

Kerala NMMS Science

Sample Paper – 1

Duration: 30 Minutes

Maximum Marks: 30

Instructions

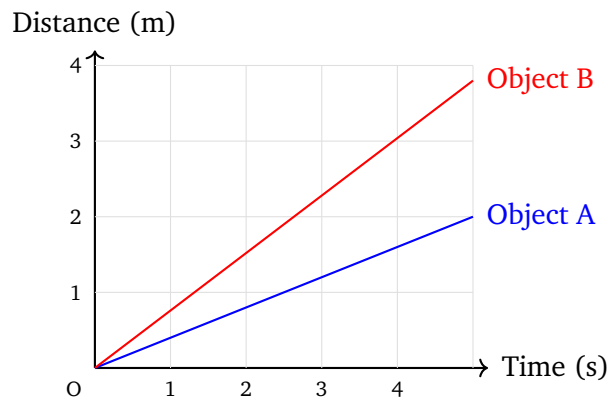
- This paper contains **30** Multiple Choice Questions (Single Correct Answer), modelled on the Science portion of **Kerala NMMS (SAT)**.
- Each correct answer carries **+1 mark**. There is **no negative marking** for incorrect or unattempted answers.
- Only **one** option is correct. Choose carefully.
- 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 travels 120 km in 2 hours. What is its average speed?

- (A) 60 km/h
- (B) 40 km/h
- (C) 80 km/h
- (D) 240 km/h

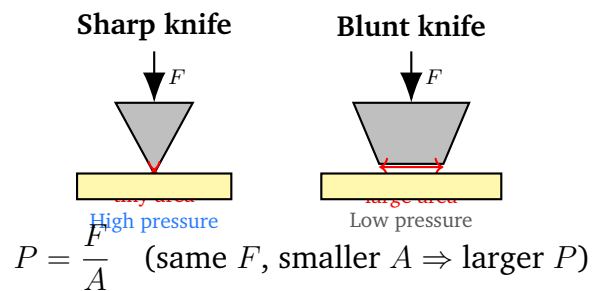
Q2. The distance-time graph below shows two objects moving in a straight line. What does the steeper line represent?





- (A) Less time taken to start moving
 - (B) Greater speed of the object
 - (C) Greater acceleration of the object
 - (D) Change in direction of motion
- Q3.** Which of the following is a **non-contact** force that acts without physical touch between objects?
- (A) Friction
 - (B) Tension
 - (C) Magnetic force
 - (D) Normal reaction
- Q4.** When two equal forces act on an object in **opposite directions**, the object:
- (A) Accelerates in the direction of the larger force
 - (B) Decelerates and comes to rest
 - (C) Stops immediately regardless of initial state
 - (D) Remains stationary or continues moving with constant velocity
- Q5.** Refer to the figure below showing a sharp knife and a blunt knife pressed with the same force on bread. Why does the sharp knife cut the bread more easily?





- (A) The smaller contact area gives greater pressure for the same force
- (B) The larger contact area gives greater pressure for the same force
- (C) A sharp knife exerts a smaller force on the bread
- (D) A blunt knife concentrates more pressure at the tip

Q6. Which instrument is used to measure **atmospheric pressure**?

- (A) Thermometer
- (B) Barometer
- (C) Manometer
- (D) Hygrometer

Q7. A dam is made much thicker and wider at the base than at the top. This is because:

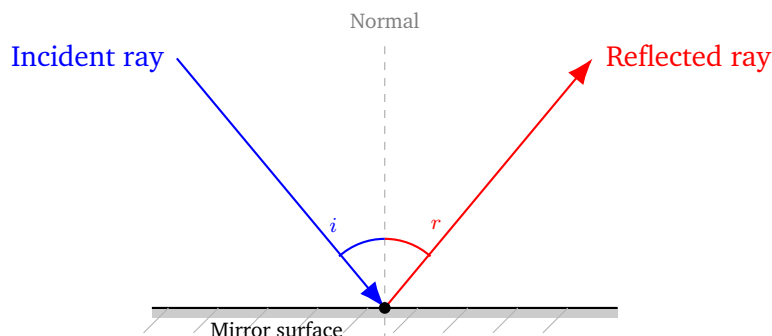
- (A) Water pressure decreases as depth increases
- (B) Water pressure remains the same at all depths
- (C) Water pressure increases with increasing depth
- (D) Water pressure depends only on the density of the dam material

Q8. Metals are good conductors of heat because they possess:

- (A) Free electrons that can transfer thermal energy rapidly
- (B) Tightly bound atoms that trap heat energy
- (C) Low density that allows heat to pass through easily
- (D) High melting points that absorb more heat



Q9. The diagram below shows a ray of light hitting a plane mirror. Which statement correctly describes the law of reflection?



- (A) The angle of incidence is always greater than the angle of reflection
- (B) The angle of incidence is always less than the angle of reflection
- (C) The sum of the angle of incidence and angle of reflection is 180
- (D) The angle of incidence is always equal to the angle of reflection

Q10. A sound wave with a **higher frequency** will produce a sound with:

- (A) Lower pitch
- (B) Higher pitch
- (C) Greater amplitude
- (D) Lower speed in air

Q11. When an acidic solution is tested with blue litmus paper, what happens?

