

Kerala NMMS Science

Sample Paper – 4

Duration: 30 Minutes

Maximum Marks: 30

Instructions

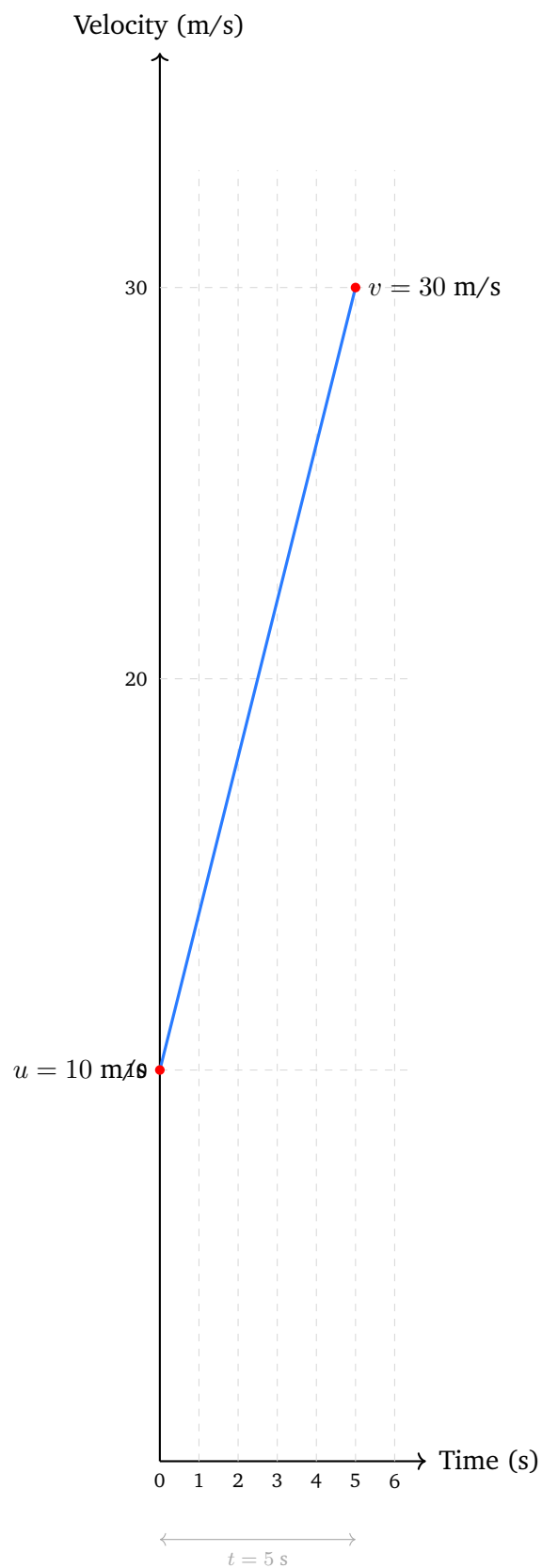
- This paper contains **30** Multiple Choice Questions (Single Correct Answer), modelled on the Science portion of **Kerala NMMS (SAT)**.
- Each correct answer carries **+1 mark**. There is **no negative marking** for incorrect or unattempted answers.
- Only **one** option is correct. Choose carefully.
- 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 person travels 40 km in the first 2 hours and then 60 km in the next 3 hours. What is his average speed for the entire journey?

- (A) 25 km/h
- (B) 15 km/h
- (C) 30 km/h
- (D) 20 km/h

Q2. The velocity–time graph below shows the motion of an object. What is the acceleration of the object?



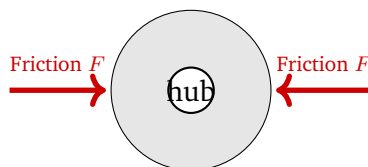


- (A) 6 m/s^2
- (B) 8 m/s^2
- (C) 4 m/s^2



(D) 2 m/s^2

- Q3.** The diagram below shows friction forces acting on a bicycle wheel when brakes are applied. Which statement correctly describes the role of friction in everyday life?



Equal & opposite friction forces (braking)

- (A) Friction is harmful in bicycle brakes, so brake pads are made smooth to reduce friction.
- (B) Bicycle brakes, walking without slipping, and writing with a pen all depend on friction.
- (C) Friction always speeds up moving objects and is therefore desirable in all situations.
- (D) Only writing requires friction; bicycles and walking work better without any friction.
- Q4.** A boy pushes a wall with a force of 50 N. According to Newton's third law of motion, what is the reaction force exerted by the wall on the boy?
- (A) 50 N in the direction opposite to the push (away from the wall)
- (B) More than 50 N because the wall is heavier than the boy
- (C) 50 N in the same direction as the push (into the wall)
- (D) Zero, because the wall is stationary and does not exert any force
- Q5.** A hydraulic lift is used to raise heavy vehicles in a garage. A small force applied on a small piston creates a large force on the large piston. Which law/principle explains this working?
- (A) Archimedes' principle

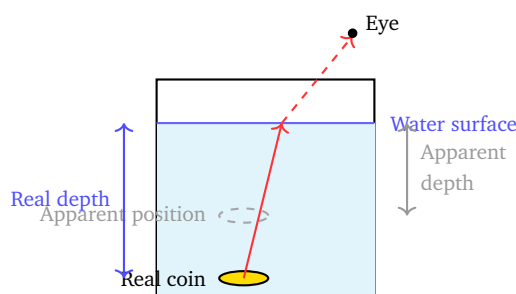


- (B) Bernoulli's principle
- (C) Newton's second law
- (D) Pascal's law

Q6. Coastal areas experience moderate climate – warm winters and cool summers – compared to inland areas at the same latitude. The main scientific reason is:

- (A) Sea water has a very low specific heat capacity and therefore cools down very quickly.
- (B) Coastal areas receive more solar radiation than inland areas throughout the year.
- (C) Sea water has a very high specific heat capacity and therefore heats up and cools down slowly.
- (D) Strong convection currents carry warm air from the sea directly to coastal towns.

