AL HUDA SCIENCE ACADEMY

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Most Important Short Questions with Answers of Physics

Short Questions & Answers

Q1. Can a non-physical quantity be measured? If yes, then how? No, a non-physical quantity cannot be measured using tools or instruments because it does not possess measurable physical properties. Quantities such as love, fear, or wisdom pertain to the perception or interpretation of an observer and can only be described qualitatively or compared using pre-determined criteria.

Q2. Differentiate between physical and non-physical quantities. Physical quantities can be measured directly or indirectly using instruments (e.g., length, mass, time) and describe natural phenomena. Non-physical quantities, like emotions or beauty, cannot be measured with instruments and rely on human perception or estimation rather than numerical measurement.

Q3. Does a non-physical quantity have dimensions? No, a non-physical quantity does not have dimensions because it cannot be measured using standard physical units or instruments. Dimensions are associated with physical quantities that have magnitude and units.

Q4. What is measurement? Name its two parts. A measurement is a process of comparing an unknown quantity with a widely accepted standard quantity known as a unit. It consists of two essential parts: a number (magnitude) and a unit. A measurement without a unit is meaningless.

Q5. Write the names of 3 base quantities and 3 derived quantities. Base quantities: length, mass, time. Derived quantities: speed, area, volume (described in terms of one or more base quantities).

Q6. Differentiate between base and derived quantities. Base quantities are selected arbitrarily by scientists to play a key role (length, mass, time). Derived quantities are defined in terms of one or more base quantities (e.g., speed from distance and time, or density).

Q7. Why do we need a standard unit for measurements? A standard unit avoids confusion and ensures that measurements taken by different people give the same value. Without a standard, measurements using arbitrary methods (like hand spans) would differ from person to person, making trade and scientific exchange difficult.

Q8. Write the names and symbols of all SI base units. Metre (m) — length; Kilogram (kg) — mass; Second (s) — time; Ampere (A) — electric current; Kelvin (K) — temperature; Candela (cd) — intensity of light; Mole (mol) — amount of substance.

Q9. Why are prefixes used? Name three sub-multiple and three multiple prefixes with their symbols. Prefixes express very large or very small quantities conveniently using powers of 10. Sub-multiples: milli (m), micro (μ), nano (n). Multiples: kilo (k), mega (M), giga (G).

Q10. Express the unit of pressure "pascal" in some other units. The pascal (Pa) is a derived unit. Since pressure = force per unit area, $1\ \text{Pa} = 1\ \text{N/m}^2 = 1\ \text{kg}\cdot\text{m}^{-1}\cdot\text{s}^{-2}$.

Q11. What are the key rules for writing SI unit symbols and prefixes correctly? Symbols are written without full stops (SI, not S.I.) and do not take plural forms (5 kg, not 5 kgs). Prefixes are written close to the unit without a space (mm), while compound units have a space (N m). Double prefixes are not allowed.

Q12. Define base units. Give two examples. Base units are the units of the seven base quantities defined by the SI system, which cannot be derived from one another. Examples: metre (m) for length, kilogram (kg) for mass.

Q13. Define prefixes. Give two examples. Prefixes are words or symbols added before an SI unit to represent multiples or sub-multiples of that unit using powers of 10. Examples: "kilo" (k) = 10^3, "milli" (m) = 10^{-3}.

Q14. Convert 3,500,000,000 Hz into MHz and 0.00003 g into µg by using prefixes. 3,500,000,000 Hz = 3500×10^6 Hz = 3500 MHz (since 1 MHz = 10^6 Hz). 0.00003 g = 30×10^{-6} g = 30 µg (since 1 µg = 10^{-6} g).

Q15. Why is a standard unit needed to measure a quantity correctly? Early measurement methods using body parts (hands, feet) varied from person to person, causing confusion and inaccurate results. A standard ensures a measurement taken by anyone, anywhere, gives the same result — facilitating consistent trade and science.

Q16. Express the following in scientific notation: (a) 0.45 m (b) 0.004 kg (c) 186000 s (a) 4.5×10^{-1} m (b) 4×10^{-3} kg (c) 1.86×10^5 s

Q17. Define scientific notation with an example. Scientific notation expresses a number as a value between 1 and 9 multiplied by a whole-number power of 10. Example: the Earth–Sun distance, 138,000,000 km, is written as 1.38×10^8 km.

Q18. Write in standard form: (i) 384,000,000 m (ii) 0.00045 s (i) 3.84×10^8 m (ii) 4.5×10^{-4} s

Q19. What is meant by zero error? Zero error is a defect in a measuring instrument where the zero of the scale does not coincide with the zero index (or the other jaw) when the instrument is closed or not in use. It must be determined and applied to the observed reading for a correct measurement.

Q20. Define measuring tape and write its least count. A measuring tape is a flexible instrument used to measure length, typically ranging from 1 mm to several metres, often used for longer distances. Its least count is 1 mm.

Q21. What are the essential laboratory safety rules to follow during experiments? Handle all apparatus and chemicals carefully; do not taste chemicals; do not eat or drink in the laboratory; never tamper with electrical mains; wash hands after work; avoid placing flammable substances near naked flames.

Q22. Define least count and measuring instrument. Give an example. A measuring instrument is a tool used to measure physical quantities (e.g., metre rule, stopwatch). The least count is the smallest measurement that can be taken accurately with that instrument — e.g., the least count of a metre rule is 1 mm.

Q23. Differentiate between base and derived units. Base units are fundamental units defined by SI that cannot be resolved into simpler units (metre, kilogram). Derived units are expressed in terms of base units (square metre for area, newton for force).

Q24. Define least count. Write the least count of a metre rule. Least count is the smallest measurement an instrument can record accurately. The least count of a standard metre rule is 1 mm.

Q25. Why does parallax error occur? Parallax error occurs when the eye is not positioned directly above the measurement marking (e.g., reading a scale from an angle), causing the object to appear a different length than it actually is. It is avoided by keeping the eye perpendicular to the scale.

Q26. How many divisions are there on a Vernier scale? The Vernier scale on a standard Vernier Calliper has a length of 9 mm divided into 10 equal divisions.

Q27. Write four rules of laboratory safety.

1. Handle all apparatus and chemicals carefully. 2. Do not eat, drink, or play in the laboratory. 3. Do not taste any chemical unless instructed. 4. Wash your hands after all laboratory work.

Q28. Define the pitch of a micrometer screw gauge. The pitch is the distance the spindle moves on the main scale when the thimble completes one full rotation. Typically, the pitch is 0.5 mm.

Q29. For what purpose is a micrometer screw gauge used? It is used to measure very small lengths with high precision, such as the diameter of a wire or the thickness of a metal sheet, correct up to 0.01 mm.

Q30. Why does a micrometer screw gauge measure more accurately than Vernier Callipers? Because it has a smaller least count (0.01 mm) compared to Vernier Callipers (0.1 mm), allowing it to detect smaller differences in length.