- (A) Red litmus paper turns blue
- (B) Blue litmus paper turns yellow
- (C) Blue litmus paper turns red
- (D) Both litmus papers turn green

Q12. When an acid reacts with a base (neutralisation reaction), the products formed are:

- (A) Salt and water
- (B) Salt and carbon dioxide



- (C) Water and carbon dioxide
- (D) Metal oxide and water

Q13. Baking soda, used in cooking to make baked goods rise, is chemically known as:

- (A) Sodium chloride (NaCl)
- (B) Sodium carbonate (Na_2CO_3)
- (C) Hydrochloric acid (HCl)
- (D) Sodium bicarbonate (NaHCO_3)

Q14. Iron rusts when exposed to which combination of substances?

- (A) Only oxygen (dry air)
- (B) Both oxygen and water (moisture)
- (C) Only water (distilled, oxygen-free)
- (D) Heat alone

Q15. Steel is an alloy made primarily of:

- (A) Iron and zinc
- (B) Iron and copper
- (C) Iron and carbon
- (D) Iron and tin

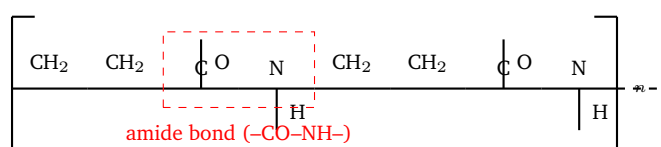
Q16. Diamond and graphite are both naturally occurring forms of the element carbon. These different structural forms of the same element are called:

- (A) Allotropes of carbon
- (B) Compounds of carbon and silicon
- (C) Isotopes of carbon
- (D) Isomers of carbon



- Q17.** The “fire triangle” shows the three things required to sustain combustion. Which option correctly lists all three components?
- (A) Fuel and oxygen only
(B) Fuel and heat only
(C) Oxygen and heat only
(D) Fuel, oxygen, and heat (ignition temperature)
- Q18.** Hard water does not lather easily with soap. This is because hard water contains dissolved salts of:
- (A) Sodium ions (Na^+)
(B) Calcium and magnesium ions (Ca^{2+} and Mg^{2+})
(C) Iron ions (Fe^{2+})
(D) Potassium ions (K^+)
- Q19.** The approximate composition of air by volume is:
- (A) 78% nitrogen and 21% oxygen
(B) 21% nitrogen and 78% oxygen
(C) 60% nitrogen and 30% oxygen
(D) 90% nitrogen and 9% oxygen
- Q20.** The diagram below shows a portion of a polymer chain with repeating amide ($-\text{CO}-\text{NH}-$) linkages. This structure represents nylon, the first fully synthetic fibre. Nylon was synthesised from:

Nylon polymer chain (simplified repeating unit)



- (A) Cotton – a natural plant fibre
(B) Silk – a natural protein fibre

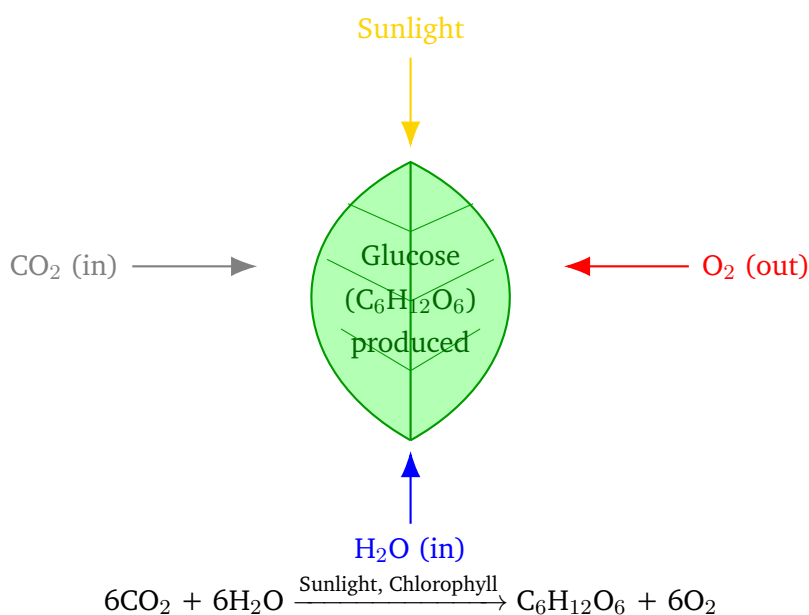


- (C) Petrochemicals – it is the first fully synthetic fibre
- (D) Rayon – a semi-synthetic fibre from wood pulp

Q21. Which statement about the **cell wall** is correct?

- (A) It is present only in animal cells
- (B) It is present in all types of cells
- (C) It is absent in plant cells
- (D) It is absent in animal cells

Q22. The diagram below shows a leaf carrying out photosynthesis. What are the **products** of photosynthesis?



- (A) Carbon dioxide and water
- (B) Glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) and oxygen (6O_2)
- (C) Glucose and carbon dioxide
- (D) Water and oxygen only
- Q23.** The stomach produces hydrochloric acid (HCl). What is the primary role of HCl in digestion?
- (A) It activates the enzyme pepsin to begin the digestion of proteins



- (B) Salivary amylase uses HCl to digest proteins in the stomach
- (C) Bile uses HCl to emulsify fats in the stomach
- (D) Pancreatic lipase is activated by HCl to digest carbohydrates

Q24. Yeast performs anaerobic respiration (fermentation) in the absence of oxygen. The products of this process are:

- (A) Carbon dioxide only
- (B) Lactic acid and carbon dioxide
- (C) Ethanol (alcohol) and carbon dioxide
- (D) Lactic acid only

Q25. Which tissue in plants is responsible for transporting water and dissolved mineral salts from the roots upward to the leaves?

