

Kerala NMMS Science

Sample Paper – 2

Duration: 30 Minutes

Maximum Marks: 30

Instructions

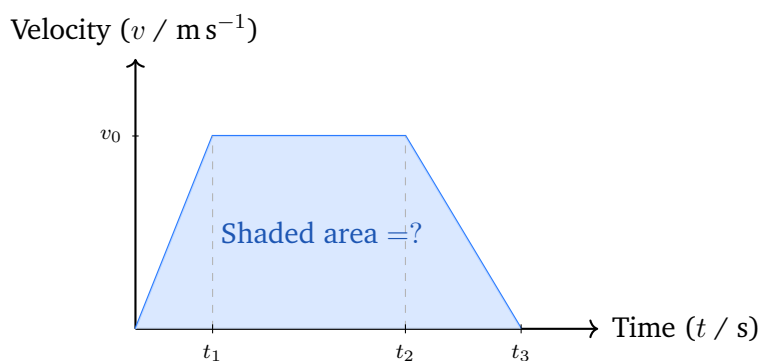
- This paper contains **30** Multiple Choice Questions (Single Correct Answer), modelled on the Science portion of **Kerala NMMS (SAT)**.
- Each correct answer carries **+1 mark**. There is **no negative marking** for incorrect or unattempted answers.
- Only **one** option is correct. Choose carefully.
- Syllabus level: **Class 7–8 (SCERT Kerala / NCERT) — Physics (Motion, Force & Pressure, Heat, Light, Sound, Electricity, Magnetism), Chemistry (Acids Bases Salts, Chemical Reactions, Metals & Non-metals, Carbon, Water, Air), Biology (Cell, Nutrition, Respiration, Transport, Reproduction, Microorganisms, Natural Resources).**
- Use of mobile phones, calculators, or electronic gadgets is strictly prohibited. Rough work may be done in the space provided.

Q1. A car is travelling at 72 km/h. What is its speed in m/s?

- (A) 18 m/s
- (B) 20 m/s
- (C) 25 m/s
- (D) 30 m/s

Q2. The velocity-time graph of a moving object is shown below. What does the shaded area under the graph represent?





- (A) Displacement of the object
- (B) Average speed of the object
- (C) Acceleration of the object
- (D) Net force on the object

Q3. A magnet is brought near a heap of iron filings. Which of the following correctly describes what happens?

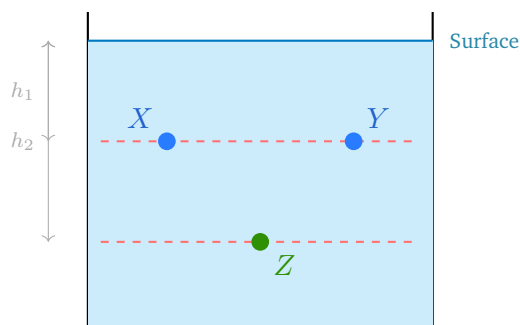
- (A) The iron filings move away from the magnet in all directions
- (B) The iron filings cluster only at one pole and are repelled at the other
- (C) The iron filings remain completely undisturbed
- (D) The iron filings align along the magnetic field lines of the magnet

Q4. A book is sliding on a table. The applied force on the book is exactly equal to the friction force acting on it. What will happen to the book?

- (A) It accelerates in the direction of the applied force
- (B) It gradually slows down and then stops
- (C) It continues to move at constant velocity
- (D) It stops immediately

Q5. The diagram below shows a container filled with water. Points X and Y are at the same depth h_1 , while point Z is at a greater depth h_2 . Which statement about liquid pressure is correct?





- (A) Pressure at X is greater than pressure at Y because X is on the left side of the container
- (B) Pressure at X equals pressure at Y , and both are less than pressure at Z
- (C) Pressure in a liquid decreases as depth increases
- (D) Pressure at any point in a liquid depends on the direction in which it is measured

Q6. Pascal's law states that pressure applied to an enclosed fluid is:

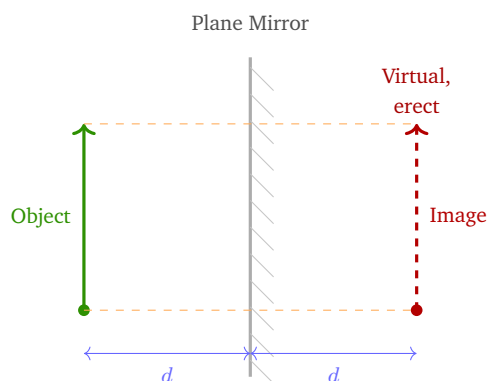
- (A) Transmitted equally in all directions throughout the fluid
- (B) Transmitted only downward in the direction of gravity
- (C) Absorbed by the walls of the container
- (D) Proportional to the volume of the fluid in the container

Q7. Which of the following correctly describes the mechanism of convection in a liquid?

- (A) Hot liquid sinks to the bottom and cool liquid rises to the top
- (B) Both hot and cool liquid sink together when the liquid is heated
- (C) Hot liquid moves horizontally without any vertical movement
- (D) Hot liquid rises to the top and cool liquid sinks, setting up a convection current

Q8. The diagram below shows an object placed in front of a plane mirror. Which of the following correctly describes the image formed?





- (A) Real, inverted, and diminished
- (B) Real, erect, and magnified
- (C) Virtual, erect, and the same size as the object
- (D) Virtual, inverted, and the same size as the object

Q9. Which characteristic of a sound wave determines the **loudness** of the sound heard?