Q31. Why is it better to place the object close to the metre scale? Placing the object close to the metre scale (or placing the scale on its edge) helps eliminate parallax error, ensuring the marking is directly adjacent to the object's edge for a more accurate reading.

Q32. Differentiate between systematic and random errors. Systematic errors influence all measurements equally due to a definite cause, such as a zero error in an instrument. Random errors occur due to unknown, unpredictable causes and produce different values on repeated measurement.

Q33. Round off to 2 significant figures: (i) 4.45×10^2 m (ii) 4.55×10^2 m (i) The digit before 5 is even (4), so it remains unchanged: 4.4×10^2 m. (ii) The digit before 5 is odd (5), so it is increased by one: 4.6×10^2 m.

Q34. Define scalar and vector quantities. A scalar quantity is completely described by its magnitude (number and unit) only, e.g., mass or time. A vector quantity requires both magnitude and direction, e.g., velocity or force.

Q35. State the head-to-tail rule for addition of vectors. Draw the vectors such that the head of the first vector coincides with the tail of the second. The resultant vector is drawn from the tail of the first vector to the head of the last vector.

Q36. Differentiate between circular motion and rotatory motion. Circular motion is motion of a body along a circular path (e.g., a stone whirled on a string). Rotatory motion is motion of a body spinning about a fixed axis passing through the body itself (e.g., a spinning top or wheel).

Q37. Define uniform and non-uniform velocities. Uniform velocity occurs when a body covers equal displacements in equal intervals of time (constant speed and direction). Non-uniform (variable) velocity occurs if the speed or direction changes during motion.

Q38. What is a resultant vector? A resultant vector is a single vector that has the same effect as two or more vectors added together — it represents their sum in both magnitude and direction.

Q39. Who discovered relativity? Albert Einstein proposed the theory of special relativity, which modified basic concepts of physics and established the speed of light as a universal constant.

Q40. Is it possible for a body to have acceleration when moving with (i) constant velocity (ii) constant speed? (i) No — if velocity is constant, acceleration is zero (no change in magnitude or direction). (ii) Yes — a body moving with constant speed can have acceleration if its direction changes, such as a car moving on a circular road.

Q41. Define Mechanics. Name its branches. Mechanics is the branch of physics dealing with the motion of objects and the forces that change it. Its two main branches are Kinematics (motion without reference to forces) and Dynamics (forces and their effect on motion).

Q42. Define kinematics. Kinematics is the branch of mechanics that studies motion of objects without referring to the forces causing it, using parameters like position, velocity, and acceleration.

Q43. Write the symbolic representation methods of vectors. In print, vectors are represented by bold-face letters (A, v, F). In handwriting, a small arrow is placed over the letter (e.g., A with arrow, v with arrow).

Q44. Define resultant vector. A resultant vector is a single vector obtained by adding two or more vectors, producing the same effect as the combined action of all individual vectors.

Q45. How are vector quantities important in our daily life? Vector quantities describe direction in addition to magnitude — e.g., knowing a car's velocity tells us not just how fast it's going but also where it's heading, essential for navigation.

Q46. Explain briefly that the state of rest and motion is relative. Rest and motion are relative concepts. An object may be at rest relative to one observer but in motion relative to another — e.g., a passenger in a moving train is at rest relative to other passengers but in motion relative to someone on the platform.

Q47. Differentiate between speed and velocity. Speed is a scalar quantity defined as distance covered per unit time ($v = S/t$). Velocity is a vector quantity defined as the rate of displacement ($v = d/t$), including both magnitude and direction.

Q48. Describe the SI unit of distance and displacement. Both distance (scalar) and displacement (vector) have the metre (m) as their SI unit.

Q49. A body moving with uniform speed — will its velocity be uniform? Give reason. Not necessarily. Uniform speed gives uniform velocity only if the body moves in a straight line. If direction changes (e.g., on a circular track), velocity changes even though speed remains constant, because velocity is a vector.

Q50. A car moving on a circular road may have constant speed, but its velocity is changing at every instant. Why? Velocity involves both magnitude (speed) and direction. On a circular road, even if speed is constant, the direction of motion changes continuously, causing velocity to change.

Q51. Define instantaneous speed. Instantaneous speed is the speed of an object at any specific instant of time — the value shown by a vehicle's speedometer at a particular moment.

Q52. A player covers 80 m in 10 seconds. Find the average speed. $v_{av} = S/t = 80\text{ m} / 10\text{ s} = 8\text{ m/s}$

Q53. An eagle dives to the ground along a 300 m path with an average speed of 60 m/s. How long does it take? $t = S/v_{av} = 300\text{ m} / 60\text{ m/s} = 5\text{ s}$

Q54. Is it possible that the velocity of an object is zero at an instant, but its acceleration is not zero? Give an example. Yes. When a body is thrown vertically upward, its velocity becomes zero at the highest point, but gravitational acceleration (g) still acts downward.

Q55. Define acceleration. Give its formula. Acceleration is the time rate of change of velocity of a body: $a_{av} = (v_f - v_i) / t$, where v_f is final velocity, v_i is initial velocity, and t is time.

Q56. Define positive and negative acceleration. Acceleration is positive if velocity is increasing, and negative (deceleration/retardation) if velocity is decreasing.

Q57. What is retardation? Retardation, or negative acceleration, occurs when a body's velocity decreases over time; its direction is opposite to the direction of motion.

Q58. What are distance–time and speed–time graphs? A distance–time graph shows the relationship between distance covered and time taken. A speed–time graph shows the relationship between speed and time elapsed.

Q59. Define graph. A graph is a pictorial diagram, usually a straight line or curve, showing the relationship between two physical quantities (variables).

Q60. Speed of a car is 72 km/h. Convert this to m/s. $72\text{ km/h} = (72 \times 1000\text{ m}) / 3600\text{ s} = 72000/3600 = 20\text{ m/s}$

Q61. Convert m/s to km/h. Multiply the value by 3.6. Example: $20\text{ m/s} = 20 \times 3.6 = 72\text{ km/h}$

Q62. Write the three equations of motion.

1. $v_f = v_i + at$
2. $S = v_i t + \frac{1}{2}at^2$
3. $2aS = v_f^2 - v_i^2$

Q63. Falling objects near Earth have the same constant acceleration. Does this mean a heavier object falls faster than a lighter one? No. In the absence of air resistance (vacuum), both light and heavy objects fall with the same acceleration due to gravity ($g = 10\text{ m/s}^2$) and move side by side.

Q64. What is meant by the universal speed limit? It refers to the speed of light in a vacuum, approximately 3×10^8 m/s. According to Einstein's theory of relativity, no object with mass can reach or exceed this speed.

Q65. Write three equations of motion under gravity.