- (A) Phloem – transports water from roots to leaves
- (B) Xylem – transports water and minerals upward from roots
- (C) Xylem – transports prepared food downward from leaves
- (D) Phloem – transports water downward from leaves to roots

Q26. When flowering plants are pollinated by insects attracted by bright colours and nectar, this type of pollination is called:

- (A) Anemophily (wind pollination)
- (B) Hydrophily (water pollination)
- (C) Zoophily (animal pollination by non-insect animals)
- (D) Entomophily (insect pollination)

Q27. Bacteria are classified as **prokaryotes**. Which feature best distinguishes a prokaryotic cell from a eukaryotic cell?

- (A) Prokaryotes have no membrane-bound nucleus; genetic material lies free in the cytoplasm

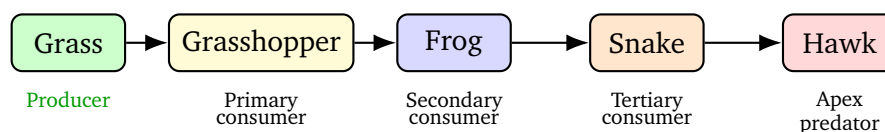


- (B) Prokaryotes have a well-defined membrane-bound nucleus
- (C) Prokaryotes have a membrane-bound nucleus but no cell wall
- (D) Prokaryotes are larger and more complex than eukaryotes

Q28. Penicillin, the first antibiotic, was discovered in 1928. Who discovered it?

- (A) Louis Pasteur
- (B) Robert Koch
- (C) Alexander Fleming
- (D) Joseph Lister

Q29. Study the food chain shown in the diagram below. Which organism is the **producer** in this food chain?



- (A) Grasshopper, because it eats grass
- (B) Frog, because it feeds on smaller organisms
- (C) Snake, because it is near the top of the chain
- (D) Grass, because it prepares its own food through photosynthesis

Q30. Kharif crops are sown at the beginning of the monsoon season (June–July) and harvested in September–October. Which of the following is a **Kharif crop**?

- (A) Paddy (rice)
- (B) Wheat
- (C) Mustard
- (D) Barley



Detailed Solutions**Q1.****Solution****Concept:** Motion/Speed: Speed is defined as the distance travelled per unit time:

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}.$$

Step 1 — Identify given values: Distance = 120 km, Time = 2 hours.**Step 2 — Apply the formula:**

$$\text{Speed} = \frac{120 \text{ km}}{2 \text{ h}} = 60 \text{ km/h}$$

Why other options are wrong: Option (B): 40 km/h would mean $40 \times 2 = 80$ km, not 120 km. Option (C): 80 km/h would give $80 \times 2 = 160$ km, not 120 km. Option (D): 240 km/h results from multiplying instead of dividing ($120 \times 2 = 240$).**Answer: (A)** [Go Back to Q1](#)**Q2.****Solution****Concept:** Motion/Distance-Time Graph: In a distance-time graph, the slope (gradient) of the line represents speed. A steeper line means a greater slope, which means the object covers more distance per unit time, i.e., it has a greater speed.**Step 1 — Recall the formula for slope:**

$$\text{Slope} = \frac{\Delta \text{Distance}}{\Delta \text{Time}} = \text{Speed}$$

Step 2 — Interpret the graph: Object B has a steeper line than Object A, so Object B has a higher speed. A greater slope directly indicates greater speed.**Why other options are wrong:** Option (A): The slope tells us speed, not when motion starts — both lines begin from the origin (same start time). Option (C): Acceleration would show a curved line, not a straight line; both lines are straight, indicating constant speed. Option (D): A straight line on a distance-time graph indicates motion in one direction; direction change would require the line to slope downward.**Answer: (B)** [Go Back to Q2](#)

Q3.

Solution

Concept: Force/Non-contact Forces: Forces that act between objects without any physical contact between them are called non-contact forces. Examples include gravitational force, magnetic force, and electrostatic force.

Step 1 — Define non-contact force: A non-contact force can act across a distance without the objects touching each other.

Step 2 — Classify the options: Magnetic force acts between magnets (or magnets and magnetic materials) even when they are separated by a distance, so it is a non-contact force. Friction, tension, and normal reaction all require direct physical contact between surfaces or objects.

Why other options are wrong: Option (A): Friction is a contact force — it acts at the surface where two objects are in contact. Option (B): Tension acts in a rope or string and requires the string to be in physical contact with the object. Option (D): Normal reaction is a contact force that arises when two surfaces are in direct contact.

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

Q4.

Solution

Concept: Force/Balanced Forces: When forces acting on an object are balanced (equal magnitude, opposite direction), the net force is zero. By Newton's first law, a zero net force means no change in the state of motion.

Step 1 — Apply Newton's first law: Net force = $F_1 - F_1 = 0$ (equal and opposite). With zero net force, the object experiences no acceleration.

Step 2 — Interpret the result: An object with no net force either remains at rest (if initially stationary) or continues to move with constant velocity (if already moving). Both outcomes are possible.