- (A) Frequency
- (B) Amplitude
- (C) Wavelength
- (D) Speed

Q10. Three bulbs are connected in a **series** circuit. Which of the following statements about the current in the circuit is correct?

- (A) The same current flows through all three bulbs
- (B) The current is divided equally among the three bulbs at each junction
- (C) The bulb nearest to the positive terminal receives the most current
- (D) Each bulb carries a different amount of current depending on its resistance

Q11. A student dips a strip of red litmus paper into an unknown solution. The paper turns blue. What can be concluded about the solution?

- (A) The solution is acidic and turns blue litmus paper red



- (B) The solution is acidic and turns both red and blue litmus papers red
- (C) The solution is neutral and has no effect on litmus paper
- (D) The solution is basic (alkaline) and turns red litmus paper blue

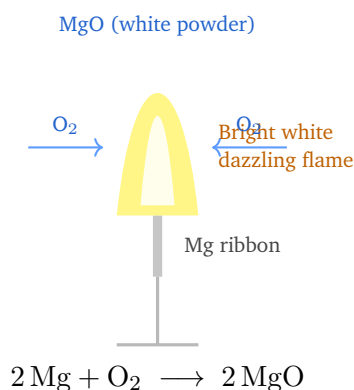
Q12. Common salt (NaCl) is formed by the neutralisation reaction between which acid and base?

- (A) Sulphuric acid (H_2SO_4) and sodium hydroxide (NaOH)
- (B) Hydrochloric acid (HCl) and potassium hydroxide (KOH)
- (C) Hydrochloric acid (HCl) and sodium hydroxide (NaOH)
- (D) Nitric acid (HNO_3) and sodium hydroxide (NaOH)

Q13. Baking powder, used in making cakes and bread to make them soft and spongy, is a mixture of which substances?

- (A) Only baking soda (sodium hydrogen carbonate, NaHCO_3)
- (B) Baking soda, tartaric acid, and starch
- (C) Washing soda and baking soda mixed in equal amounts
- (D) Baking soda and vinegar pre-mixed together

Q14. The diagram below shows a magnesium ribbon burning brightly in oxygen. What type of chemical reaction is this?



- (A) Combination (synthesis) reaction
- (B) Decomposition reaction



- (C) Displacement reaction
- (D) Neutralisation reaction

Q15. When a zinc strip is placed in copper sulphate solution, the blue colour of the solution slowly fades and a reddish-brown deposit forms on the zinc strip. What does this correctly indicate?

- (A) Copper displaces zinc from zinc sulphate solution because copper is more reactive
- (B) Iron displaces zinc from zinc sulphate solution
- (C) Zinc merely dissolves in the copper sulphate solution without any chemical reaction
- (D) Zinc displaces copper from copper sulphate solution because zinc is more reactive

Q16. Which of the following is a property of **non-metals**?

- (A) They are malleable, ductile, and good conductors of heat
- (B) They are lustrous, hard, and good conductors of electricity
- (C) They are brittle (in solid form) and poor conductors of heat and electricity
- (D) They are sonorous, dense, and have very high melting points

Q17. Carbon dioxide (CO_2) dissolves in water to form carbonic acid (H_2CO_3). Therefore, a solution of CO_2 in water is:

- (A) Basic in nature
- (B) Acidic in nature
- (C) Neutral in nature
- (D) Amphoteric in nature

Q18. Soft water easily forms a good lather with soap, while hard water does not. Which of the following correctly explains why soft water lathers easily?



- (A) Soft water does not contain dissolved calcium or magnesium salts, so soap acts freely
- (B) Soft water forms a curdy scum with soap before producing lather
- (C) Soft water contains dissolved calcium and magnesium bicarbonates
- (D) Soft water requires a larger quantity of soap than hard water to produce lather

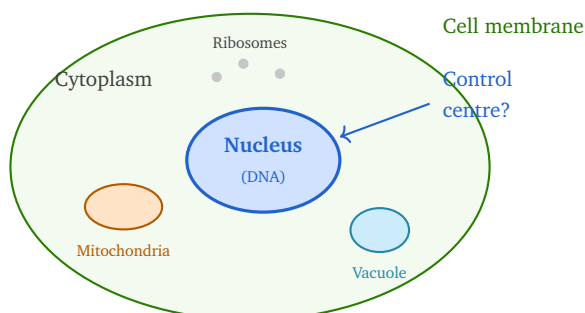
Q19. Which gases are primarily responsible for the **greenhouse effect** and global warming?

- (A) Nitrogen and oxygen
- (B) Nitrogen and carbon dioxide
- (C) Oxygen and methane
- (D) Carbon dioxide and methane

Q20. Polyester is widely used in clothing because it is wrinkle-resistant and durable. Which statement correctly identifies polyester?

- (A) It is a natural fibre obtained from the cotton plant
- (B) It is a natural fibre obtained from the jute plant
- (C) It is a synthetic fibre made from ester linkages (formed from ethylene glycol and terephthalic acid)
- (D) It is a natural fibre obtained from the fleece of sheep

Q21. The diagram below shows a generalised animal cell with its organelles. Which organelle is correctly identified as the **control centre** of the cell?