1. $v_f = v_i + gt$

2. $S = v_i t + \frac{1}{2}gt^2$
3. $2gS = v_f^2 - v_i^2$

Q66. What kind of change in motion may be produced by a force? A force can start a body from rest, stop a moving body, or change the magnitude (speed) and direction of its velocity — force produces acceleration or deceleration.

Q67. Give 5 examples of contact forces. Friction, drag force, thrust, normal force, and tension force — all act when objects are in physical contact.

Q68. Define the common concept of force with an example. Force is a push or a pull that affects the motion of a body — e.g., pushing a door open or pulling a wheelbarrow.

Q69. Differentiate between electrostatic and magnetic field. An electrostatic field is the region where an electrostatic force acts between electric charges. A magnetic field is the region where a magnet exerts force on other magnets or magnetic materials like iron.

Q70. What are strong and weak nuclear forces? The strong nuclear force holds protons and neutrons together in the nucleus, overcoming repulsion. The weak nuclear force is responsible for nuclear disintegration, such as beta decay where a neutron transforms into a proton.

Q71. Define contact forces with an example. A contact force is exerted by one object on another at the point of physical contact — e.g., pushing a book on a table, or friction between a tyre and the road.

Q72. Differentiate between friction and drag force. Friction resists motion between two solid surfaces in contact. Drag force is the resistant force experienced by an object moving through a fluid (liquid or gas).

Q73. Differentiate between normal force and tension. Normal force is the perpendicular reaction force exerted by a surface on an object resting on it. Tension is the pulling force experienced by a rope or string when pulled by a load.

Q74. Define air resistance. Air resistance is a type of friction/drag force that opposes an object's motion as it falls or moves through air, depending on speed and surface area.

Q75. What is elastic force? Give examples. Elastic force restores materials to their original shape after deformation. Examples: stretched rubber bands, springs, a trampoline.

Q76. Define gravitational force with an example. Gravitational force is the attractive force between all bodies with mass — e.g., Earth attracting a falling apple.

Q77. Differentiate between electrostatic force and magnetic force. Electrostatic force acts between electric charges (like charges repel, unlike attract). Magnetic force is exerted by a magnet on other magnets or magnetic materials. Both are non-contact forces.

Q78. An object moves with constant velocity in free space. How long will it continue to move with this velocity? In free space, with no external forces (friction/air resistance), it will continue moving with the same constant velocity forever, per Newton's first law (inertia).

Q79. Why has Newton's first law not been proved on Earth? Because on Earth, opposing forces like friction and air resistance are always present, making it difficult to observe a body continuing motion indefinitely without a net force.

Q80. When sitting in a car that suddenly accelerates, you are pushed back into the seat. Why? Due to inertia — the lower part of your body moves forward with the car, but your upper body tends to remain at rest, so you feel pushed back against the seat.

Q81. State Newton's first law of motion. A body continues its state of rest or uniform motion in a straight line unless acted upon by some net external force.

Q82. State Newton's third law of motion. For every action, there is an equal and opposite reaction. If one body exerts a force on a second, the second exerts an equal and opposite force on the first.

Q83. When a bus suddenly starts, passengers fall backward. Explain why. Due to inertia — passengers' bodies want to retain their state of rest. When the bus moves forward suddenly, the lower body moves with it while the upper body remains stationary, causing a backward fall.

Q84. Derive F = ma from Newton's second law. Acceleration a is directly proportional to force F ($a \propto F$) and inversely proportional to mass m ($a \propto 1/m$). Combining: $a \propto F/m$, or $F \propto ma$. Using SI units with constant k = 1, F = ma.

Q85. When someone jumps from a small boat onto the river bank, why does the jumper often fall into the water? As the jumper pushes the boat backward (action) to jump forward, the boat moves away (reaction). If the boat is small and unstable, it moves back significantly, and the jumper may not get enough forward reaction to reach the bank, falling into the water.

Q86. Write the difference between mass and weight. Mass is the quantity of matter in a body — a scalar, constant everywhere. Weight is the force of gravity acting on an object (w = mg) — a vector, varying with the gravitational field strength of the location.

Q87. A 10 kg block moves on a frictionless horizontal surface with an acceleration of 2 m/s². What is the force acting on the block? $F = ma = 10\ kg \times 2\ m/s^2 = 20\ N$

Q88. Define gravitational field strength. It is the gravitational force acting on a unit mass at a point in the gravitational field, denoted by 'g'.

Q89. Write the value of gravitational field strength. Near Earth's surface, $g \approx 10\ N/kg$ (or $10\ m/s^2$).

Q90. Define terminal velocity of an object. Terminal velocity is the constant velocity attained by a falling object when the upward force of air resistance equals the downward force of gravity (weight) — the object stops accelerating.

Q91. Differentiate between friction and kinetic friction. Friction is the general force opposing motion between surfaces. Kinetic friction is the specific type of sliding friction acting when a body is already moving over a surface.

Q92. Define rolling friction. Rolling friction is the friction produced when an object (typically with wheels) rolls over a surface. It is significantly smaller (about 100 times less) than sliding friction.

Q93. Define streamline flow. Streamline flow is the smooth flow of a fluid (air or water) over a surface. Vehicles are streamlined to allow air to pass smoothly over them, reducing air resistance.

Q94. Why doesn't water form a wet layer between the tyre surface and the road, and how does this reduce skidding? Water does not form a continuous slippery layer because tread patterns (grooves) on the tyre allow water to escape or channel away, maintaining contact between the tyre and road, reducing skidding.

Q95. How does a wheel produce a frictional force when it contacts the surface? Practically, the contact point of a wheel is not perfectly circular — it becomes flat under pressure. This small flat portion tends to slide against the surface, producing a small frictional force.

Q96. How does a hovercraft move over both water and ground? A hovercraft ejects air underneath using powerful fans, creating an air cushion. It moves over this cushion, which offers very small friction, allowing travel over both water and land.

Q97. Define sliding friction. Name its categories. Sliding friction exists between two solid surfaces sliding against each other. Its categories are static friction (before motion starts) and kinetic friction (during motion).

Q98. Differentiate between static friction and kinetic friction. Static friction (F_s) is the opposing force preventing a stationary object from moving when force is applied. Kinetic friction acts on an object while it is sliding/moving. Static friction is generally greater than kinetic friction.

Q99. State the law of conservation of linear momentum. If no external force acts on an isolated system, the total linear momentum remains constant — total momentum before collision equals total momentum after collision.

Q100. Differentiate between impulse and momentum. Momentum ($p = mv$) is the product of mass and velocity, representing quantity of motion. Impulse ($I = F \times \Delta t$) is the product of a large force and the short time it acts, equal to the total change in momentum.

Q101. A bullet of mass 15 g is fired with a velocity of 150 m/s. What is its momentum? $m = 15$ g = 0.015 kg, $v = 150$ m/s $p = m \times v = 0.015 \times 150 = 2.25$ kg·m/s

Q102. How do crumple zones in automobiles help protect passengers during an accident? Crumple zones compress/deform during a crash, absorbing crash energy and increasing the time of impact, thereby reducing the force transmitted to passengers and the cabin.