Why other options are wrong: Option (A): Acceleration requires a net (unbalanced) force; balanced forces produce zero net force, so no acceleration occurs. Option (B): Deceleration also requires a net force opposing motion; balanced forces cannot cause deceleration. Option (C): Stopping immediately would require a net decelerating force; balanced forces produce no such effect.

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



Q5.

Solution

Concept: Pressure: $P = \frac{F}{A}$, where P is pressure, F is force, and A is area of contact. For the same applied force, a smaller contact area produces a greater pressure.

Step 1 — Identify the variables: Both knives are pressed with the same force F . The sharp knife has a very small contact area A_{sharp} ; the blunt knife has a larger contact area A_{blunt} .

Step 2 — Compare pressures:

$$P_{\text{sharp}} = \frac{F}{A_{\text{sharp}}} \gg P_{\text{blunt}} = \frac{F}{A_{\text{blunt}}} \quad \text{since } A_{\text{sharp}} \ll A_{\text{blunt}}$$

The sharp knife exerts far greater pressure on the bread, allowing it to cut through easily.

Why other options are wrong: Option (B): Larger area gives *smaller* pressure for the same force — this is the blunt knife. Option (C): The sharp knife does not exert less force; it exerts the *same* force over a smaller area, giving greater pressure. Option (D): A blunt knife concentrates *less* pressure at its wider tip.

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

Q6.

Solution

Concept: Pressure/Measuring Instruments: Different instruments are designed to measure different physical quantities. Atmospheric pressure is measured by a barometer; the standard atmospheric pressure is approximately 101,325 Pa (1 atm), equivalent to 76 cm of mercury column.

Step 1 — Recall instrument functions:

- Barometer: measures atmospheric pressure.
- Thermometer: measures temperature.
- Manometer: measures pressure of enclosed gases.
- Hygrometer: measures humidity (water vapour content) of air.

Step 2 — Identify the correct instrument: A barometer is specifically designed to measure atmospheric pressure.



Why other options are wrong: Option (A): A thermometer measures temperature (in C or K), not pressure. Option (C): A manometer measures the pressure of a gas in a closed container relative to atmospheric pressure. Option (D): A hygrometer measures the relative humidity of the air.

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

Q7.

Solution

Concept: Pressure/Liquid Pressure: The pressure exerted by a liquid increases with depth. Mathematically, $P = h\rho g$, where h is the depth, ρ is the density of the liquid, and g is acceleration due to gravity. At greater depth, h is larger, so P is larger.

Step 1 — Apply the formula: At the base of a dam, the depth of water h is maximum. Therefore, the water pressure $P = h\rho g$ is also maximum at the base.

Step 2 — Explain dam design: To withstand this high pressure at the base, dams are constructed thicker and wider at the bottom. This gives the structure the strength needed to resist the large outward force of water pressure at depth.

Why other options are wrong: Option (A): Pressure *increases* with depth, not decreases — this is the opposite of the correct statement. Option (B): Pressure is not uniform at all depths; it varies linearly with depth ($P \propto h$). Option (D): Liquid pressure depends on the liquid's density and depth, not on the material of the dam wall.

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

Q8.

Solution

Concept: Heat/Thermal Conductors: Metals are good conductors of heat because of the presence of free (delocalised) electrons. These electrons can move rapidly through the metal lattice and transfer kinetic energy (heat) from hotter regions to cooler regions efficiently.

Step 1 — Identify the mechanism in metals: In metals, some electrons are not bound to individual atoms but are free to move. When one end is heated, these free electrons gain kinetic energy and quickly transfer it to adjacent electrons and atoms throughout the metal.

Step 2 — Compare with non-metals: Non-metals such as wood, glass, and plastic lack free electrons. Heat can only transfer through lattice vibrations, which is



much slower. This makes them poor conductors (insulators).

Why other options are wrong: Option (B): Tightly bound atoms would *trap* heat energy and impede conduction — this describes insulators, not conductors. Option (C): Low density alone does not determine thermal conductivity; many low-density materials (like foam) are good insulators. Option (D): High melting points relate to bond strength, not to the ease of heat conduction.

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

Q9.

Solution

Concept: Light/Law of Reflection: When a ray of light strikes a reflective surface, it bounces off according to the law of reflection. Both the angle of incidence (i) and the angle of reflection (r) are measured from the normal (a line perpendicular to the mirror surface at the point of incidence).

Step 1 — State the law: The angle of incidence equals the angle of reflection: $i = r$.

Step 2 — Apply to the diagram: In the figure, the incident ray strikes the mirror at angle i from the normal, and the reflected ray leaves at angle r from the normal. By the law of reflection, $i = r$ always.

Why other options are wrong: Option (A): The angle of incidence is never necessarily greater than the angle of reflection; the law states they are always equal. Option (B): Similarly, the angle of incidence is never necessarily smaller; they are always equal. Option (C): The angles of incidence and reflection are each measured from the normal, and their sum equals $2i$ (not 180). The sum $i + r = 180$ would be impossible since each angle is between 0 and 90.

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

Q10.

Solution

Concept: Sound/Frequency and Pitch: The **pitch** of a sound is determined by the frequency of the sound wave. Frequency is measured in Hertz (Hz) and represents the number of vibrations per second.

