates its energy by nuclear fusion of hydrogen nuclei into helium. In its core, the Sun fuses 620 million metric tons of hydrogen each second. Fusion is a nuclear reaction in which two or more atomic nuclei come very close and then collide at a very high speed and join to form a new nucleus.

826. (3) On a chilly day, the room temperature is lower than our body temperature. Since metals have a higher coefficient of thermal conductivity than plastic, they are better conductor of heat than plastic. So, when we touch the metal cap and the plastic body of a pen, heat from our fingers will flow to the metal cap much more quickly than to the plastic body.

827. (3) Copper is generally preferred for electrical power transmission instead of iron because of its high electrical conductivity and low resistivity. The conductivity (in σ (S/m) at 20 °C) of copper is 5.96×107, while that of iron is 1.00×107. Among metals, silver has the highest electrical conductivity of 6.30×107, but it is not used commonly due to its high cost.

828. (3) A transformer is an electrical device that transfers energy from one circuit to another by magnetic coupling with no moving parts. It converts high voltage AC into low voltage AC and vice-versa. It is based upon the principle of mutual induction. Transformers alone cannot convert AC to DC or DC to AC; besides, they cannot change the voltage or current of DC.

829. (3) Sound "quality" or "timbre" describes those characteristics of sound which allow the ear to distinguish sounds which have the same pitch and loudness. Timbre is mainly determined by the harmonic content of a sound and the dynamic characteristics of the sound such as vibrato and the attack-decay envelope of the sound. Harmonic content is the most important of these.

830. (4) When fast moving electrons strike on high atomic weight substance, X – ray is produced. In contrast, Photoelectric effect takes place when radiation of sufficient frequency incident on the metal surface and electrons are emitted. Hence, X – ray is the inverse phenomenon of photoelectric effect.

831. (4) A single solar cell can produce only a small amount of electricity. In those cases where more electrical power is needed, a large number of solar cells are joined in series. This group of solar cells is called a 'solar cell panel'. Thus, a solar cell panel consists of a large number of solar cells joined together in a definite pattern.

832. (3) A nanometer is a unit of spatial measurement that is 10^{-9} meter, or one billionth of a meter. It is often used to express dimensions on an atomic scale. It is commonly used in nanotechnology, the building of extremely small machines.

833. (4) Relative density is the ratio of the density (mass of a unit volume) of a substance to the density of a given reference material.So, it is a dimensionless quantity and has no unit.

834. (1) Acceleration, in physics, is the rate of change of velocity of an object with respect to time. An object's acceleration is the net result of any and all forces acting on the object, as described by Newton's Second Law. Newton's second law of motion states that acceleration is directly proportional to net force when mass is constant.

835. (1) Adding salt raises the boiling point of water, which allows food to cook at higher temperature. The higher the temperature, the higher the rate of heat transfer between the food and water, thus it cooks more quickly.

836. (2) The hydraulic brake is an arrangement of braking mechanism which uses brake fluid, typically containing glycol ethers or diethylene glycol, to transfer pressure from the controlling mechanism to the braking mechanism. It works on the principle of Pascal's law which states that "pressure at a point in a fluid is equal in all directions in space". When pressure is applied on a fluid it travels equally in all directions so that uniform braking action is applied on all wheels.

837. (4) A fuse wire is a safety wire connected in series with the live wire that has high resistivity and low melting point. Fuses are always connected in series with the component(s) to be protected from overcurrent. In case of any large current supply or malfunctioning in the electric connections, it melts and breaks the electric circuit. □□□