Q103. What is a seat belt, and how does it help protect passengers in a car? A seatbelt prevents passengers from moving forward due to inertia when a car stops suddenly, reducing the chance of hitting the windshield or steering wheel.

Q104. A person falling on a cemented floor gets badly hurt. Explain why. Hitting a hard floor changes the person's momentum to zero in a very short time. By $F = \Delta p/t$, a short time results in a very large impact force, causing injury.

Q105. A cricket player draws back his hands while catching a ball. Explain why. Pulling hands back increases the time interval over which the ball's momentum changes to zero, reducing the impact force ($F = \Delta p/t$) on the hands, preventing injury.

Q106. State Newton's second law of motion in terms of momentum. The time rate of change of momentum of a body is equal to the net force acting on it ($F = \Delta p/\Delta t$); the direction of change is the same as the force.

Q107. What is the advantage of air bags over seat belts in terms of momentum? While seatbelts restrain the passenger, airbags provide a cushion that increases the impact time for the upper body during a crash, reducing the rate of change of momentum and thus the force exerted.

Q108. When a cricket ball hits high, a fielder draws hands backward while catching it. Why? Drawing hands back increases the time taken to stop the ball. Since force is the rate of change of momentum ($F = \Delta p/t$), increasing time reduces the impact force.

Q109. Define system and isolated system. A system is a collection of objects being studied. An isolated system is one on which no external forces act — interactions occur only between objects within the system.

Q110. State the law of conservation of momentum. For an isolated system (no external force), the total momentum remains constant before and after an interaction, such as a collision.

Short Questions & Answers

Q1. Define like and unlike parallel forces. Like parallel forces are parallel to each other and act in the same direction. Unlike parallel forces are parallel but act in opposite directions.

Q2. Difference between like and unlike parallel forces. Like parallel forces act in the same direction (e.g., people pushing a bus from behind); unlike parallel forces act in opposite directions (e.g., forces on a steering wheel).

Q3. Differentiate between like parallel forces and unlike parallel forces. Like parallel forces act parallel to each other in the same direction. Unlike parallel forces act parallel to each other but in opposite directions.

Q4. A ripe mango does not normally fall from the tree, but when the branch is shaken, it falls easily. Why? This is due to inertia. When the branch is shaken, it moves, but the mango tends to remain at rest due to inertia. This creates tension that breaks the stem, and gravity pulls the mango down.

Q5. Define resultant force. A resultant force is a single force having the same effect as the combined effect of all forces being added — the vector sum of all individual forces acting on a body.

Q6. Explain the head-to-tail rule. A graphical method to add vectors: draw the vectors such that the tail of the second coincides with the head of the first. The resultant is drawn from the tail of the first to the head of the last vector.

Q7. What is the line of action of a force? The line along which a force acts, passing through the point of application and extending in the direction of the force vector.

Q8. Define couple and give an example. A couple is formed by two unlike parallel forces of the same magnitude but not along the same line of action. Example: forces applied to a steering wheel or a double-arm spanner.

Q9. Define turning effect of a force (torque) with examples. Torque (moment of force) is the product of the force and the moment arm ($\tau = F \times L$). Examples: opening a door, tightening a nut with a spanner.

Q10. Differentiate between line of action of force and moment arm. The line of action is the straight line along which the force acts. The moment arm is the perpendicular distance from the axis of rotation to the line of action.

Q11. Give a real-life example of torque. Using a spanner to loosen/tighten a nut — the force at the end of the handle creates torque that turns the nut. Another example: opening a door by pushing the handle.

Q12. Why are steering wheels of smaller diameter installed in modern vehicles? Because modern vehicles use power steering systems — a hydraulic or electric pump provides the necessary force, so a large moment arm (large wheel) is not required.

Q13. What are rectangular components of a vector and their values? Rectangular components are components of a vector that are perpendicular to each other. For a force F at angle θ with the x-axis: horizontal component $F_x = F \cos \theta$; vertical component $F_y = F \sin \theta$.

Q14. What is resolution of force? Resolution of force is splitting a single force vector into two or more components (usually perpendicular), which when combined produce the same effect as the original force.

Q15. Define rectangular components of a force. The split parts of a force that are mutually perpendicular (usually along x and y axes), typically denoted F_x and F_y.

Q16. Can a rectangular component of a vector be greater than the resultant vector? No — the components form the sides of a right-angled triangle where the resultant is the hypotenuse, always the longest side.

Q17. How does a tightrope walker balance himself? He carries a long pole (often bamboo) to increase his moment of inertia and adjust his center of gravity. By shifting the pole, he keeps his center of gravity vertically above the rope.

Q18. State the principle of moments. A body is balanced if the sum of clockwise moments acting on it equals the sum of anticlockwise moments about the pivot.

Q19. Differentiate between clockwise and anticlockwise moment. A clockwise moment tends to rotate a body in the direction of clock hands (usually negative). An anticlockwise moment rotates a body opposite to clock hands (usually positive).

Q20. Give an example of a body that is moving yet in equilibrium. A paratrooper falling with terminal velocity is in dynamic equilibrium — net force is zero (weight balanced by air resistance), but the body moves with uniform velocity.

Q21. Differentiate between static and dynamic equilibrium. Static equilibrium: a body at rest under the action of forces (e.g., a book on a table). Dynamic equilibrium: a body moving with uniform velocity (zero acceleration) under balanced forces.

Q22. State the first condition of equilibrium. A body is in equilibrium if the vector sum of all external forces acting on it is zero ($\Sigma F = 0$), meaning $\Sigma F_x = 0$ and $\Sigma F_y = 0$.

Q23. State the second condition of equilibrium. For a body to be in complete equilibrium, the vector sum of all torques acting on it about any axis must be zero ($\Sigma\tau = 0$).

Q24. Define stable equilibrium. A body is in stable equilibrium if, after a slight tilt, it returns to its original position. The center of gravity is usually at its lowest position and rises when tilted.

Q25. Define unstable equilibrium. A body is in unstable equilibrium if, after a slight tilt, it moves further from its original position. The center of gravity is at its highest point and lowers when tilted.

Q26. Define neutral equilibrium with an example. A body is in neutral equilibrium if it stays in its new position after being disturbed; the height of its center of gravity remains constant. Example: a ball rolling on a horizontal surface.

Q27. Define centripetal force. Write its formula and direction. Centripetal force keeps a body moving in a circular path, always directed toward the center of the circle. Formula: $Fc = mv^2/r$.

Q28. Define centripetal acceleration and write its equation. Centripetal acceleration is produced by centripetal force, directed toward the center of the circle. Equation: $ac = v^2/r$.