Step 1 — Relate frequency to pitch: The higher the frequency of vibration, the higher the pitch of the sound produced. A high-frequency sound wave (e.g., 5000 Hz) produces a high-pitched sound (like a whistle), while a low-frequency wave (e.g., 50 Hz) produces a low-pitched sound (like a drum).



Step 2 — Confirm the relationship: Pitch $\propto$ Frequency. Therefore, higher frequency $\Rightarrow$ higher pitch.

Why other options are wrong: Option (A): Lower frequency gives *lower* pitch, not higher pitch — this reverses the relationship. Option (C): Amplitude determines the *loudness* of a sound, not the pitch. Option (D): The speed of sound in air is approximately constant (about 340 m/s) and is not significantly affected by frequency.

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

Q11.

Solution

Concept: Chemistry/Acids and Bases/Litmus Test: Litmus is a natural indicator. It exists in two forms: blue litmus and red litmus. Acids turn blue litmus paper red; bases turn red litmus paper blue.

Step 1 — Identify the indicator response: An acidic solution has a pH less than 7. When blue litmus paper is dipped in an acidic solution, the acid turns the blue litmus red.

Step 2 — State the observation: Blue litmus paper turns red in acidic solution. Red litmus paper remains red (no change) in an acidic solution.

Why other options are wrong: Option (A): Red litmus turning blue is the response to a *base* (alkaline solution), not an acid. Option (B): Litmus does not turn yellow; it only changes between red and blue. Option (D): Litmus does not turn green; green is the colour of a neutral solution on universal indicator, not litmus.

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

Q12.

Solution

Concept: Chemistry/Neutralisation: A neutralisation reaction occurs when an acid reacts with a base to form a salt and water. The acid and base cancel each other out (neutralise), and neither acidic nor basic products remain.

Step 1 — Write the general equation:



Step 2 — Example: $\text{HCl} + \text{NaOH} \rightarrow \text{NaCl} + \text{H}_2\text{O}$



The products are sodium chloride (a salt) and water. This confirms the general rule.

Why other options are wrong: Option (B): Salt + CO₂ are products of acid reacting with a carbonate or bicarbonate, not a base. Option (C): Water + CO₂ are products of acid + carbonate reaction. Option (D): Metal oxide + water does not describe neutralisation products; metal oxide + acid gives salt + water.

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

Q13.

Solution

Concept: Chemistry/Salts: Baking soda is sodium bicarbonate (sodium hydrogen carbonate), chemical formula NaHCO₃. It is a mild alkali (base) that releases CO₂ gas when heated or mixed with an acid, making doughs and batters rise.

Step 1 — Identify the compound: Baking soda = NaHCO₃. When heated: $2\text{NaHCO}_3 \rightarrow \text{Na}_2\text{CO}_3 + \text{H}_2\text{O} + \text{CO}_2 \uparrow$. The CO₂ released makes baked goods light and fluffy.

Step 2 — Classify its nature: NaHCO₃ is a mild base (mild alkali) used safely in food. Its aqueous solution has a pH slightly above 7.

Why other options are wrong: Option (A): NaCl is common table salt (sodium chloride) — it is neutral and does not make dough rise. Option (B): Na₂CO₃ is washing soda, a stronger alkali used in cleaning, not in cooking. Option (C): HCl is hydrochloric acid, a strong acid — it is corrosive and never used in baking.

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

Q14.

Solution

Concept: Chemistry/Chemical Reactions/Rusting: Rusting is an electrochemical oxidation process in which iron reacts with oxygen in the presence of moisture (water) to form hydrated iron(III) oxide (rust). Both oxygen and water are essential; neither alone can cause rusting.

Step 1 — State the condition: Rusting requires both:

- Oxygen (from air) – provides the oxidising agent.
- Water (moisture) – acts as the electrolyte to enable the electrochemical reaction.



Step 2 — Experimental evidence: Iron kept in completely dry air (no moisture) does not rust. Iron kept in water that has been boiled (to remove dissolved O_2) and sealed with oil does not rust either. Only when both O_2 and H_2O are present does rusting occur.

Why other options are wrong: Option (A): Dry air (oxygen only) does not cause rusting — the absence of moisture prevents the reaction. Option (C): Distilled, oxygen-free water does not cause rusting without dissolved oxygen. Option (D): Heat alone does not cause rusting; it may accelerate it if moisture and oxygen are present, but it is not a required component.

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

Q15.

Solution

Concept: Chemistry/Metals and Non-metals/Alloys: An alloy is a homogeneous mixture of two or more metals (or a metal and a non-metal). Steel is the most widely used alloy, made by combining iron with carbon. The carbon content (typically 0.2–2.1%) significantly improves the hardness and strength of iron. Stainless steel further includes chromium and nickel for corrosion resistance.

Step 1 — Identify steel's composition: Iron (Fe) + Carbon (C) = Steel. This is a metal–non-metal alloy.

Step 2 — Verify: Carbon makes iron stronger and harder; pure iron is relatively soft and bends easily.

Why other options are wrong: Option (A): Iron + zinc forms galvanised iron (used for rust prevention), not steel. Option (B): Iron + copper forms a different alloy, not standard steel. Option (D): Iron + tin forms tin plate or pewter, not steel.

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

Q16.

Solution

Concept: Chemistry/Carbon: Diamond and graphite are two of the most well-known **allotropes** of carbon. Allotropes are different structural (physical) forms of the same element. Both contain only carbon atoms but arranged differently, giving them vastly different properties.