- (A) Mitochondria, as it produces energy and controls all metabolic activities
- (B) Nucleus, as it contains DNA (genetic material) and controls all cellular activities
- (C) Vacuole, as it stores cell sap and regulates all cell processes
- (D) Ribosome, as it synthesises all types of proteins that run the cell

Q22. Stomata are tiny pores found on leaf surfaces, regulated by guard cells. What is the primary role of stomata during **photosynthesis**?

- (A) Carbon dioxide enters the leaf and oxygen exits through stomata
- (B) Oxygen enters the leaf and carbon dioxide exits through stomata
- (C) Only carbon dioxide enters the leaf; no gas exits through stomata during photosynthesis
- (D) Stomata allow only water vapour to exit; no gas exchange occurs through them

Q23. Which part of the human digestive system is the **main site of both digestion and absorption** of nutrients?

- (A) Stomach, where all proteins are digested and nutrients are absorbed into the blood
- (B) Large intestine, where final digestion and all nutrient absorption occurs
- (C) Liver, which is the primary site of digestion of all nutrients
- (D) Small intestine, which is the main site of both digestion and absorption of nutrients into the blood

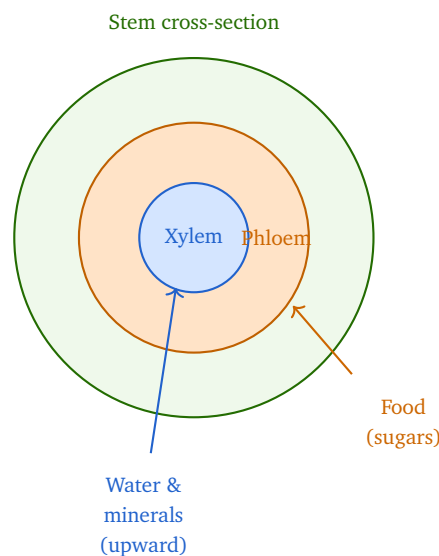
Q24. Which of the following correctly represents the **products** of aerobic respiration in cells?

- (A) Glucose and carbon dioxide only
- (B) Lactic acid and a small amount of energy (2 ATP)



- (C) Carbon dioxide, water, and energy (ATP)
- (D) Ethanol, carbon dioxide, and energy

Q25. The diagram below shows a cross-section of a plant stem. Which tissue is responsible for transporting prepared food (sugars) from leaves to all parts of the plant?



- (A) Xylem, which transports prepared food from leaves to other parts of the plant
- (B) Phloem, which transports prepared food (sugars) from leaves to all parts of the plant
- (C) Xylem, which transports water, minerals, and food throughout the plant
- (D) Phloem, which transports water and dissolved minerals from roots up to the leaves

Q26. In **self-pollination** (autogamy), pollen grains from the anther are transferred to:

- (A) The stigma of the same flower or another flower on the same plant
- (B) The stigma of a flower on a different plant of the same species
- (C) The stigma of a flower on a plant of a completely different species
- (D) The anther of a flower on another plant carried by wind or insects



- Q27.** Viruses differ fundamentally from bacteria and fungi. Which of the following correctly describes the unique nature of viruses?
- (A) They are unicellular organisms with a rigid cell wall made of peptidoglycan
 - (B) They are unicellular eukaryotes with a well-defined nucleus and cell organelles
 - (C) They are multicellular organisms that reproduce by spore formation
 - (D) They are acellular entities made of genetic material and a protein coat that can only reproduce inside a host cell
- Q28.** *Rhizobium* bacteria play an important role in agriculture by enriching the soil. Where do they live and what function do they perform?
- (A) They live in the leaves of leguminous plants and fix carbon dioxide
 - (B) They live in the root nodules of cereal crops such as wheat and rice, and fix nitrogen
 - (C) They live in the root nodules of leguminous plants (peas, beans, lentils) and fix atmospheric nitrogen
 - (D) They live freely in open soil and fix nitrogen without associating with any plant
- Q29.** A **food web** in an ecosystem is best described as:
- (A) A single linear sequence showing who eats whom in the ecosystem
 - (B) A network of multiple interconnected food chains within an ecosystem
 - (C) The total amount of energy stored in the soil at each trophic level
 - (D) A relationship between only two organisms — a predator and its prey
- Q30.** Which of the following groups contains only **Rabi crops**, grown in the winter season in India?



- (A) Wheat, mustard, and gram (chickpea)
- (B) Paddy, maize, and cotton
- (C) Paddy, jute, and sugarcane
- (D) Rice, cotton, and soybean



Detailed Solutions

Q1.

Solution

Concept: To convert speed from km/h to m/s, multiply by $\frac{1000}{3600} = \frac{5}{18}$.

Step 1: Given speed = 72 km/h.

Step 2: Convert to m/s.

$$72 \text{ km/h} = 72 \times \frac{1000}{3600} \text{ m/s} = 72 \times \frac{5}{18} \text{ m/s} = \frac{360}{18} \text{ m/s} = 20 \text{ m/s}$$

Why other options are wrong: Option (A) 18 m/s corresponds to $18 \times \frac{18}{5} = 64.8$ km/h, not 72 km/h. Option (C) 25 m/s corresponds to 90 km/h. Option (D) 30 m/s corresponds to 108 km/h.

Answer: (B) [Go Back to Q1](#)

Q2.

Solution

Concept: The area under a velocity-time (v-t) graph represents the **displacement** of the object. This follows directly from the definition: Displacement = velocity $\times$ time, which is the area enclosed between the v-t graph and the time axis.

$$\text{Displacement} = \int_{t_1}^{t_3} v \, dt = \text{area under the } v\text{-}t \text{ graph}$$

Step 1: The trapezoid-shaped shaded region has a definite area on the v-t graph.