Q29. What is the work done on an object that remains at rest when a force is applied to it? Zero. By $W = F \times S$, if there is no displacement ($S = 0$), no work is done regardless of the applied force.

Q30. Define work and its SI unit. Work is the product of the force acting on an object and the distance the object moves in the direction of the force ($W = FS$). Its SI unit is the Joule (J).

Q31. Define efficiency of a working system. Why can't a system have 100% efficiency? Efficiency is the ratio of useful output energy to total input energy. 100% efficiency is impossible because some energy is always lost to overcome friction and air resistance, usually as heat.

Q32. A person does 200 J of work pushing a carton through 5 m. How much force is applied? $W = F \times S \rightarrow 200 = F \times 5 \rightarrow F = 40$ N

Q33. Find the work done by a 65 N force pulling a suitcase 20 m (at 30° to horizontal). $W = FS \cos\theta = 65 \times 20 \times \cos 30° = 1300 \times 0.866 = 1125.8$ J

Q34. A 120 N block is dragged up a 20 m slope with a force of 100 N to lift it 10 m. Calculate the efficiency. Input energy = 100 N × 20 m = 2000 J. Output energy = 120 N × 10 m = 1200 J. Efficiency = (1200/2000) × 100 = 60%

Q35. Discuss the case when work done is maximum. Work done is maximum when the force is applied in the same direction as the displacement ($\theta = 0°$, $\cos 0° = 1$), so $W = F \times S$.

Q36. How is work done if a 4 kg brick is pulled up a height of 5 m? $W = mgh = 4\text{ kg} \times 10\text{ m/s}^2 \times 5\text{ m} = 200$ J

Q37. Define the SI unit of work. Also discuss its bigger units. The SI unit is the Joule (J) — the work done when a 1 N force moves a body 1 m. Bigger units: kilojoule (1 kJ = 1000 J), megajoule (1 MJ = 10^6 J).

Q38. A person does 200 J of work pushing a carton through 5 m. How much force is applied? $W = F \times S \rightarrow 200 = F \times 5 \rightarrow F = 40$ N

Q39. A slow-moving car may have more kinetic energy than a fast-moving motorcycle. How is this possible? Kinetic energy depends on both mass and velocity (K.E. = $\frac{1}{2}mv^2$). A car's much larger mass can give it more kinetic energy even at lower speed than a motorcycle's.

Q40. A woman gains 4500 J of gravitational PE running up stairs. If she runs up with twice the speed, what will her PE gain be? The same, 4500 J. Potential energy (P.E. = mgh) depends only on mass, gravity, and height — not speed.

Q41. Find an expression for the kinetic energy of a moving body. A body of mass m at rest is moved distance S by force F to velocity v. Work done $W = F \times S$. Since $F = ma$ and $2aS = v^2$, substituting gives $W = \frac{1}{2}mv^2$. Thus K.E. = $\frac{1}{2}mv^2$.

Q42. What is gravitational potential energy? Give an example. Energy possessed by a body due to its position or height relative to Earth. Examples: water stored in a dam, a stone lifted to a height.

Q43. Describe the conservation of energy. Energy cannot be created or destroyed, only converted from one form to another. The total energy in an isolated system remains constant.

Q44. Difference between nuclear energy and chemical energy. Chemical energy is stored in chemical bonds (e.g., in food or fuel). Nuclear energy is stored in the nucleus of an atom, released during fission or fusion.

Q45. Difference between gravitational potential energy and nuclear energy. Gravitational PE is due to height above the ground (mgh). Nuclear energy is stored within the atomic nucleus, released when nuclei split or combine.

Q46. According to Einstein's theory of relativity, how are matter and energy related? Mass and energy are interchangeable, described by $E = mc^2$, where c is the speed of light.

Q47. A 10 kg body is raised to a height of 5 m. Find its gravitational potential energy. P.E. = mgh = $10 \times 10 \times 5 = 500$ J

Q48. In which form is energy stored in a stretched bow? As elastic potential energy.

Q49. Differentiate between kinetic energy and potential energy. Kinetic energy is due to motion (K.E. = $\frac{1}{2}mv^2$). Potential energy is due to position or configuration (e.g., P.E. = mgh).

Q50. What is the energy content of the nuclear bomb dropped on Hiroshima? Approximately 8.0×10^{13} Joules.

Q51. Describe the energy output of a power station in one year. A typical large power station generates approximately 10^{16} Joules per year.

Q52. Write the formula and SI unit of potential energy. Formula: P.E. = mgh. SI unit: Joule (J).

Q53. Differentiate between gravitational potential energy and elastic potential energy. Gravitational PE depends on the height of an object (mgh). Elastic PE is the energy stored in a deformed elastic object, such as a compressed spring or stretched bow.

Q54. Differentiate between chemical potential energy and nuclear potential energy. Chemical PE is stored in chemical bonds and released during chemical reactions (e.g., burning coal). Nuclear PE is stored in atomic nuclei and released during fission or fusion.

Q55. Comment on the statement: "An object has one joule of potential energy." This means 1 J of work was done to lift the object to its current position against gravity, or it has the capacity to do 1 J of work if allowed to fall.

Q56. State the law of conservation of energy. Energy can neither be created nor destroyed, only changed from one form to another; the total energy of a system remains constant.

Q57. What is meant by waste energy? Energy not used for useful work during an energy transformation — it often appears as heat (friction) or sound and dissipates into the atmosphere.

Q58. Difference between renewable and non-renewable energy. Renewable energy (solar, wind) can be replenished naturally in a short time. Non-renewable energy (coal, oil) takes millions of years to form and is depleted with use.

Q59. Describe two advantages of energy production. It drives industrial and economic growth by powering factories and transportation, and improves quality of life by providing electricity for homes, hospitals, and communication.

Q60. Write two disadvantages of energy production. Burning fossil fuels produces harmful gases causing pollution and global warming. Nuclear energy production carries the risk of radiation leaks and hazardous radioactive waste.

Q61. Name some non-renewable energy sources. Coal, petroleum (oil), and natural gas — fossil fuels that cannot be replaced once consumed.

Q62. What is power? Define the unit used for it. Power is the rate of doing work or transferring energy ($P = W/t$). Its SI unit is the Watt (W) — one joule of work done in one second.

Q63. What do you know about the watt? The watt is the SI unit of power — the power developed when 1 J of work is done in 1 second ($1\ W = 1\ J/s$).

Q64. What is the unit of power in the British engineering system? The horsepower (hp). $1\ hp \approx 746$ Watts.

Q65. Calculate the power of a machine that does 4 J of work in 2 seconds. $P = Work/Time = 4\ J / 2\ s = 2$ Watts

Q66. Difference between output and input energy. Input energy is the total energy supplied to a machine/system. Output energy is the useful work or energy delivered. Efficiency is the ratio of output to input.