Q7. A coin is placed at the bottom of a beaker filled with water. The diagram below shows how the eye perceives the coin's position. Which statement correctly describes what is observed?

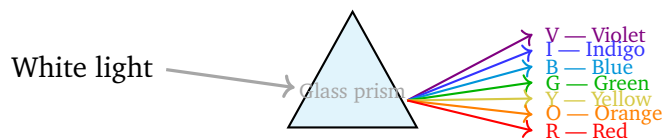


- (A) The apparent depth equals the real depth; refraction has no effect on the coin's position.
- (B) The apparent depth is less than the real depth; the coin appears closer to the surface.
- (C) The apparent depth is greater than the real depth; the coin appears deeper than it actually is.



(D) Refraction causes the coin to completely disappear when viewed from outside the beaker.

Q8. A ray of white light passes through a glass prism as shown below. Which colour bends (refracts) the most on passing through the prism?



- (A) Violet, because it has the shortest wavelength among visible colours
- (B) Red, because it has the longest wavelength among visible colours
- (C) Green, because it is in the middle of the spectrum and bends most
- (D) All colours bend by the same amount; dispersion only separates them by intensity

Q9. Ultrasound waves (frequency greater than 20,000 Hz) are used in which of the following devices or systems to detect underwater objects, measure ocean depth, and locate submarines?

- (A) X-ray imaging system
- (B) Radar (Radio Detection And Ranging)
- (C) Optical telescope
- (D) SONAR (Sound Navigation And Ranging)

Q10. A circuit has a battery providing a voltage of 12 V across a resistor. If the resistance is $4\ \Omega$, what is the current flowing through the circuit? (Use Ohm's law: $V = IR$)

- (A) 2 A
- (B) 4 A
- (C) 3 A
- (D) 6 A



- Q11.** Turmeric (curcumin) is a natural indicator used to test acidic and basic solutions. What colour does turmeric paper turn in an acidic solution and in a basic (alkaline) solution respectively?
- (A) Blue in acidic solution; yellow in basic solution
(B) Yellow in acidic solution; red/brick-red in basic solution
(C) Pink in acidic solution; colourless in basic solution
(D) Colourless in acidic solution; blue in basic solution
- Q12.** Baking powder is commonly used while baking cakes to make them soft and fluffy. Which of the following correctly explains why baking powder causes a cake to rise?
- (A) It releases CO_2 gas on heating, and the gas bubbles make the cake light and fluffy.
(B) It releases O_2 gas on heating, which burns excess fat inside the dough.
(C) It absorbs CO_2 from the surroundings and expands the dough from outside.
(D) It produces no gas; it only adds sweetness and changes the texture of the cake.
- Q13.** The four main types of chemical reactions taught at the Class 7–8 level are:
- (A) Combination, decomposition, precipitation, and substitution
(B) Synthesis, analysis, combustion, and neutralisation
(C) Oxidation, reduction, displacement, and exchange
(D) Combination, decomposition, displacement, and double displacement
- Q14.** Iron pipes and iron structures are often coated with a thin layer of a metal to protect them from rusting (corrosion). This process is called galvanising. Which metal is used in galvanising?



- (A) Tin
- (B) Copper
- (C) Zinc
- (D) Lead

Q15. Diamond and graphite are both allotropes of carbon. Which of the following statements about diamond is correct?

- (A) Diamond is the softest known substance and is used as a lubricant in machinery.
- (B) Diamond is the hardest naturally occurring substance and is used in cutting and grinding tools.
- (C) Diamond is an excellent conductor of electricity and is used in electrical wires.
- (D) Diamond is a transparent semiconductor and is used in electronic chips.

Q16. LPG (Liquefied Petroleum Gas) is widely used as cooking fuel in Indian homes. LPG is mainly composed of which gases?

- (A) Butane (C_4H_{10}) and propane (C_3H_8)
- (B) Methane (CH_4) and ethane (C_2H_6)
- (C) Ethylene (C_2H_4) and acetylene (C_2H_2)
- (D) Hydrogen (H_2) and helium (He)

Q17. Chlorination is commonly used to treat drinking water before it is supplied to homes. What is the primary purpose of adding chlorine or its compounds to drinking water?

- (A) To remove turbidity (cloudiness) by making suspended particles settle down
- (B) To remove dissolved salts and permanent hardness from the water
- (C) To add essential minerals such as calcium and fluoride to the water



(D) To kill disease-causing microorganisms such as bacteria and viruses

Q18. Particulate matter (PM 2.5 and PM 10) is a major air pollutant consisting of tiny solid and liquid particles suspended in the air. Which of the following correctly describes the primary health effects of breathing air with high levels of particulate matter?

- (A) It promotes plant growth by adding carbon and nitrogen to the soil through rainfall.
- (B) It has no significant health effects; the particles are too small to cause any harm.
- (C) It causes respiratory diseases (asthma, bronchitis) and cardiovascular problems.
- (D) It only causes mild skin and eye irritation; the lungs are fully protected by mucus.