Step 2: By the definition above, this area gives the total displacement of the object during the time interval shown.

Why other options are wrong: Option (B) Average speed is computed as total distance divided by total time — it is not an area. Option (C) Acceleration is the *slope* (gradient) of the v-t graph, not its area. Option (D) Net force cannot be read directly from a v-t graph without knowing the mass.

Answer: (A) [Go Back to Q2](#)



Q3.

Solution

Concept: Magnetic force is a **non-contact force** that acts at a distance without physical contact. Iron is a magnetic (ferromagnetic) material. When a magnet is brought near iron filings, they experience a magnetic force and physically arrange themselves along the **magnetic field lines** of the magnet, with maximum density near the poles.

Step 1: The magnet has a magnetic field that extends in space around it, represented by field lines running from the North pole to the South pole.

Step 2: Iron filings respond to this field by rotating and aligning along the field lines, making the invisible field pattern visible.

Why other options are wrong: Option (A) Iron is attracted to, not repelled from, a magnet. Option (B) Filings cluster more at both poles; they do not ignore one pole. Option (C) Iron filings in a magnetic field cannot remain undisturbed — they are ferromagnetic and will respond.

Answer: (D) [Go Back to Q3](#)

Q4.

Solution

Concept: Newton's First Law of Motion (Law of Inertia): An object in motion continues to move at the same velocity (constant speed in the same direction) if the net force acting on it is zero.

Step 1: Applied force = Friction force, so net force = 0.

Step 2: With zero net force, there is no acceleration ($a = F_{\text{net}}/m = 0$). The book maintains its current state of motion — it continues to slide at **constant velocity**.

Why other options are wrong: Option (A) Acceleration requires a non-zero net force. Option (B) Slowing down would require friction to exceed the applied force (net force opposing motion). Option (D) Stopping immediately would require a very large opposing net force acting for zero time, which is not the case here.

Answer: (C) [Go Back to Q4](#)



Q5.

Solution

Concept: Pressure in a liquid at a point depends only on the **depth** of that point below the free surface, the density of the liquid, and gravitational acceleration:

$$P = h\rho g$$

Pressure is the **same at all points at the same depth**, regardless of horizontal position or direction.

Step 1: Points X and Y are at the same depth h_1 , so:

$$P_X = P_Y = h_1\rho g$$

Step 2: Point Z is at greater depth $h_2 > h_1$, so:

$$P_Z = h_2\rho g > P_X = P_Y$$

Thus $P_X = P_Y < P_Z$, which matches Option (B).

Why other options are wrong: Option (A) Pressure in a liquid does not depend on the horizontal position (left, centre, or right). Option (C) Pressure *increases* with depth, not decreases. Option (D) At a given depth, pressure acts equally in all directions (this is part of Pascal's principle, not a reason for pressure to vary with direction).

Answer: (B) [Go Back to Q5](#)

Q6.

Solution

Concept: Pascal's Law: When pressure is applied to an enclosed incompressible fluid (liquid or gas), it is **transmitted equally and undiminished in all directions** throughout the fluid.

Step 1: This principle is the basis of hydraulic machines. A small force F_1 applied over a small area A_1 creates pressure $P = F_1/A_1$. This same pressure P acts over a larger area A_2 , producing a larger force $F_2 = P \times A_2$.

Applications: Hydraulic brakes (in vehicles), hydraulic jacks, hydraulic lifts, and hydraulic presses all work on Pascal's Law.

Why other options are wrong: Option (B) Pressure in a fluid acts in all directions — not only downward. Option (C) Container walls transmit the pressure rather than absorbing it. Option (D) Pascal's Law describes the transmission of pressure,



not a proportionality to volume.

Answer: (A) [Go Back to Q6](#)

Q7.

Solution

Concept: Convection is the mode of heat transfer in fluids (liquids and gases) involving the actual bulk movement of fluid particles.

Step 1: When a liquid is heated, the hot portion at the bottom:

- Expands and becomes **less dense** (lower density).
- Therefore **rises to the top**.

Step 2: The cooler liquid from the top:

- Is **denser** than the hot liquid.
- **Sinks to the bottom**, gets heated, and the cycle repeats — forming a **convection current**.

Application: Sea breeze blows from the sea to land during the day because land heats up faster, hot air over land rises, and cooler sea air moves inland to replace it.

Why other options are wrong: Option (A) Reverses the direction — hot fluid rises, not sinks. Option (B) Hot and cool fluid move in opposite vertical directions, not together. Option (C) Convection requires vertical movement driven by density differences, not just horizontal flow.

Answer: (D) [Go Back to Q7](#)

Q8.

Solution

Concept: The image formed by a **plane mirror** has the following properties:

- **Virtual** — cannot be formed on a screen; formed behind the mirror.
- **Erect** — the same orientation (right-side up) as the object.
- **Same size** as the object (magnification $m = 1$).
- **Laterally inverted** — left and right are swapped.



- At the **same distance** behind the mirror as the object is in front.

Step 1: From the diagram, the image is the same height as the object, erect, and at distance d behind the mirror (same as the object's distance in front).

Step 2: The image cannot be projected on a screen, confirming it is virtual.

Why other options are wrong: Option (A) Real, inverted, diminished images are formed by concave mirrors when the object is beyond the centre of curvature. Option (B) No mirror produces a real, erect, magnified image. Option (D) The image is erect (not inverted) — lateral inversion is a left-right reversal, not an up-down flip.