Q67. Why is the energy output always less than the energy input? Because some input energy is always wasted overcoming friction and air resistance, dissipating as heat and sound rather than doing useful work.

Q68. A cyclist does 12 J of useful work from every 80 J of food energy. Find his % efficiency. Efficiency $= (Output/Input) \times 100 = (12/80) \times 100 = 15\%$

Q69. Why doesn't an ideal system exist in daily life? Because frictional forces and air resistance are always present in real-world systems, causing unavoidable energy losses as heat.

Short Questions & Answers

Chapter 6: Properties of Matter

Q70. State what you mean by elasticity of a solid. Elasticity is the property of a solid that enables it to return to its original shape and size after the deforming force is removed.

Q71. Describe deformation of solids with an example. Deformation is a change in shape, size, or length of a solid when an external force is applied — e.g., stretching a rubber band or compressing a spring.

Q72. Steel is more elastic than rubber. Why? Steel offers greater resistance to deformation and returns to its original shape more precisely with greater force than rubber does, for the same strain.

Q73. Write four differences between the solid and gas states of matter.

1. Solids have fixed shape; gases do not. 2. Solids have fixed volume; gases fill their container. 3. Molecules in solids are tightly packed; in gases, far apart. 4. Strong intermolecular forces in solids; very weak in gases.

Q74. Define deforming force. An external force applied to an object that changes its shape, length, or volume. If the object is elastic, it recovers when the force is removed.

Q75. Describe any two applications of Hooke's law. Hooke's law is applied in spring balances (weighing objects) and in the balance wheels of mechanical clocks (regulating timekeeping).

Q76. Difference between galvanometer and spring scales. A spring scale measures weight/force using the extension of a spring. A galvanometer detects small electric currents using the twist of a suspension wire or hairspring. Both rely on elasticity.

Q77. Define elastic limit and Hooke's law. Hooke's law: stress is directly proportional to strain within the elastic limit ($F = kx$). Elastic limit is the maximum stress a material can endure without permanent deformation.

Q78. What is spring constant? Write its SI unit. Spring constant (k) measures the stiffness of a spring: $k = F/x$. SI unit: Newton per metre (N/m).

Q79. Give names of three applications of Hooke's law.

1. Spring balances. 2. Suspension systems of vehicles. 3. Galvanometers.

Q80. Springs are made of steel instead of iron. Why? Steel is more elastic and durable than pure iron and can withstand repeated stress without permanent deformation or breaking.

Q81. Why do heavy animals like elephants have a large foot area? To increase the surface area in contact with the ground, reducing pressure exerted ($P = F/A$) and preventing sinking into the soil.

Q82. Why is it painful to walk barefoot on pebbles? Pebbles have small surface areas; the body's weight acts on a small area, creating very high pressure ($P = F/A$), causing pain.

Q83. Distinguish between force and pressure. Force is a push or pull measured in Newtons (N). Pressure is force acting normally per unit area, measured in Pascals (Pa) — it depends on the area over which force is applied.

Q84. Describe any two examples of pressure in daily life.

1. Cutting with a sharp knife is easier because the thin edge exerts high pressure. 2. Inserting a thumb tack is easy because the sharp point concentrates force into high pressure.

Q85. Why do sports boots have studs on their soles? Studs reduce the contact area with the ground, increasing pressure so they sink in slightly, providing better grip/traction and preventing slipping.

Q86. A girl walking on a carpet in high heels leaves deep impressions. Why? High heels have a very small contact area; the weight concentrated there exerts extremely high pressure, crushing carpet fibers and leaving marks.

Q87. Why is the cutting edge of a knife made very thin? A thin edge has a very small surface area — for a given force, this produces very high pressure, making cutting easier.

Q88. Why are water tanks constructed at the highest level in houses? To increase the height (h) of the water column. Since liquid pressure depends on depth ($P = \rho gh$), greater height ensures sufficient pressure for water to reach taps.

Q89. Define pressure. Write its formula and unit. Pressure is force applied perpendicular to a surface per unit area: $P = F/A$. SI unit: Pascal (Pa) or N/m^2.

Q90. What is one pascal? The pressure exerted when a force of 1 N acts normally on an area of 1 m^2.

Q91. What is the relationship between liquid pressure and depth? Liquid pressure is directly proportional to depth: $P = \rho gh$. As depth increases, pressure increases.

Q92. Calculate the pressure of a column of mercury 76 cm high (density of mercury = 13.6×10^3 kg/m^3). $P = \rho gh = 13600 \times 10 \times 0.76 = 101{,}328$ Pa $\approx 1.013 \times 10^5$ Pa

Q93. Describe atmospheric pressure. The pressure exerted by the weight of the atmosphere (air) acting on Earth's surface — approximately 101,300 Pa at sea level.

Q94. Which instrument measures atmospheric pressure? A barometer — the most common type being the mercury barometer.

Q95. How does a change in atmospheric pressure relate to weather? A sudden fall in atmospheric pressure often indicates a storm or rain. A gradual rise usually predicts fair, dry weather.

Q96. Define atmospheric pressure. The force per unit area exerted against a surface by the weight of the air above it.

Q97. Explain the effect of variation of atmospheric pressure with height. As altitude increases, air density and the height of the air column above decrease. Consequently, atmospheric pressure decreases with increasing height.

Q98. State Pascal's law. Give an application. Pressure applied at any point in a liquid enclosed in a container is transmitted without loss to all other parts of the liquid. Application: the hydraulic press.

Q99. State the basic principle used in the hydraulic brake system of automobiles. Hydraulic brakes work on Pascal's law — pressure applied to the brake pedal is transmitted equally through the brake fluid to the pistons at the wheels.

Q100. Define force multiplier. A force multiplier is a machine that allows a small input force to produce a large output force — hydraulic systems (like a press) act as force multipliers based on Pascal's law.

Q101. Define hydraulic brake. A braking mechanism that uses brake fluid to transfer pressure from the controlling mechanism (pedal) to the braking mechanism (pads/discs), amplifying force.

Q102. Write the advantages of Pascal's law. It allows the design of hydraulic systems that lift very heavy loads with small forces (force multiplication) and transmit force to remote locations via pipes.

Q103. Write the uses of a hydraulic press.

1. Compressing cotton bales and other materials. 2. Lifting heavy loads like cars in service stations. 3. Forging and shaping metals.

Chapter 7: Thermal Properties of Matter

Q1. What is the effect of raising the temperature of a liquid? When heated, a liquid's temperature rises and molecular motion becomes more vigorous, increasing average kinetic energy and causing thermal expansion or a change of state.

Q2. What is meant by the temperature of a body? The degree of hotness or coldness of a body — a physical quantity measured with a thermometer, depending on the average kinetic energy of its molecules.

Q3. What determines the direction of heat flow? Temperature. Heat always flows from a body at a higher temperature to one at a lower temperature until thermal equilibrium is reached.