Q19. Bakelite and melamine are examples of thermosetting plastics. Which of the following correctly describes the special property of thermosetting plastics compared to thermoplastics?

- (A) They can be easily remoulded and reshaped on reheating, just like thermoplastics.
- (B) Once set, they cannot be remoulded because cross-linked polymer chains form on heating.
- (C) They can be recycled repeatedly and are therefore more environment-friendly than thermoplastics.
- (D) They soften on gentle heating and harden again on cooling, just like wax.

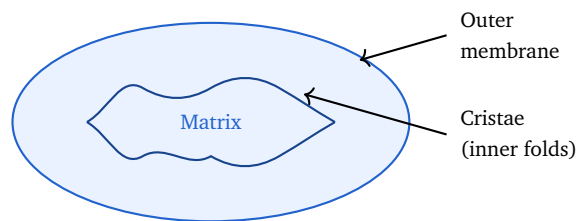
Q20. Jute is a natural fibre used to make ropes, sacks, and carpets. From which part of the jute plant is jute fibre obtained?

- (A) Stem (bast) of the jute plant
- (B) Seed of the cotton plant



- (C) Leaf of the banana plant
- (D) Root of the flax plant

Q21. The diagram below shows the structure of an important cell organelle. It is called the “powerhouse of the cell.” Identify the organelle and its function.



Mitochondrion — “Powerhouse of the Cell”

- (A) Nucleus; it controls all cell activities and stores genetic information.
 - (B) Ribosome; it is the site of protein synthesis in the cell.
 - (C) Vacuole; it stores food, water, and waste materials in the cell.
 - (D) Mitochondrion; it is the site of aerobic cellular respiration and ATP production.
- Q22.** Venus flytrap, Sundew, and Pitcher plant are examples of insectivorous (carnivorous) plants. Why do these plants trap and digest insects?
- (A) They grow in air that is poor in carbon dioxide and obtain it by digesting insects.
 - (B) They lack chlorophyll entirely and depend on insects for all their nutritional needs.
 - (C) They grow in soil poor in nitrogen and obtain nitrogen by trapping and digesting insects.
 - (D) They live exclusively in water and trap insects only for mineral salts like potassium.
- Q23.** Which of the following correctly distinguishes between breathing and cellular respiration?



- (A) Both breathing and cellular respiration are chemical processes occurring inside cells.
- (B) Breathing is a physical (mechanical) process; cellular respiration is a chemical process.
- (C) Breathing and cellular respiration are exactly the same process described differently.
- (D) Cellular respiration is a physical process; breathing is a chemical process inside the lungs.

Q24. The heart is a muscular organ that pumps blood continuously throughout the body. What is the normal resting heart rate (pulse rate) of a healthy adult human?

- (A) 60–80 beats per minute; the heart pumps blood to all parts of the body.
- (B) 100–120 beats per minute; the heart purifies blood by removing CO_2 .
- (C) 40–50 beats per minute; the heart pumps lymph through lymphatic vessels.
- (D) 20–30 beats per minute; the heart filters blood by removing waste products.

Q25. Spore formation is a type of asexual reproduction in which tiny reproductive units called spores are produced. Which of the following groups of organisms reproduces by spore formation?

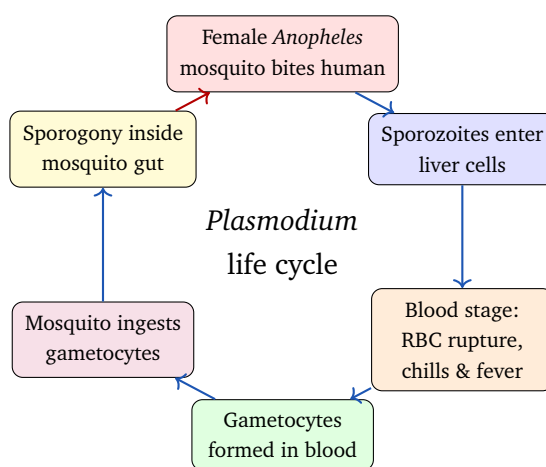
- (A) Mango, neem, and peepal — all reproduce by spore formation
- (B) Wheat, maize, and rice — all reproduce by spore formation
- (C) Rose, jasmine, and hibiscus — all reproduce by spore formation
- (D) Ferns, mosses, and fungi — all reproduce by spore formation

Q26. Vallisneria and Hydrilla are aquatic plants in which pollen is released into the water and carried to the stigma. What type of pollination is this called?



- (A) Entomophily — pollination carried out by insects
- (B) Anemophily — pollination carried out by wind
- (C) Hydrophily — pollination carried out by water
- (D) Ornithophily — pollination carried out by birds

Q27. The diagram below shows a simplified life cycle of a protozoan parasite that causes a serious disease in humans. Identify the parasite, the disease it causes, and the vector (carrier) that transmits it.



- (A) *Plasmodium* causes typhoid fever and is transmitted by houseflies.
- (B) *Plasmodium* causes malaria and is transmitted by the female *Anopheles* mosquito.
- (C) *Plasmodium* causes dengue fever and is transmitted by the *Aedes* mosquito.
- (D) *Plasmodium* is a bacterium that causes cholera through contaminated water.

Q28. Vaccination is one of the most important achievements of modern medicine. How does vaccination protect a person against a specific disease?

- (A) It stimulates the immune system to produce antibodies and memory cells, providing future immunity.
- (B) It directly kills all bacteria and viruses present in the body at the time of injection.