Answer: (C) [Go Back to Q8](#)

Q9.

Solution

Concept: The characteristics of a sound wave and their corresponding perceptual properties:

- **Amplitude** → **Loudness** (greater amplitude = louder sound; measured in decibels, dB)
- **Frequency** → **Pitch** (higher frequency = higher pitch / shriller sound)
- **Wavelength** → related inversely to frequency ($\lambda = v/f$)
- **Speed** → depends on the medium and temperature, not on loudness

Step 1: Loudness is a measure of the energy carried by the sound wave per unit time.

Step 2: The energy of a wave is proportional to the square of its amplitude. Greater amplitude $\Rightarrow$ greater energy $\Rightarrow$ louder sound.

Why other options are wrong: Option (A) Frequency determines the pitch (shrillness), not the loudness. Option (C) Wavelength determines the type of wave (ultrasonic, audible, infrasonic) when combined with speed, not the loudness. Option (D) The speed of sound depends on the medium (solid > liquid > gas) and temperature, not on loudness.

Answer: (B) [Go Back to Q9](#)



Q10.

Solution

Concept: In a **series circuit**, all components are connected end-to-end forming a single, continuous loop. There is only **one path** for current to flow. Therefore, the **same current** flows through every component in the circuit.

Step 1: In a series circuit with three bulbs: $I_1 = I_2 = I_3 = I$ (current is identical throughout).

Step 2: The total voltage is divided among the components: $V = V_1 + V_2 + V_3$, but the current remains unchanged.

Contrast with parallel: In a parallel circuit, voltage is the same across all branches, but current divides at junctions.

Why other options are wrong: Option (B) Current division at junctions occurs in a *parallel* circuit, not a series circuit. Option (C) In a series circuit, every point in the loop carries the same current — position relative to the battery does not matter. Option (D) Each bulb in a series circuit does carry current; what is true is that if one bulb *fuses*, the circuit breaks and all go out.

Answer: (A) [Go Back to Q10](#)

Q11.

Solution

Concept: Litmus is a natural indicator derived from lichens. It changes colour depending on the nature of the solution:

- **Acid** turns **blue** litmus → **red**.
- **Base (alkali)** turns **red** litmus → **blue**.
- **Neutral** solution causes **no colour change** in either litmus.

Step 1: Red litmus paper turns **blue**. This indicates the presence of a base.

Step 2: Bases (e.g., NaOH, KOH, Ca(OH)_2 , Mg(OH)_2) taste bitter, feel soapy/slippery to touch, and turn red litmus paper blue.

Why other options are wrong: Option (A) An acid would turn blue litmus red, not red litmus blue. Option (B) Acids turn both litmus papers red (i.e., they turn blue litmus red). Option (C) A neutral solution leaves both litmus papers unchanged.

Answer: (D) [Go Back to Q11](#)



Q12.

Solution

Concept: Neutralisation: Acid + Base $\rightarrow$ Salt + Water.

Step 1: Write the product salt for each reaction:

- (A) $\text{H}_2\text{SO}_4 + 2\text{NaOH} \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$ (sodium *sulphate* — not NaCl)
- (B) $\text{HCl} + \text{KOH} \rightarrow \text{KCl} + \text{H}_2\text{O}$ (potassium *chloride* — not NaCl)
- (C) $\text{HCl} + \text{NaOH} \rightarrow \text{NaCl} + \text{H}_2\text{O}$ (**common salt — Correct!**)
- (D) $\text{HNO}_3 + \text{NaOH} \rightarrow \text{NaNO}_3 + \text{H}_2\text{O}$ (sodium *nitrate* — not NaCl)

Step 2: Only hydrochloric acid (HCl) reacting with sodium hydroxide (NaOH) gives sodium chloride (NaCl), which is common table salt.

Why other options are wrong: As shown above, options (A), (B), and (D) produce different salts (sodium sulphate, potassium chloride, and sodium nitrate respectively) — none of which is NaCl.

Answer: (C) [Go Back to Q12](#)

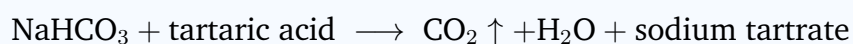
Q13.

Solution

Concept: Baking powder is a dry chemical leavening agent that makes baked goods rise and become soft. It is a mixture of:

- **Baking soda** (NaHCO_3 — sodium hydrogen carbonate): the base.
- **Tartaric acid:** the acid that reacts with baking soda.
- **Starch:** absorbs moisture and keeps the mixture dry and stable.

Step 1: When baking powder is heated or moistened, the acid-base reaction releases CO_2 :



Step 2: The CO_2 gas gets trapped in the dough, causing it to rise and making the product light and spongy.

Why other options are wrong: Option (A) Baking soda alone is not baking powder; without an acid to activate it, CO_2 release is limited. Option (C) Washing



soda (Na_2CO_3) is not a component of baking powder. Option (D) Vinegar is a liquid and cannot be pre-mixed into a dry powder.

Answer: (B) [Go Back to Q13](#)

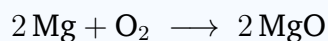
Q14.

Solution

Concept: A **combination (synthesis) reaction** is one in which two or more substances react to form a *single* new product:



Step 1: The reaction of magnesium with oxygen is:



Two reactants (Mg and O_2) combine to form one product (MgO). This fits the definition of a combination reaction perfectly.