Q4. Distinguish between heat and internal energy. Internal energy is the sum of kinetic and potential energies of all molecules within an object. Heat is energy in transit, transferred between objects due to a temperature difference.

Q5. Relation between temperature and internal energy. As temperature increases, molecular motion becomes more vigorous, increasing internal energy — a direct relationship.

Q6. Differentiate between temperature and heat. Temperature measures the degree of hotness/coldness (average kinetic energy of molecules). Heat is the energy transferred between bodies due to a temperature difference, not contained within a body.

Q7. Why does heat energy transfer from one thing to another? Because of the temperature difference between them — thermal energy naturally flows from higher to lower temperature.

Q8. Why does a cup of tea get cold after some time? Heat energy transfers from the hot tea to the cooler surroundings until the tea's temperature equals the surrounding temperature.

Q9. Discuss whether the Sun is matter. Yes — the Sun is composed of plasma, the fourth state of matter, consisting largely of ionized atoms, positive ions, and electrons.

Q10. What is meant by thermometric property? List some thermometric properties. A physical property that changes appreciably with temperature and is used to measure it — e.g., thermal expansion, gas pressure, electrical resistance of a wire.

Q11. Describe the main scales used for measuring temperature. Celsius (Centigrade), Fahrenheit, and Kelvin (Absolute) scales — each assigning different numerical values to fixed points like freezing/boiling points of water.

Q12. Write down basic thermometric properties. Good conductor of heat, uniform thermal expansion, high boiling point, low freezing point, large expansivity, and visibility.

Q13. Explain the liquid-in-glass thermometer. It measures temperature based on the expansion of a liquid (mercury or alcohol) in a narrow glass tube — as temperature rises, the liquid expands uniformly and moves up the capillary tube.

Q14. Differentiate between upper and lower fixed points. The lower fixed point (ice point) is the melting point of pure ice. The upper fixed point (steam point) is the temperature of steam above boiling water at standard atmospheric pressure.

Q15. Define the Fahrenheit scale and label its fixed points. The interval between fixed points is divided into 180 parts. Lower fixed point (ice point) = 32°F; upper fixed point (steam point) = 212°F.

Q16. Define the absolute (Kelvin) temperature scale. Used in scientific measurement; its zero point is absolute zero (0 K), and the interval between its fixed points (273 K and 373 K) is divided into 100 equal parts.

Q17. Explain the relationship between Kelvin and Celsius scales. $T_K = T_C + 273$. One degree on the Celsius scale equals one Kelvin on the Absolute scale.

Q18. How much would 30°C be on the Fahrenheit and Kelvin scales? Fahrenheit: $T_F = (9/5) \times 30 + 32 = 54 + 32 = 86°F$ Kelvin: $T_K = 30 + 273 = 303\ K$

Q19. Define thermocouple thermometer. Two wires of different metals joined to form two junctions; it measures temperature by detecting the electric current/voltage produced due to the temperature difference between the junctions.

Q20. Why are the walls of a thermometer bulb thin? To allow heat to conduct quickly from the object to the liquid inside, enabling a rapid response to temperature changes.

Q21. What are thermometric properties? Physical characteristics of materials that change uniformly and appreciably with temperature, making them suitable for use in thermometers — e.g., volume expansion of liquids, electrical resistance.

Q22. Define absolute zero. What is its value? The temperature at which molecules cease to move and their average kinetic energy becomes zero. Value: −273.15°C (taken as −273°C) or 0 K.

Q23. Why does current flow in a thermocouple thermometer? A potential difference is produced across the two junctions of different metals when kept at different temperatures — the greater the temperature difference, the greater the voltage.

Q24. Why is mercury usually preferred to alcohol as a thermometric liquid? Mercury is a good conductor of heat, is opaque and visible, does not wet glass, has uniform thermal expansion, and covers a wide temperature range with a high boiling point.

Q25. Why are there no negative numbers on the Kelvin scale? Because its zero point (0 K) represents absolute zero — the lowest possible temperature, where molecular motion ceases.

Chapter 8: Magnetism

Q26. Define magnetism with examples. Magnetism is a force acting at a distance on magnetic materials, causing attraction — e.g., a magnet attracting iron nails, nickel rings, or paper clips.

Q27. Differentiate between magnetic and non-magnetic materials. Magnetic materials (iron, nickel, cobalt) are attracted by magnets and can be magnetized. Non-magnetic materials (wood, glass, copper) are not attracted by magnets.

Q28. Define magnet. How many properties does a magnet have? A magnet attracts magnetic materials and aligns north–south when freely suspended. Key properties: two poles (N and S), attraction of magnetic materials, and attraction/repulsion between poles.

Q29. Difference between north and south magnetic poles. The pole of a suspended magnet pointing toward geographic north is the north pole (N); the one pointing toward geographic south is the south pole (S).

Q30. Define magnetic pole and attraction/repulsion of magnetic poles. Magnetic poles are the ends of a magnet where the magnetic force is strongest. Like poles (N-N or S-S) repel; unlike poles (N-S) attract.

Q31. Define induced magnetism. Temporary magnetism produced in a magnetic material (like iron) when placed near or in contact with a permanent magnet; it vanishes when the permanent magnet is removed.

Q32. Define magnetised and unmagnetised. A magnetized material has its magnetic domains aligned, creating a net magnetic field. An unmagnetized material has randomly oriented domains, so their fields cancel out.

Q33. Describe the direction of internal and external magnetic field lines. Externally, field lines appear to originate from the north pole and end at the south pole. Internally, they form continuous loops from south to north.

Q34. Define magnetization. The process of inducing magnetism in a material, typically by aligning its magnetic domains using an external field or stroking with a permanent magnet.

Q35. What are temporary and permanent magnets? Temporary magnets (soft iron) act as magnets only while in a magnetic field. Permanent magnets (steel or alloys) retain their magnetism for a long time even after the external field is removed.

Q36. Difference between temporary and permanent magnets. Temporary magnets lose their magnetism as soon as the magnetizing force is removed; permanent magnets retain their magnetism indefinitely.

Q37. Define the magnetic field of a magnet. The region around a magnet where another magnetic object or pole experiences a magnetic force — a vector quantity with magnitude and direction.

Q38. What are magnetic lines of force? Imaginary lines representing the magnetic field pattern — indicating the direction a north pole would move and the field's strength based on their density.

Q39. Define magnetic line of force. The path along which a unit north pole would move if free to do so in a magnetic field; the tangent at any point gives the field's direction.

Q40. How does a magnetic field work? It exerts a force on magnetic materials or moving charges within its region — attracting or repelling objects; this is the principle behind electric motors and generators.

Q41. What determines the strength of a magnetic field? It is proportional to the number of magnetic lines of force passing through a unit area perpendicular to the lines — stronger where lines are closer together.

Q42. Which material is used for temporary magnets? Soft iron, because its magnetic domains are easily oriented by an external field and return to random positions when the field is removed.