Step 1 — Compare structures:



- **Diamond:** each C atom bonded to 4 others in a tetrahedral network $\Rightarrow$ hardest natural substance.
- **Graphite:** each C atom bonded to 3 others in flat hexagonal layers $\Rightarrow$ soft and a good conductor.

Step 2 — Classify: Since both are made entirely of carbon atoms but have different arrangements, they are called allotropes of carbon. The same element, different forms.

Why other options are wrong: Option (B): Both diamond and graphite are pure carbon; neither contains silicon. Option (C): Isotopes of carbon differ in the number of neutrons (e.g., ^{12}C , ^{13}C , ^{14}C), not in their bonding structure. Option (D): Isomers are compounds with the same molecular formula but different structural arrangements; diamond and graphite are not compounds, so they cannot be isomers.

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

Q17.

Solution

Concept: Chemistry/Combustion/Fire Triangle: Combustion is a chemical reaction in which a fuel reacts rapidly with oxygen, releasing heat and light. For combustion to begin and continue, three components must be present simultaneously: fuel (a combustible substance), oxygen (or an oxidiser), and heat (to reach ignition temperature). This is represented by the fire triangle. Removing any one component extinguishes the fire.

Step 1 — Name the three components:

- Fuel** — the substance that burns (e.g., wood, LPG, paper).
- Oxygen** — the oxidiser required for the reaction (usually from air).
- Heat** — energy needed to reach the fuel's ignition temperature.

Step 2 — Apply to fire-fighting: Fire extinguishers work by removing one component: water cools the fuel (removes heat), CO_2 extinguishers displace oxygen (removes oxygen), and smothering removes oxygen contact.

Why other options are wrong: Option (A): Omitting heat is incorrect — without sufficient heat to reach ignition temperature, combustion cannot begin. Option (B): Omitting oxygen is incorrect — fuel and heat alone cannot sustain combustion without an oxidiser. Option (C): Omitting fuel is incorrect — oxygen and heat cannot sustain fire without something to burn.



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

Q18.

Solution

Concept: Chemistry/Water/Hard Water: Hard water contains dissolved mineral salts, particularly the bicarbonates, sulphates, and chlorides of calcium (Ca^{2+}) and magnesium (Mg^{2+}). These ions react with the fatty acid salts in soap to form insoluble scum (calcium/magnesium stearate), preventing lathering.

Step 1 — Identify the ions responsible: Ca^{2+} and Mg^{2+} ions in water react with soap (sodium stearate):



The precipitate is insoluble scum, wasting soap and reducing lather.

Step 2 — Confirm: Soft water (lacking these ions) lathers easily with soap.

Why other options are wrong: Option (A): Na^{+} ions form sodium salts with soap, which are *soluble* — this is how soap works. Sodium ions do not cause hardness. Option (C): Fe^{2+} (ferrous) ions can cause some hardness but are not the primary cause; the main culprits are Ca^{2+} and Mg^{2+} . Option (D): K^{+} ions form potassium soaps, which are soluble and actually used in soft soaps.

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

Q19.

Solution

Concept: Chemistry/Air/Composition: Air is a mixture of several gases. By volume, the approximate composition of dry air is: nitrogen (N_2) $\approx 78\%$, oxygen (O_2) $\approx 21\%$, argon (Ar) $\approx 0.93\%$, carbon dioxide (CO_2) $\approx 0.04\%$, and trace amounts of other gases.

Step 1 — State the key values: Nitrogen: 78%, Oxygen: 21%. Together they account for about 99% of dry air. Nitrogen is the most abundant gas in air.

Step 2 — Verify: $78 + 21 = 99\%$, with the remaining 1% being argon and other gases. This is a standard fact for Class 7–8 SCERT/NCERT Science.

Why other options are wrong: Option (B): 21% N_2 and 78% O_2 swaps the values of nitrogen and oxygen — nitrogen is far more abundant. Option (C): 60% N_2 and 30% O_2 are incorrect percentages with no basis in air composition data. Option (D): 90% N_2 and 9% O_2 overestimates nitrogen and underestimates oxygen.



significantly.

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

Q20.

Solution

Concept: Chemistry/Synthetic Fibres: Nylon was the first fully synthetic (man-made) fibre, developed by DuPont in 1935 and commercially introduced in 1939. It is a polyamide polymer synthesised from petrochemicals (coal, water, and air) — specifically from adipic acid and hexamethylenediamine. Its repeating unit contains the characteristic amide linkage ($-\text{CO}-\text{NH}-$) as shown in the diagram.

Step 1 — Identify the key property: Nylon is classified as *fully synthetic* because all its raw materials are obtained from petrochemicals (crude oil derivatives), with no natural fibre involved.

Step 2 — Distinguish from other fibres:

- Cotton: natural plant fibre (from cotton boll seed hairs).
- Silk: natural protein fibre (from silkworm cocoons).
- Rayon: semi-synthetic — derived from natural cellulose (wood pulp) but chemically processed.
- Nylon: fully synthetic — entirely from petrochemicals.

Why other options are wrong: Option (A): Cotton is a natural fibre obtained from plants and was used long before synthetic fibres were invented. Option (B): Silk is a natural protein fibre produced by silkworms; it is not synthetic. Option (D): Rayon is semi-synthetic, not fully synthetic, because it is derived from natural cellulose.

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



Q21.