- (C) It provides immunity only once; repeat doses have no additional protective effect.
- (D) It provides complete immunity against all possible diseases with a single injection.

Q29. Bacteria and fungi act as decomposers in an ecosystem. What is the most important role of decomposers in nature?

- (A) They fix atmospheric nitrogen directly into complex organic compounds like proteins.
- (B) They produce oxygen through photosynthesis just like green plants.
- (C) They only cause disease in living organisms and have no beneficial role in the environment.
- (D) They break down dead organic matter and return nutrients like nitrogen, carbon, and phosphorus to the soil.

Q30. Siberian cranes, flamingos, and Bar-headed geese visit India every year, travelling thousands of kilometres from their native habitats. Which of the following correctly explains why these birds migrate?

- (A) They migrate to escape predators during the summer months in their native regions.
- (B) They migrate toward colder polar regions in winter to find ice fish and frozen prey.
- (C) They travel thousands of kilometres in winter to find food and suitable breeding conditions in warmer regions.
- (D) These birds stay in the same region throughout the year and do not actually migrate.



Detailed Solutions

Q1.

Solution

Concept: Average speed = $\frac{\text{Total distance}}{\text{Total time}}$. Do not average the two speeds directly.

Step 1: Find total distance and total time.

$$\text{Total distance} = 40 \text{ km} + 60 \text{ km} = 100 \text{ km}$$

$$\text{Total time} = 2 \text{ h} + 3 \text{ h} = 5 \text{ h}$$

Step 2: Calculate average speed.

$$\text{Average speed} = \frac{100}{5} = 20 \text{ km/h}$$

Why other options are wrong: Option (A) 25 km/h is the result of incorrectly averaging the two individual speeds ($\frac{20+30}{2} = 25$), which is valid only when time intervals are equal. Option (B) 15 km/h has no correct basis. Option (C) 30 km/h is the speed for the second leg only.

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

Q2.

Solution

Concept: Acceleration $a = \frac{v - u}{t}$, where u is initial velocity, v is final velocity, and t is time. The slope of a velocity–time graph equals acceleration.

Step 1: Read values from the graph: $u = 10 \text{ m/s}$ (at $t = 0$), $v = 30 \text{ m/s}$ (at $t = 5 \text{ s}$).

Step 2: Apply the formula.

$$a = \frac{v - u}{t} = \frac{30 - 10}{5} = \frac{20}{5} = 4 \text{ m/s}^2$$

Graphically: The slope of the line = $\frac{\Delta v}{\Delta t} = \frac{30 - 10}{5 - 0} = 4 \text{ m/s}^2$.

Why other options are wrong: Option (A) 6 m/s^2 would require $\Delta v = 30$, not 20. Option (B) 8 m/s^2 doubles the correct answer, perhaps from halving the time. Option (D) 2 m/s^2 halves the correct answer, perhaps from using $\Delta v = 10$.

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



Q3.

Solution

Concept: Friction is a contact force that opposes relative motion between two surfaces. It is not always harmful – in many everyday situations it is essential.

Analysis of each example:

- **Bicycle brakes:** Brake pads press against the rim/disc. Friction between pad and rim generates the force that decelerates the wheel. Without friction, brakes would not work.
- **Walking without slipping:** Friction between the shoe sole and the ground prevents the foot from sliding backward. Without friction, we could not walk normally.
- **Writing with a pen:** Friction between the pen tip and paper causes ink to be deposited. Without friction, the pen would glide without leaving any mark.

Therefore: All three situations — brakes, walking, and writing — depend on friction. Option (B) is correct.

Why other options are wrong: Option (A) is false; brake pads are made rough, not smooth, to maximise friction. Option (C) is false; friction opposes motion and does not speed up objects. Option (D) is false; walking and braking both require friction.

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

Q4.

Solution

Concept: Newton's third law of motion states: "For every action there is an equal and opposite reaction." The two forces act on different bodies.

Step 1: Action — the boy exerts a force of 50 N on the wall (pushing it).

Step 2: Reaction — the wall exerts a force of exactly 50 N on the boy, directed away from the wall (opposite in direction).

Key points:

- The reaction force is **equal in magnitude** ($50\text{ N} = 50\text{ N}$).
- The reaction force is **opposite in direction** (away from wall, not into the wall).
- The wall does exert a force even though it does not move.



Why other options are wrong: Option (B) says the wall pushes back with more force — Newton's third law requires equal magnitude. Option (C) says same direction — reaction is always opposite. Option (D) says the wall exerts no force — a stationary object can and does exert a reaction force.

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

Q5.

Solution

Concept: Pascal's law states: "Pressure applied to an enclosed fluid is transmitted equally in all directions throughout the fluid."

Working of a hydraulic lift:

- A small force F_1 is applied on a small piston of area A_1 .
- This creates pressure $P = \frac{F_1}{A_1}$ in the fluid.
- This same pressure P acts on the large piston (area $A_2 \gg A_1$).
- Force on large piston: $F_2 = P \times A_2 = F_1 \times \frac{A_2}{A_1} \gg F_1$.

A small input force produces a much larger output force because the pressure is the same but the area is much larger.

Why other options are wrong: Archimedes' principle deals with buoyancy of objects in fluids. Bernoulli's principle relates fluid velocity and pressure in flowing fluids. Newton's second law relates net force to acceleration ($F = ma$). None of these explains force multiplication in a static enclosed fluid.

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

Q6.

Solution

Concept: Specific heat capacity is the amount of heat energy required to raise the temperature of 1 kg of a substance by 1°C .