Step 2: The reaction produces a characteristic bright white dazzling flame, and the product is a white powder (magnesium oxide, MgO).

Why other options are wrong: Option (B) Decomposition involves one reactant breaking into two or more products (e.g., $2\text{H}_2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{O}_2$). Option (C) Displacement involves one element replacing another in a compound. Option (D) Neutralisation involves an acid and a base forming a salt and water.

Answer: (A) [Go Back to Q14](#)

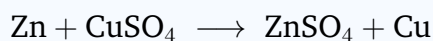
Q15.

Solution

Concept: Activity (Reactivity) Series: Metals are arranged in decreasing order of reactivity. A **more reactive metal displaces a less reactive metal** from its salt solution.

Step 1: In the reactivity series: $\dots > \text{Zn} > \dots > \text{Cu} > \dots$ (Zinc is more reactive than Copper).

Step 2: Since Zn is more reactive than Cu, zinc displaces copper from copper sulphate (CuSO_4) solution:



The blue colour of CuSO_4 fades as Cu^{2+} ions are removed from solution. A reddish-brown copper deposit appears on the zinc strip.

Why other options are wrong: Option (A) Copper is *less* reactive than zinc, so Cu cannot displace Zn from a zinc salt solution. Option (B) Iron is not involved in this experiment. Option (C) A clear chemical reaction *does* occur — the colour change and deposit are evidence.

Answer: (D) [Go Back to Q15](#)

Q16.

Solution

Concept: Comparison of properties of metals and non-metals:

Non-metals	Metals
Brittle in solid form	Malleable and ductile
Poor conductors (except graphite)	Good conductors of heat & electricity
Not lustrous (except iodine, diamond)	Lustrous (shiny)
Low density and melting point (mostly)	High density and melting point
Not sonorous	Sonorous (ring when struck)

Step 1: Option (C) states that non-metals are brittle and poor conductors of heat and electricity. This is correct for most non-metals. (Exception: graphite conducts electricity.)

Why other options are wrong: Options (A) and (B) describe properties of metals (malleable, ductile, lustrous, good conductors). Option (D) sonorous behaviour and high density/melting point are characteristic of metals.

Answer: (C) [Go Back to Q16](#)

Q17.

Solution

Concept: The reaction of oxides with water determines their acidic or basic nature:

- **Non-metal oxides** + water $\rightarrow$ **Acid** (acidic oxide)
- **Metal oxides** + water $\rightarrow$ **Base** (basic oxide)

Step 1: Carbon dioxide (CO_2) is a **non-metal oxide** (carbon is a non-metal).



Step 2: When CO_2 dissolves in water, it forms **carbonic acid** (H_2CO_3):



Carbonic acid is **acidic**: it turns blue litmus red and has $\text{pH} < 7$.

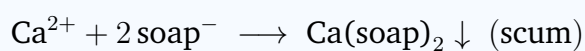
Why other options are wrong: Option (A) Only metal oxides form bases with water; CO_2 is a non-metal oxide and forms an acid. Option (C) The solution of CO_2 in water is definitely acidic, not neutral. Option (D) Amphoteric substances react with both acids and bases (e.g., Al_2O_3 , ZnO); carbonic acid acts only as an acid.

Answer: (B) [Go Back to Q17](#)

Q18.

Solution

Concept: **Hard water** contains dissolved calcium (Ca^{2+}) and magnesium (Mg^{2+}) salts (as bicarbonates, sulphates, or chlorides). These ions react with soap to form an insoluble scum (calcium/magnesium stearate) instead of lather:



Soft water lacks these salts. Soap in soft water directly produces lather without forming scum.

Step 1: Soft water does not contain dissolved Ca^{2+} or Mg^{2+} salts.

Step 2: Without interfering ions, soap molecules are free to form micelles and produce foam, making soft water ideal for washing.

Why other options are wrong: Option (B) Forming a curdy scum is the behaviour of soap in *hard* water. Option (C) Containing dissolved calcium and magnesium salts is the defining property of *hard* water. Option (D) Requiring more soap is the drawback of using soap with *hard* water.

Answer: (A) [Go Back to Q18](#)



Q19.

Solution

Concept: The **greenhouse effect** occurs because certain gases in the atmosphere absorb and re-emit outgoing infrared (heat) radiation from the Earth's surface, trapping heat and warming the planet. The main greenhouse gases are:

- **Carbon dioxide** (CO_2): released by burning fossil fuels, deforestation, cement production.
- **Methane** (CH_4): released from paddy fields, cattle digestion, landfills, and natural gas leaks.
- Others: water vapour, nitrous oxide (N_2O), ozone (O_3).

Step 1: Among the options given, only CO_2 and methane are recognised greenhouse gases.

Why other options are wrong: Option (A) Nitrogen (N_2) and oxygen (O_2) are the bulk components of air (about 78% and 21% respectively) but they do **not** absorb infrared radiation and are not greenhouse gases. Option (B) Nitrogen is not a greenhouse gas. Option (C) Oxygen is not a greenhouse gas.

Answer: (D) [Go Back to Q19](#)

Q20.

Solution

Concept: Fibres are classified into two broad categories:

- **Natural fibres:** obtained directly from plants or animals — cotton (plant), jute (plant), wool (animal/sheep), silk (animal/silkworm).
- **Synthetic fibres:** manufactured chemically from petrochemicals — nylon, polyester, acrylic, rayon.