Solution

Concept: Biology/Cell/Cell Wall: The cell wall is a rigid outer covering found in plant cells (made of cellulose) and bacterial cells (made of peptidoglycan). It provides structural support and protection. Animal cells do not have a cell wall — they are bounded only by the flexible cell membrane.

Step 1 — Identify which cells have a cell wall:

- Plant cells: have a cell wall (cellulose).
- Bacterial cells: have a cell wall (peptidoglycan).
- Fungal cells: have a cell wall (chitin).
- Animal cells: do **not** have a cell wall.

Step 2 — Confirm the statement: The cell wall is **absent** in animal cells. Animal cells are bounded by the cell (plasma) membrane only, giving them flexibility.

Why other options are wrong: Option (A): The cell wall is absent in animal cells, not present only in them — this reverses the fact. Option (B): The cell wall is not present in all cells; animal cells lack it. Option (C): Plant cells do have a cell wall — it is one of the key features distinguishing plant cells from animal cells.

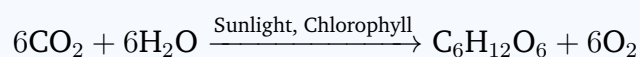
Answer: (D) [Go Back to Q21](#)

Q22.

Solution

Concept: Biology/Nutrition/Photosynthesis: Photosynthesis is the process by which green plants (and algae) use sunlight, carbon dioxide, and water to produce glucose and oxygen. Chlorophyll in the leaves captures sunlight to drive this reaction.

Step 1 — Write the photosynthesis equation:



Step 2 — Identify reactants and products:

- **Reactants (inputs):** Carbon dioxide (CO_2) from air, water (H_2O) from soil/roots, and sunlight energy.
- **Products (outputs):** Glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) stored in the plant, and oxygen



(O₂) released into the air.

Why other options are wrong: Option (A): CO₂ and H₂O are the *reactants* (inputs), not the products. Option (C): Glucose + CO₂ is incorrect; CO₂ is a reactant, not a product of photosynthesis. Option (D): Water and oxygen alone are not the complete products; glucose is the main organic product stored by the plant.

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

Q23.

Solution

Concept: Biology/Nutrition/Digestion: The stomach secretes gastric juice, which contains hydrochloric acid (HCl), mucus, and the enzyme pepsinogen. HCl creates the strongly acidic environment (pH 1.5–2) required to convert the inactive pepsinogen into its active form, pepsin. Pepsin then begins the digestion of proteins into smaller polypeptides.

Step 1 — Identify the role of HCl:

- Activates pepsinogen → pepsin (active enzyme).
- Kills harmful bacteria that may have entered with food.
- Provides the acidic pH needed for pepsin to function.

Step 2 — State the key fact: HCl activates pepsin, and pepsin digests proteins. This is the primary function of HCl in the stomach.

Why other options are wrong: Option (B): Salivary amylase acts in the mouth and digests *starch* (carbohydrates), not proteins. It is not related to HCl in the stomach. Option (C): Bile is secreted by the liver and stored in the gall bladder; it emulsifies fats in the *small intestine*, not in the stomach. Option (D): Pancreatic lipase digests fats (lipids) in the small intestine, not proteins, and is not activated by HCl.

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

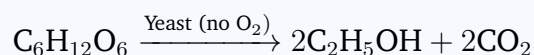


Q24.

Solution

Concept: Biology/Respiration/Anaerobic Respiration: Anaerobic respiration occurs in the absence of oxygen. Yeast is a unicellular fungus that respire anaerobically by breaking down glucose into ethanol (ethyl alcohol) and carbon dioxide. This process is called fermentation and is used in the production of bread, beer, and wine.

Step 1 — Write the equation for yeast fermentation:



Glucose $\rightarrow$ Ethanol + Carbon dioxide.

Step 2 — Confirm the products: Ethanol (alcohol) and CO_2 are the only products of yeast fermentation. The CO_2 makes bread rise; the ethanol is used in beverages and fuel.

Why other options are wrong: Option (A): CO_2 alone is not the only product — ethanol is also produced. Producing only CO_2 without alcohol does not represent fermentation. Option (B): Lactic acid + CO_2 are the products of anaerobic respiration in certain *bacteria* (e.g., *Lactobacillus*), not in yeast. Option (D): Lactic acid alone is produced in human muscle cells during intense exercise (anaerobic), not by yeast.

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

Q25.

Solution

Concept: Biology/Transport in Plants: Plants have two types of vascular tissue: xylem and phloem. Xylem transports water and dissolved mineral salts from the roots upward to the stem and leaves (upward transport). Phloem transports the food (sucrose/glucose) prepared in the leaves to all other parts of the plant (both upward and downward).

Step 1 — Recall the functions:

- **Xylem:** Water and minerals — roots $\rightarrow$ leaves (upward, one-directional).
- **Phloem:** Prepared food (sucrose) — leaves $\rightarrow$ all parts (bi-directional).

Step 2 — Identify the correct answer: Xylem transports water and dissolved mineral salts upward from roots to leaves. This is Option (B).

Why other options are wrong: Option (A): Phloem transports *food* (prepared



sugar), not water, and mainly carries it from leaves to other parts — this confuses phloem's function with xylem's. Option (C): Xylem transports water *upward*, not food downward — this describes phloem's function. Option (D): Phloem does not transport water downward from leaves; this is an incorrect description of both tissues.