Key fact: Water has a very high specific heat capacity ($c = 4200 \text{ J kg}^{-1} ^\circ\text{C}^{-1}$), much higher than land/rock.

Effect on coastal climate:

- In summer, the sea absorbs a large amount of solar energy but its tempera-



ture rises only slowly. It keeps coastal air cooler than inland areas.

- In winter, the sea loses heat slowly, keeping coastal air warmer than inland areas.

Result: Coastal areas experience moderate climate – warm winters, cool summers.

Why other options are wrong: Option (A) is the opposite of the truth – water has **high** specific heat. Option (B) is incorrect; coastal areas do not receive more radiation than comparable inland areas. Option (D) is a minor effect; the dominant reason is high specific heat capacity of sea water.

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

Q7.

Solution

Concept: When light travels from a denser medium (water) to a rarer medium (air), it bends away from the normal. This is called refraction.

Effect on apparent depth:

- Light from the coin at the bottom of the beaker travels upward through water and refracts (bends away from normal) at the water–air surface.
- The eye traces the refracted rays backward in a straight line and locates the coin at a position higher than its actual position.
- Thus the coin appears to be closer to the surface than it actually is.

Result: Apparent depth < Real depth.

Relation: Apparent depth = $\frac{\text{Real depth}}{n}$ where n is the refractive index of water (≈ 1.33). Since $n > 1$, apparent depth is less than real depth.

Why other options are wrong: Option (A) says they are equal – refraction does change the perceived position. Option (C) says apparent depth is greater – this would require the light to bend toward the normal when going from denser to rarer medium, which is opposite to what happens. Option (D) denies refraction altogether.

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



Q8.

Solution

Concept: Dispersion is the splitting of white light into its component colours (VIBGYOR) by a prism. Different colours have different wavelengths and are refracted by different amounts.

Key rule: The extent of refraction (bending) increases as wavelength decreases.

- Violet has the shortest wavelength ($\approx 380\text{--}450\text{ nm}$) $\Rightarrow$ bends the **most**.
- Red has the longest wavelength ($\approx 620\text{--}750\text{ nm}$) $\Rightarrow$ bends the **least**.

Order (VIBGYOR): Violet, Indigo, Blue, Green, Yellow, Orange, Red – from most bent to least bent.

Mnemonic: “Violet bends vigorously; Red runs straight.”

Why other options are wrong: Option (B) says red bends most – this is the opposite of the correct rule. Option (C) says green bends most – green is in the middle and has intermediate bending. Option (D) says all colours bend equally – if that were true, dispersion (and rainbows) would not occur.

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

Q9.

Solution

Concept: SONAR stands for **S**ound **N**avigation **A**nd **R**anging. It uses ultrasound pulses to detect objects underwater.

Working of SONAR:

- A transmitter sends an ultrasound pulse downward (or forward) into the water.
- The pulse reflects (echoes) off the underwater object or ocean floor.
- A receiver detects the returned echo.
- Distance = $\frac{\text{Speed of sound in water} \times \text{Time for echo}}{2}$.

Uses: Locating submarines, measuring ocean depth, detecting fish shoals.

Why other options are wrong: X-rays cannot penetrate large bodies of water and are used for medical imaging in air. Radar uses radio waves (electromagnetic), which are rapidly absorbed by water and cannot detect submerged objects. A



telescope uses visible light and works only in air/space for distant astronomical objects.

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

Q10.

Solution

Concept: Ohm's law: $V = IR$, where V is voltage (volts), I is current (amperes), and R is resistance (ohms).

Step 1: Rearrange for current: $I = \frac{V}{R}$.

Step 2: Substitute values: $V = 12 \text{ V}$, $R = 4 \Omega$.

$$I = \frac{12}{4} = 3 \text{ A}$$

Verification: $V = IR = 3 \times 4 = 12 \text{ V}$. **Confirmed.**

Why other options are wrong: Option (A) $I = 2 \text{ A}$ would require $R = 6 \Omega$ for $V = 12 \text{ V}$. Option (B) $I = 4 \text{ A}$ would require $R = 3 \Omega$. Option (D) $I = 6 \text{ A}$ would require $R = 2 \Omega$. None of these match $R = 4 \Omega$.

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

Q11.

Solution

Concept: Natural indicators change colour depending on whether the solution is acidic, neutral, or basic. Turmeric contains curcumin, a natural dye that acts as a pH indicator.

Turmeric colour changes:

- **Acidic solution:** Turmeric remains **yellow** (no colour change from its original yellow colour).
- **Neutral solution:** Turmeric remains **yellow**.
- **Basic (alkaline) solution:** Turmeric turns **red/brick-red**.

Practical use: Turmeric-stained cloth turns red when soap (alkaline) touches it; it reverts to yellow on washing with water (neutral/slightly acidic).

Why other options are wrong: Litmus turns red in acid and blue in base – not turmeric. Option (A) describes the reverse behaviour of litmus. Option (C) de-



scribes neither turmeric nor litmus correctly. Option (D) also incorrectly assigns colours.

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

Q12.

Solution

Concept: Baking powder is a mixture of baking soda (NaHCO_3) and a weak acid (such as tartaric acid). When heated, a chemical reaction occurs.

Reaction:



In the presence of the acid in baking powder, CO_2 is released more readily even at room temperature when mixed with wet dough.

Effect: The CO_2 gas bubbles are trapped in the dough as it bakes. When the cake solidifies, the gas pockets remain, making the cake light, soft, and fluffy (well-risen).