Q43. Describe the relation between magnetic field strength and magnetic lines of force. Direct relation: the field is stronger where lines are crowded together and weaker where lines are far apart.

Q44. Name some uses of permanent magnets and electromagnets. Permanent magnets: loudspeakers, door catchers, generators. Electromagnets: electric bells, magnetic relays, cranes, maglev trains.

Q45. Define an A.C. generator. A device converting mechanical energy into electrical energy by rotating a coil between the poles of a permanent magnet, inducing an alternating current.

Q46. Define one application of a permanent magnet. Moving coil loudspeakers — a coil carrying varying current interacts with a permanent magnet's field to vibrate a cone and produce sound.

Q47. Define moving coil loudspeaker. A device converting electrical audio signals into sound, using a voice coil suspended in a permanent magnet's field, which vibrates the speaker cone when current flows.

Q48. What is the reverse process of an electric generator? The electric motor — instead of producing current from motion, it uses electrical current in a coil within a magnetic field to produce rotational motion.

Q49. Describe the use of permanent magnets in flour mills. They separate iron impurities from grains — as grains pass over the magnets, iron nails and ferrous objects are attracted and removed before grinding.

Q50. Write the use of permanent magnets in the medical field. Used to remove iron splinters from eyes, and as essential components in MRI (Magnetic Resonance Imaging) machines.

Q51. Define uses of electromagnets. Used in devices requiring temporary magnetism: electric bells, telephone receivers, circuit breakers, magnetic relays, and heavy-duty cranes for lifting scrap iron.

Q52. Define the circuit breaker. An automatic safety switch that uses an electromagnet to break a circuit when current exceeds a safe limit, protecting appliances from damage.

Q53. Explain the use of electromagnets in maglev trains. Maglev trains use electromagnets for magnetic levitation, allowing the train to float above the guideway without wheels, eliminating friction and enabling very high speeds.

Q54. State some uses of electromagnets. Lifting heavy iron loads in cranes, operating electric bells and relays, recording data on magnetic tapes/hard disks, and medical imaging.

Q55. What is a magnetic relay? An electrically operated switch that uses a low-current circuit to control a high-current circuit; an electromagnet attracts an armature to close/open the high-current contacts.

Q56. Difference between magnetisation and demagnetisation. Magnetization induces magnetic properties by aligning domains. Demagnetization destroys magnetic properties by disturbing domain alignment (e.g., by heating).

Q57. Describe the single-touch and double-touch methods. Single-touch: a steel bar is stroked with one pole of a magnet in one direction. Double-touch: the bar is stroked from the center outward using unlike poles of two magnets simultaneously.

Q58. Define heating and hammering as demagnetization methods. Heating strongly disturbs the alignment of magnetic domains due to thermal vibrations, causing loss of magnetism. Hammering also disrupts domains, leading to demagnetization.

Q59. State the right-hand grip rule. Grip the solenoid with the right hand so fingers curl in the direction of the current; the thumb then points toward the North pole of the electromagnet.

Q60. Write the stroking method of magnetisation. Rubbing a permanent magnet along a steel bar aligns the magnetic domains within it, turning it into a permanent magnet — done using single- or double-touch techniques.

Q61. Name the methods of demagnetisation of magnets. Heating strongly, hammering (or hitting), and using an alternating current (A.C.) solenoid to scramble the magnetic domains.

Chapter 9: Nature of Science

Q62. State what science is, in your own words. Write its two main groups. Science is collective knowledge about natural phenomena gained through observation and reasoning. Its two main groups: Biological Sciences (living things) and Physical Sciences (non-living things).

Q63. What is physics all about? Name some of its branches. Physics is the study of matter, energy, space, time, and their mutual interactions. Branches: Mechanics, Thermodynamics, Optics, Electromagnetism, Nuclear Physics, and Quantum Mechanics.

Q64. Write the scope of physics. Ranges from subatomic particles to the entire universe — dealing with fundamental concepts like space, time, matter, and energy, explaining phenomena from everyday motion to celestial events.

Q65. Explain the concept of the theory of relativity. It explains that space and time are not absolute but interrelated and relative to the observer — describing how gravity and speed influence space and time (e.g., time dilation).

Q66. What is the difference between geophysics and climate physics? Geophysics applies physical principles to Earth's internal structure and magnetic fields. Climate physics studies physical processes in the atmosphere, weather, and climate change.

Q67. State some uses of physics in daily life. Designing automobiles, appliances, and electronics; technologies like refrigerators, electricity, smartphones, and medical imaging (MRI, X-rays) — all applications of physical principles.

Q68. Differentiate between mechanics and quantum mechanics. Mechanics (classical) studies motion of macroscopic objects and forces. Quantum mechanics explains particle behavior at atomic/subatomic levels, where classical laws don't apply.

Q69. Define heat and thermodynamics. The branch of physics dealing with thermal energy possessed by materials and the laws governing its flow and transformation from one body to another.

Q70. Differentiate between acoustics and optics. Acoustics studies the production, properties, and applications of sound waves. Optics deals with the physical aspects of visible light and its interaction with matter.

Q71. Define relativistic mechanics. The branch of physics based on the theory of relativity, dealing with objects moving at speeds close to the speed of light, where space and time are relative to the observer.

Q72. Differentiate between biophysics and biomedical physics. Biophysics applies physics principles to explain biological systems (e.g., cell mechanics). Medical/biomedical physics uses physics to develop healthcare technologies like MRI and radiation therapy.

Q73. Differentiate between astrophysics and geophysics. Astrophysics deals with the physical properties and processes of celestial bodies (stars, galaxies). Geophysics applies physics to Earth's internal structure, earthquakes, and magnetic fields.

Q74. List the main steps of the scientific method.

1. Observation 2. Hypothesis 3. Experiment 4. Theory 5. Prediction 6. Law

Q75. What is a hypothesis? Give an example. A proposed explanation or educated guess based on observations, which can be tested — e.g., assuming shadows are formed because light travels in a straight line.

Q76. Distinguish between a theory and a law of physics. A theory is a logical explanation of natural events supported by evidence and experiments. A law is a theory tested extensively and generally accepted as a constant truth.

Q77. Differentiate between theory and law. A theory explains "why" and "how" something happens based on verified hypotheses. A law describes "what" happens in nature under specific conditions, confirmed by repeated testing.

Q78. Is the theory of science an ultimate truth? No — scientific theories are man-made explanations liable to be modified or rejected if new evidence or advanced research contradicts them.

Q79. When is a theory rejected or in need of modification? When new experimental results disagree with its predictions, or when future scientific advances bring fresh facts that disprove the existing understanding.

Q80. If a hypothesis is not testable, is it wrong? Not necessarily wrong — it is considered unscientific rather than factually wrong. Falsifiability requires a scientific hypothesis to make predictions that can be proven false by experiment.