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

Q26.

Solution

Concept: Biology/Reproduction/Pollination: Pollination is the transfer of pollen grains from the anther to the stigma of a flower. Different agents carry pollen, and pollination is named after the agent used.

Step 1 — Define the types of pollination:

- **Anemophily:** By wind (e.g., grass, maize). Flowers are small, no nectar, light pollen.
- **Hydrophily:** By water (e.g., Vallisneria, Hydrilla). Flowers are small, submerged.
- **Entomophily:** By insects (e.g., rose, sunflower). Flowers have bright colours, nectar, and fragrance to attract insects.
- **Zoophily:** By non-insect animals such as birds (ornithophily) or bats (chiropterophily).

Step 2 — Apply to the question: Insects are attracted by bright colours and nectar, so insect pollination = entomophily.

Why other options are wrong: Option (A): Anemophily is wind pollination, not insect pollination. Wind-pollinated flowers usually lack bright colours or nectar. Option (B): Hydrophily involves water as the pollinating agent, not insects. Option (C): Zoophily is pollination by non-insect animals (birds, bats, etc.); insects form a specific sub-category called entomophily.

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



Q27.

Solution

Concept: Biology/Microorganisms/Prokaryotes vs Eukaryotes: All living organisms are classified as either prokaryotes or eukaryotes based on the organisation of their cells. The key distinction is the presence or absence of a membrane-bound nucleus.

Step 1 — Define prokaryotes: Prokaryotic cells (*pro* = before, *karyon* = nucleus) lack a membrane-bound nucleus. Their genetic material (DNA) lies free in the cytoplasm in a region called the nucleoid. Bacteria and Archaea are prokaryotes.

Step 2 — Compare with eukaryotes: Eukaryotic cells (animals, plants, fungi, protists) have a well-defined nucleus enclosed by a nuclear membrane. Their DNA is contained within this membrane-bound nucleus.

Why other options are wrong: Option (B): Having a well-defined membrane-bound nucleus is the feature of *eukaryotes*, not prokaryotes. Prokaryotes lack this structure. Option (C): Prokaryotes do not have a membrane-bound nucleus at all — this combines features incorrectly. Option (D): Prokaryotes are actually *smaller* and *simpler* than eukaryotes; eukaryotic cells are larger and have membrane-bound organelles.

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

Q28.

Solution

Concept: Biology/Microorganisms/Antibiotics: Penicillin was the first antibiotic to be discovered, marking a revolution in medicine. It was discovered accidentally by Scottish bacteriologist Alexander Fleming in 1928, when he noticed that a mould (*Penicillium notatum*) contaminating one of his bacterial culture plates was killing the surrounding bacteria (*Staphylococcus aureus*).

Step 1 — State the key fact: Alexander Fleming discovered penicillin in 1928. Later, Howard Florey and Ernst Chain developed it into a usable antibiotic drug (for which they shared the 1945 Nobel Prize in Physiology or Medicine with Fleming).

Step 2 — Confirm: Penicillin was derived from the fungus *Penicillium*, and Fleming's observation led to the antibiotic era.

Why other options are wrong: Option (A): Louis Pasteur developed the germ theory of disease and invented pasteurisation; he did not discover penicillin. Option (B): Robert Koch identified the causative agents of tuberculosis and cholera (Koch's postulates), but did not discover penicillin. Option (D): Joseph Lister



pioneered antiseptic surgery using carbolic acid; he lived before penicillin was discovered (he died in 1912).

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

Q29.

Solution

Concept: Biology/Natural Resources/Food Chain: A food chain shows the flow of energy and matter through a series of organisms in an ecosystem. The first organism in a food chain is always the **producer** — a green plant or photosynthetic organism that makes its own food from sunlight, CO₂, and water.

Step 1 — Identify each organism's role in the chain:



Step 2 — Define producer: A producer prepares its own food through photosynthesis. Grass is a green plant that fixes solar energy into organic matter, making it the producer and the foundation of the food chain.

Why other options are wrong: Option (A): The grasshopper is the primary *consumer*; it eats the producer (grass) but does not produce its own food. Option (B): The frog is the secondary consumer; it is two levels above the producer in this chain. Option (C): The snake is the tertiary consumer, even further from the producer level.

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

Q30.

Solution

Concept: Biology/Natural Resources/Agriculture/Crop Seasons: In India, crops are grown in two main seasons. **Kharif crops** are sown at the beginning of the monsoon (June–July) and harvested in September–October. They require warm and moist conditions. **Rabi crops** are sown in winter (October–November) and harvested in March–April; they grow in cool, dry conditions.

Step 1 — Identify Kharif crops: Paddy (rice), maize, cotton, groundnut, jute, soybean, sugarcane. These crops need heavy rainfall and warm temperatures.

Step 2 — Identify Rabi crops: Wheat, mustard, barley, gram (chickpea), peas. These crops grow during the cool, dry winter season.



Step 3 — Match: Paddy (rice) is a Kharif crop sown during the monsoon season. Wheat, mustard, and barley are Rabi crops sown in winter.

Why other options are wrong: Option (B): Wheat is a Rabi crop sown in October–November and harvested in March–April during cooler, drier weather. Option (C): Mustard is also a Rabi crop, grown in winter and harvested in spring. Option (D): Barley is a Rabi crop that grows best in cool, dry conditions during the winter season.

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



Answer Key

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