Why other options are wrong: Option (B) incorrectly says O_2 is released; baking soda does not release oxygen. Option (C) incorrectly says it absorbs CO_2 ; it produces CO_2 . Option (D) says no gas is produced; CO_2 production is the entire mechanism behind leavening.

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

Q13.

Solution

Concept: Chemical reactions are classified into four main types at the Class 7–8 level:

- **Combination (Synthesis):** Two or more substances combine to form a single product. Example: $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$.
- **Decomposition:** A single compound breaks down into two or more simpler substances. Example: $2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$.
- **Displacement (Single displacement):** A more reactive element displaces a less reactive element from its compound. Example: $\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$.
- **Double displacement (Metathesis):** Two compounds exchange ions to form two new compounds. Example: $\text{NaCl} + \text{AgNO}_3 \rightarrow \text{AgCl} \downarrow + \text{NaNO}_3$.



Why other options are wrong: Options (A), (B), and (C) each contain at least one incorrect or non-standard classification for this level. “Precipitation” and “combustion” are sub-types, not the four main categories. “Oxidation” and “reduction” are a different classification system altogether.

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

Q14.

Solution

Concept: Galvanising is the process of applying a protective coating of **zinc** to iron or steel to prevent corrosion (rusting).

Why zinc works:

- Zinc is more reactive than iron and acts as a **sacrificial anode**.
- Even if the zinc coating is scratched, zinc corrodes preferentially, protecting the iron underneath.
- Zinc oxide layer also acts as a physical barrier to moisture and oxygen.

Common examples: Galvanised iron (GI) pipes, buckets, roofing sheets, and wire fences.

Why other options are wrong: Tin (Option A) is used in tin plating (food cans) but is not galvanising. Copper (Option B) is used in electroplating for decorative purposes, not to prevent rusting of iron. Lead (Option D) is toxic and is not used in modern coating to prevent rusting.

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

Q15.

Solution

Concept: Carbon has two important allotropes: diamond and graphite. Their different structures give them very different properties.

Properties of diamond:

- Diamond has a **tetrahedral** lattice where each carbon atom is bonded to 4 others by strong covalent bonds.
- This makes diamond the **hardest naturally occurring substance** on Earth (Mohs hardness = 10).



- It is an **excellent abrasive** and is used in cutting tools, drills, and grinding wheels.
- Diamond is an **electrical insulator** (no free electrons).

Why other options are wrong: Option (A) describes **graphite**, which is soft and used as a lubricant. Option (C) describes graphite, which conducts electricity (delocalized electrons). Option (D) is incorrect; diamond is an insulator, not a semiconductor.

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

Q16.

Solution

Concept: LPG (Liquefied Petroleum Gas) is a fossil fuel derived from petroleum refining. It is stored in cylinders under pressure.

Composition of LPG:

- **Butane** (C_4H_{10}) – major component, with a higher calorific value.
- **Propane** (C_3H_8) – minor component; helps LPG vaporise at lower temperatures.

Combustion of butane:



Why other options are wrong: Option (B) — methane and ethane: methane (CH_4) is the main component of **CNG** (Compressed Natural Gas) used in vehicles, not LPG. Option (C) — ethylene and acetylene: these are industrial gases (raw materials for plastics and welding), not cooking fuels. Option (D) — hydrogen and helium: helium is an inert gas used in balloons; hydrogen is a fuel but not a component of LPG.

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



Q17.

Solution

Concept: Chlorination is the addition of chlorine (Cl_2) or chlorine compounds (such as bleaching powder or sodium hypochlorite) to water as a disinfection treatment.

How chlorination works:

- Chlorine reacts with water to form hypochlorous acid (HOCl), a powerful disinfectant.
- HOCl destroys the cell walls and enzymes of bacteria and viruses.
- It kills pathogens responsible for diseases like cholera, typhoid, and dysentery.

Primary purpose: Killing disease-causing microorganisms (bacteria, viruses) in drinking water.

Why other options are wrong: Option (A) — removing turbidity is done by **coagulation and sedimentation** (e.g., using alum), not chlorination. Option (B) — removing hardness is done by **softening** processes (ion exchange, boiling). Option (C) — chlorination does not add beneficial minerals; it may actually reduce some.

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

Q18.

Solution

Concept: Particulate matter (PM) consists of tiny solid particles and liquid droplets in the air. $\text{PM}_{2.5}$ refers to particles with diameter $\leq 2.5 \mu\text{m}$; PM_{10} refers to particles $\leq 10 \mu\text{m}$.

Health effects:

- **Respiratory system:** $\text{PM}_{2.5}$ penetrates deep into the lungs (past the nose and throat defences) and causes asthma, bronchitis, and reduced lung function.
- **Cardiovascular system:** Fine particles enter the bloodstream, causing inflammation, heart attacks, and strokes.
- **Other effects:** Reduced visibility (haze), aggravation of existing conditions.

Why other options are wrong: Option (A) is false; PM does not benefit plant



growth through rainfall — it may even damage leaves. Option (B) is false; PM 2.5 is recognised by WHO as one of the most dangerous air pollutants. Option (D) understates the severity; PM causes serious internal organ damage, not just surface irritation.

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

Q19.