Step 1: Polyester is a synthetic polymer in which the monomer units are linked by **ester bonds** ($-\text{COO}-$). The most common polyester (PET — polyethylene terephthalate) is made from ethylene glycol and terephthalic acid.

Step 2: Polyester is wrinkle-resistant, strong, lightweight, and does not absorb moisture, making it widely used in clothing and textiles.

Why other options are wrong: Option (A) Cotton is a natural fibre (cellulose) from the cotton plant (*Gossypium*). Option (B) Jute is a natural fibre from the jute plant (*Corchorus*). Option (D) Wool is a natural protein fibre from the fleece of



sheep.

Answer: (C) [Go Back to Q20](#)

Q21.

Solution

Concept: The **nucleus** is the control centre of the cell because:

- It contains **DNA** (deoxyribonucleic acid) — the genetic material that encodes all the information needed for cell structure and function.
- It directs all metabolic activities by sending instructions (via mRNA) to ribosomes for protein synthesis.
- Without the nucleus, a cell cannot survive, grow, or reproduce.

Step 1: From the diagram, the nucleus (highlighted in blue at the centre of the cell) is the organelle labelled as the control centre.

Step 2: The question specifically asks which organelle is the *control centre* — this is a well-established fact in cell biology, pointing to the nucleus.

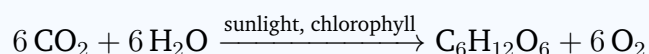
Why other options are wrong: Option (A) Mitochondria produce ATP (energy) and are called the “powerhouse of the cell,” but they do not control all activities. Option (C) Vacuoles store water, food, or waste materials; they do not control cell activities. Option (D) Ribosomes synthesise proteins by following instructions from the nucleus (via mRNA); they do not control the cell themselves.

Answer: (B) [Go Back to Q21](#)

Q22.

Solution

Concept: Photosynthesis equation:



Stomata are tiny pores on leaf surfaces controlled by **guard cells**. Their role during photosynthesis:

- **CO₂ enters** through stomata — it is a raw material (reactant) for photosynthesis.
- **O₂ exits** through stomata — it is the gaseous product of photosynthesis.



- Water vapour also exits through stomata (transpiration).

Step 1: Leaves need a continuous supply of CO_2 from the atmosphere for photosynthesis to proceed.

Step 2: Oxygen produced during the light-dependent reactions exits through the same stomata.

Why other options are wrong: Option (B) Oxygen is produced by photosynthesis, not consumed — it exits, not enters. Option (C) Both CO_2 (entering) and O_2 (exiting) are exchanged through stomata. Option (D) Stomata perform both gas exchange and water vapour transpiration.

Answer: (A) [Go Back to Q22](#)

Q23.

Solution

Concept: The human digestive tract processes food in order: mouth → oesophagus → stomach → **small intestine** → large intestine → anus.

Small intestine (approx. 6–7 m long) is the main site of:

- **Digestion:** Pancreatic juice (amylase, lipase, trypsin) and bile (from the liver/gall bladder) complete the digestion of carbohydrates, fats, and proteins.
- **Absorption:** Digested nutrients (glucose, amino acids, fatty acids, glycerol) are absorbed into the bloodstream and lymph through finger-like projections called **villi**, which greatly increase the absorptive surface area.

Why other options are wrong: Option (A) The stomach mainly digests proteins (using pepsin + HCl) and absorbs very little. Option (B) The large intestine mainly absorbs *water* and electrolytes; it eliminates undigested residue as faeces. Option (C) The liver produces bile and performs biochemical processing (detoxification, metabolism), but digestion occurs in the gut, not the liver.

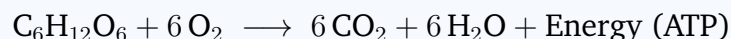
Answer: (D) [Go Back to Q23](#)



Q24.

Solution

Concept: **Aerobic respiration** occurs in the presence of oxygen and releases a large amount of energy (approximately 36–38 ATP per glucose molecule):



Step 1: Glucose is completely oxidised to carbon dioxide and water. Both are the products of aerobic respiration, along with energy in the form of ATP.

Step 2: This process occurs in three stages: glycolysis (cytoplasm), Krebs cycle (mitochondrial matrix), and electron transport chain (inner mitochondrial membrane).

Why other options are wrong: Option (A) Only listing CO_2 is incomplete; water and energy are also produced. Option (B) Lactic acid and 2 ATP are products of *anaerobic* respiration in muscle cells during intense exercise (without oxygen). Option (D) Ethanol and CO_2 are products of *anaerobic fermentation* in yeast (e.g., in bread-making and brewing) — not aerobic respiration.

Answer: (C) [Go Back to Q24](#)

Q25.

Solution

Concept: Plants have two distinct types of vascular (conducting) tissue:

- **Xylem:** Transports **water and dissolved minerals** from roots upward to leaves and other parts (unidirectional, upward flow). This process is called absorption or transpiration pull.
- **Phloem:** Transports **prepared food** (mainly sucrose/sugars) synthesised during photosynthesis in leaves to all parts of the plant — roots, growing tips, fruits, seeds (bidirectional). This process is called **translocation**.

Step 1: In the diagram, the phloem ring (shown in orange between the outer cortex and the central xylem) is the tissue responsible for transporting food.

Step 2: Phloem carries sucrose produced in leaves downward to non-photosynthetic parts (roots, stems, fruits).