Solution

Concept: Plastics are broadly divided into two categories based on their behaviour on heating:

Property	Thermoplastics	Thermosetting plastics
On heating	Soften and can be remoulded	Harden permanently; cannot be remoulded
Polymer structure	Linear/branched chains	Cross-linked network
Examples	Polythene, PVC, nylon	Bakelite, melamine, urea-formaldehyde
Recyclable	Yes	No

Reason for thermosetting behaviour: When thermosetting plastics are first heated, cross-links form between polymer chains, creating a rigid three-dimensional network. Further heating does not break these cross-links.

Why other options are wrong: Options (A), (C), and (D) all describe the behaviour of thermoplastics, not thermosetting plastics. Once Bakelite has set, it cannot be resoftened or recycled.

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

Q20.

Solution

Concept: Natural fibres come from plant or animal sources. Jute (*Corchorus* sp.) is an important natural plant fibre.

Source of jute fibre:

- Jute fibre is obtained from the **bast** (phloem) of the jute plant stem.
- The stems are harvested and soaked in water (a process called **retting**) to loosen the fibres.
- The fibres are then separated by hand and dried.



Uses of jute: Ropes, sacks/gunny bags, carpets, mats, and packaging material. Jute is biodegradable and eco-friendly.

Why other options are wrong: Option (B) — cotton fibres come from the **seed hair** of the cotton plant (*Gossypium*), not the seed itself. Option (C) — banana leaf fibres exist but are not “jute.” Option (D) — **flax** gives linen fibre (from stem), but this is a different plant, not jute.

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

Q21.

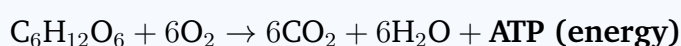
Solution

Concept: The mitochondrion is a double-membrane organelle found in eukaryotic cells. It is called the “powerhouse of the cell.”

Structure (as shown in diagram):

- **Outer membrane:** Smooth, encloses the entire organelle.
- **Inner membrane (cristae):** Highly folded inward to increase surface area; this is where the electron transport chain is located.
- **Matrix:** Fluid-filled interior; contains enzymes for the Krebs cycle.

Function: Mitochondria carry out **aerobic cellular respiration:**



ATP (adenosine triphosphate) is the energy currency of the cell.

Why other options are wrong: The nucleus controls cell activities and contains DNA (Option A). Ribosomes are tiny organelles for protein synthesis (Option B). Vacuoles are membrane-bound sacs for storage (Option C). None of these is the “powerhouse.”

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



Q22.

Solution

Concept: Insectivorous (carnivorous) plants are a special group of autotrophs that supplement their nutrition by trapping and digesting insects or small animals.

Reason: These plants grow in **nitrogen-poor (nitrogen-deficient) soils** such as waterlogged bogs, marshy areas, and acidic soil. They cannot obtain sufficient nitrogen from the soil for making proteins and other nitrogenous compounds.

Solution: They have evolved special structures to trap insects (e.g., snap traps in Venus flytrap, sticky glands in Sundew, pitcher-shaped leaves in Pitcher plant) and produce digestive enzymes to break down insect proteins, releasing nitrogen for the plant's use.

Important: These plants still possess chlorophyll and perform photosynthesis for carbohydrates. They are NOT fully heterotrophic.

Why other options are wrong: Option (A) – air is not poor in CO_2 in these habitats. Option (B) – they do have chlorophyll and photosynthesize. Option (D) – most insectivorous plants grow in waterlogged but not fully submerged conditions; they trap insects for nitrogen, not just mineral salts.

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

Q23.

Solution

Concept: Breathing and cellular respiration are related but distinct processes.

Feature	Breathing	Cellular Respiration
Nature	Physical / Mechanical	Chemical
Location	Lungs (organ level)	Inside cells (mitochondria)
Process	Inhalation & exhalation of air	Oxidation of glucose to release ATP
Product	Exchange of O_2 and CO_2	ATP, CO_2 , H_2O
Energy change	No chemical energy change	Chemical energy released as ATP

Summary: Breathing is the **physical** process of moving air in and out of the lungs. Cellular respiration is the **chemical** process of breaking down glucose using oxygen to produce ATP energy.

Why other options are wrong: Option (A) says both are chemical – breathing involves only mechanical movement (diaphragm and rib muscles), no chemical change. Option (C) says they are the same – they are entirely different in nature, location, and mechanism. Option (D) reverses the definitions.



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

Q24.

Solution

Concept: The heart is a four-chambered muscular pump that circulates blood through the body's blood vessels in a closed circulatory system.

Normal resting heart rate (pulse rate):

- Healthy adult: **60–80 beats per minute** (average $\approx$ 72 bpm).
- The pulse can be felt wherever an artery passes close to the skin (e.g., wrist — radial artery).

Function: The heart pumps oxygenated blood from the left ventricle to the body through the aorta and deoxygenated blood from the right ventricle to the lungs through the pulmonary artery.

Why other options are wrong: Option (B) — 100–120 bpm is elevated (tachycardia, typically due to exercise or fever); the heart pumps blood, not purifies it (that is partly the liver/kidneys). Option (C) — 40–50 bpm is bradycardia; the heart does not pump lymph. Option (D) — 20–30 bpm is dangerously low; the heart does not filter blood (kidneys do).

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

Q25.

Solution

Concept: Spore formation is a type of **asexual reproduction** in which tiny, lightweight, single-celled reproductive units called **spores** are produced in large numbers. Spores are resistant to harsh conditions and can be dispersed over long distances by wind.

Organisms that reproduce by spore formation:

- **Ferns** (*Pteridophyta*): Spores form in sporangia on the undersides of fronds.
- **Mosses** (*Bryophyta*): Spores form in capsules on the sporophyte stage.
- **Fungi** (e.g., *Rhizopus*/bread mould): Spores form in sporangia on hyphae.
- Also: bacteria (endospores), *Plasmodium* (sporozoites).



Why other options are wrong: Mango, neem, and peepal (Option A) are seed plants that reproduce by seeds through flowers, not spore formation. Wheat, maize, and rice (Option B) are also seed plants (angiosperms). Rose, jasmine, and hibiscus (Option C) are flowering plants that reproduce by seeds and vegetatively, not by spores.

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

Q26.

Solution

Concept: Pollination is the transfer of pollen from the anther to the stigma. The agent that carries the pollen gives the pollination its name.

Types of pollination by agent:

- **Entomophily:** By insects (bees, butterflies). Flowers are brightly coloured and scented.
- **Anemophily:** By wind. Pollen is light, dry, produced in large quantities.
- **Hydrophily:** By water. Pollen is released into water and drifts to the stigma. Examples: *Vallisneria*, *Hydrilla*, *Zostera*.
- **Ornithophily:** By birds (hummingbirds, sunbirds). Flowers are tubular, red, and produce nectar.

Answer: *Vallisneria* and *Hydrilla* are aquatic plants that release pollen into the water – this is **hydrophily** (Option C).

Why other options are wrong: The question specifically states that pollen is released into the water and carried by water, which matches hydrophily, not entomophily (A), anemophily (B), or ornithophily (D).

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



Q27.

Solution

Concept: *Plasmodium* is a protozoan parasite (not a bacterium) that causes **malaria** in humans. It requires two hosts to complete its life cycle.

Life cycle (as shown in the diagram):

1. Female *Anopheles* mosquito bites a human and injects sporozoites.
2. Sporozoites enter liver cells and multiply (exo-erythrocytic stage).
3. Merozoites are released into blood and invade red blood cells (erythrocytic stage).
4. RBCs rupture periodically, releasing merozoites and causing the characteristic fever and chills.
5. Some parasites form gametocytes in blood.
6. Mosquito ingests gametocytes during a blood meal; sexual reproduction (sporogony) occurs inside the mosquito gut.
7. New sporozoites migrate to the mosquito's salivary glands, ready to infect the next human.

Why other options are wrong: Option (A) — typhoid is caused by *Salmonella typhi* (bacterium), transmitted by contaminated food/water. Option (C) — dengue is caused by dengue virus, transmitted by female *Aedes* mosquito. Option (D) — *Plasmodium* is a protozoan, not a bacterium; cholera is caused by *Vibrio cholerae*.

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

Q28.

Solution

Concept: Vaccination (immunisation) is the introduction of weakened, killed, or subunit pathogens (or their antigens) into the body to stimulate a protective immune response.

How vaccination works:

- The vaccine antigen is recognised by the immune system as foreign.
- **B-lymphocytes** produce specific **antibodies** that neutralise the pathogen.
- **Memory cells** (B and T) are formed and remain in the body for years or decades.



- On future exposure to the same pathogen, memory cells mount a **rapid and stronger** secondary immune response, preventing disease.

Why other options are wrong: Option (B) — vaccines do not directly kill bacteria or viruses; they train the immune system to do so. Option (C) — repeat doses (boosters) do enhance and extend immunity. Option (D) — each vaccine provides immunity against one specific pathogen or strain; no single vaccine protects against all diseases.

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

Q29.

Solution

Concept: Decomposers are organisms (mainly bacteria and fungi) that break down complex organic compounds in dead plants and animals into simpler inorganic substances. They play a vital role in nutrient cycling.

Process of decomposition:

- Decomposers secrete enzymes onto dead organic matter (detritus).
- Complex molecules (proteins, carbohydrates, fats) are broken down into simple inorganic compounds.
- Nitrogen is returned to soil as ammonium ions (NH_4^+), which nitrifying bacteria convert to nitrates.
- Carbon is released as CO_2 (carbon cycle).
- Phosphorus, potassium, and other minerals are returned to soil for plant uptake.

Result: Nutrients are recycled back into the ecosystem, making them available to producers (plants) again.

Why other options are wrong: Option (A) — nitrogen fixation is done by *Rhizobium* and *Azotobacter*, not by decomposers. Option (B) — decomposers are not photosynthetic and do not produce oxygen. Option (C) — while some decomposers can cause disease, their primary ecological role is beneficial decomposition and nutrient recycling.

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



Q30.

Solution

Concept: Migration is the seasonal movement of animals (birds, fish, mammals) from one habitat to another, typically in response to changes in environmental conditions.

Reasons for bird migration:

- **Food availability:** In winter, their native cold regions (Siberia, Arctic, Central Asia) are covered with ice and snow. Food sources (fish, insects, seeds) become scarce or inaccessible.
- **Breeding conditions:** Warmer regions offer suitable wetlands, lakes, and marshes for nesting, feeding young, and breeding.
- **Temperature:** Extreme cold is stressful for many bird species that lack thick insulating coats.

Examples visiting India:

- **Siberian cranes** — from Siberia to Bharatpur (Keoladeo National Park), Rajasthan.
- **Flamingos** — from Central Asia to Rann of Kutch, Gujarat.
- **Bar-headed geese** — from Central Asia, crossing the Himalayas.

Why other options are wrong: Option (A) — predator escape is not the primary reason; the trigger is seasonal scarcity of food and unsuitable breeding conditions. Option (B) — birds move toward warmer regions, not colder ones. Option (D) — these are well-documented migratory species, not resident birds.

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



Answer Key

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