Why other options are wrong: Option (A) Xylem transports water and minerals, not food. Option (C) Xylem does not transport food. Option (D) Phloem transports food (sugars), not water and minerals — that is the function of xylem.



Answer: (B) [Go Back to Q25](#)

Q26.

Solution

Concept: Pollination is the transfer of pollen grains from the anther (male reproductive part) to the stigma (female reproductive part) of a flower. There are two types:

- **Self-pollination (Autogamy):** Pollen from the anther of a flower is transferred to the stigma of the *same flower* or to another flower on the *same plant*. No external agent is needed.
- **Cross-pollination:** Pollen is transferred to the stigma of a flower on a *different plant* of the same species. Requires wind, water, insects, or other agents.

Step 1: The question asks specifically about self-pollination.

Step 2: In self-pollination, the pollen never leaves the same plant — it pollinates the same plant's stigma.

Why other options are wrong: Option (B) Transfer to a flower on a different plant of the same species describes cross-pollination. Option (C) Transfer to a different species does not produce viable offspring (interspecific barriers prevent fertilisation). Option (D) Wind carrying pollen to another plant is cross-pollination by wind (anemophily).

Answer: (A) [Go Back to Q26](#)

Q27.

Solution

Concept: Viruses are unique infectious agents that are fundamentally different from all cellular life forms:

- They are **acellular** (not made of cells) — they have no cell membrane, cytoplasm, or organelles.
- They consist of **genetic material** (either DNA or RNA, but never both) surrounded by a **protein coat** called a capsid.
- They are **obligate intracellular parasites** — they can only reproduce by hijacking the cellular machinery of a living host cell.



- They are not considered truly “living” in the traditional sense because they lack metabolism outside a host.

Step 1: Size comparison: Viruses (20–300 nm) are much smaller than bacteria (1–10 μm).

Why other options are wrong: Option (A) describes *bacteria* (unicellular prokaryotes with a rigid cell wall containing peptidoglycan). Option (B) describes *protozoa* (unicellular eukaryotes like Amoeba, Paramecium). Option (C) describes *fungi* (many are multicellular with spores; e.g., mushrooms, moulds).

Answer: (D) [Go Back to Q27](#)

Q28.

Solution

Concept: Biological nitrogen fixation is the conversion of atmospheric nitrogen (N_2 , which plants cannot use directly) into ammonia (NH_3) or related compounds that plants can absorb.

Rhizobium bacteria:

- Live in **root nodules** of **leguminous plants** (e.g., peas, beans, lentils, groundnuts, soybean, clover).
- Have a **mutualistic/symbiotic relationship** with the host plant: the bacteria fix atmospheric $\text{N}_2 \rightarrow \text{NH}_3$ for the plant; the plant provides carbohydrates (sugars) for the bacteria’s energy needs.
- This process enriches the soil with nitrogen compounds, making legumes important in crop rotation.

Why other options are wrong: Option (A) *Rhizobium* lives in roots (not leaves) and fixes nitrogen (not carbon). Option (B) *Rhizobium* associates with leguminous plants (peas, beans), not cereal crops like wheat and rice. Option (D) *Azotobacter* is the free-living soil nitrogen fixer; *Rhizobium* requires a host legume to fix nitrogen.

Answer: (C) [Go Back to Q28](#)



Q29.

Solution**Concept:**

- **Food chain:** A single linear sequence showing the transfer of energy from one trophic level to the next (e.g., Grass → Grasshopper → Frog → Snake → Eagle).
- **Food web:** A complex network formed by the **interconnection of multiple food chains** within an ecosystem. An organism may feed on several types of prey and may itself be eaten by several predators, creating an interconnected web structure.

Step 1: In a real ecosystem, organisms rarely eat only one type of food and are rarely eaten by only one predator. This creates a web, not a chain.

Step 2: A food web is a more realistic and accurate representation of feeding relationships and energy flow in an ecosystem than a single food chain.

Why other options are wrong: Option (A) describes a food *chain* (single linear sequence). Option (C) Energy stored in soil relates to nutrient cycling and decomposition, not a food web. Option (D) A predator-prey relationship is a single link between two species — this is just one part of a food chain, let alone a food web.

Answer: (B) [Go Back to Q29](#)

Q30.

Solution

Concept: Indian food crops are classified by the season in which they are grown:

Season	Sown	Harvested
Kharif (monsoon/summer)	June–July	September–October
Rabi (winter)	October–November	March–April
Zaid (summer/inter-season)	March	May–June

Rabi crops (grown in winter): **Wheat, Mustard, Gram** (chickpea), Barley, Peas, Linseed.

Kharif crops (grown in monsoon): Paddy (rice), Maize, Cotton, Soybean, Jowar, Bajra, Jute, Sugarcane.

Step 1: Option (A) — wheat, mustard, and gram — are all classic Rabi crops sown in October–November and harvested in March–April.

Why other options are wrong: Option (B) Paddy, maize, and cotton are *Kharif*



crops (monsoon season). Option (C) Paddy, jute, and sugarcane are *Kharif* crops. Option (D) Rice, cotton, and soybean are all *Kharif* crops.

Answer: (A) [Go Back to Q30](#)



Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	B	2	A	3	D	4	C	5	B
6	A	7	D	8	C	9	B	10	A
11	D	12	C	13	B	14	A	15	D
16	C	17	B	18	A	19	D	20	C
21	B	22	A	23	D	24	C	25	B
26	A	27	D	28	C	29	B	30	A

