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Education as a Service (EaaS)

SAMPLE PAPER - SET 7

SESSION: 2025-26

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Class	IX	Subject	Science (086)
Time Allowed	3 Hours	Maximum Marks	80
Date	_____	Student Name	_____

GENERAL INSTRUCTIONS:

1. This question paper consists of **39 questions** in **5 sections**.
2. **All questions are compulsory.** However, an internal choice is provided in some questions. A student is expected to attempt only one of these questions.
3. **Section A** consists of 20 Objective Type questions carrying **1 mark each**.
4. **Section B** consists of 6 Very Short Answer questions carrying **2 marks each**. Answers to these questions should be in the range of 30 to 50 words.
5. **Section C** consists of 7 Short Answer type questions carrying **3 marks each**. Answers to these questions should be in the range of 50 to 80 words.
6. **Section D** consists of 3 Long Answer type questions carrying **5 marks each**. Answers to these questions should be in the range of 80 to 120 words.
7. **Section E** consists of 3 source-based/case-based units of assessment of **4 marks each** with sub-parts.

SECTION A (20 × 1 = 20 Marks)

Q1. The SI unit of force is: **[1]**

(a) Joule

(b) Newton

(c) Pascal

(d) Watt

Q2. Which gas is produced when metals react with dilute acids? **[1]**

(a) Oxygen

(b) Hydrogen

(c) Carbon dioxide

(d) Nitrogen

Q3. The process by which a gas changes into liquid is called: **[1]**

(a) Sublimation

(b) Evaporation

(c) Condensation

(d) Freezing

Q4. Rutherford's alpha particle scattering experiment led to the discovery of: **[1]**

(a) Electron

(b) Proton

(c) Neutron

(d) Nucleus

Q5. The full form of ATP is: **[1]**

(a) Adenosine triphosphate

(b) Adenine triphosphate

(c) Adenosine diphosphate

(d) Adenine diphosphate

Q6. Which tissue transports water in plants? **[1]**

(a) Phloem

(b) Xylem

(c) Parenchyma

(d) Collenchyma

Q7. The slope of velocity-time graph gives: **[1]**

(a) Speed

(b) Distance

(c) Acceleration

(d) Displacement

Q8. If the mass of a body is doubled, keeping velocity constant, its momentum becomes: **[1]**

(a) Half

(b) Double

(c) Four times

(d) Remains same

Q9. The value of universal gravitational constant G is: **[1]**

(a) 6.7×10^{-11} N m^2 kg^{-2}

(b) 9.8 m/s^2

(c) 6.7×10^{11} N m^2 kg^{-2}

(d) 10 m/s^2

Q10. 1 kilowatt hour (kWh) is equal to: **[1]**

(a) 3.6×10^6 J

(b) 3600 J

(c) 360 J

(d) 36×10^6 J

Q11. The audible range of frequency for human ear is: **[1]**

(a) 20 Hz to 20,000 Hz

(b) 20 Hz to 2,000 Hz

(c) 200 Hz to 20,000 Hz

(d) Less than 20 Hz

Q12. Which separation technique is used to obtain pure water from sea water? **[1]**

(a) Filtration

(b) Distillation

(c) Sublimation

(d) Centrifugation

Q13. The number of atoms in one molecule of sulphuric acid (H_2SO_4) is: **[1]**

(a) 5

(b) 6

(c) 7

(d) 8

Q14. The organelle responsible for detoxification of drugs and poisons is: **[1]**

(a) Golgi apparatus

(b) Smooth endoplasmic reticulum

(c) Rough endoplasmic reticulum

(d) Lysosome

Q15. Stomata are mainly present in: **[1]**

(a) Stem

(b) Roots

(c) Leaves

(d) Flowers

Q16. ASSERTION-REASON TYPE QUESTIONS **[1]**

Assertion (A): The distance-time graph of a body moving with uniform speed is a straight line.

Reason (R): In uniform motion, equal distances are covered in equal intervals of time.

(a) Both A and R are true and R is the correct explanation of A

(b) Both A and R are true but R is not the correct explanation of A

(c) A is true but R is false

(d) A is false but R is true

Q17. ASSERTION-REASON TYPE QUESTIONS **[1]**

Assertion (A): Mass and weight are different physical quantities.

Reason (R): Mass is constant everywhere while weight varies from place to place.

(a) Both A and R are true and R is the correct explanation of A

(b) Both A and R are true but R is not the correct explanation of A

(c) A is true but R is false

(d) A is false but R is true

Q18. ASSERTION-REASON TYPE QUESTIONS **[1]**

Assertion (A): Colloids cannot be separated by filtration.

Reason (R): Colloidal particles are larger than particles in true solution but smaller than suspension.

(a) Both A and R are true and R is the correct explanation of A

(b) Both A and R are true but R is not the correct explanation of A

(c) A is true but R is false

(d) A is false but R is true

Q19. ASSERTION-REASON TYPE QUESTIONS **[1]**

Assertion (A): Mitochondria are called powerhouse of the cell.

Reason (R): Mitochondria have cristae that increase surface area for ATP synthesis.

(a) Both A and R are true and R is the correct explanation of A

(b) Both A and R are true but R is not the correct explanation of A

(c) A is true but R is false

(d) A is false but R is true

Q20. ASSERTION-REASON TYPE QUESTIONS **[1]**

Assertion (A): Work done against friction is always positive.

Reason (R): Friction always opposes the motion of a body.

(a) Both A and R are true and R is the correct explanation of A

(b) Both A and R are true but R is not the correct explanation of A

(c) A is true but R is false

(d) A is false but R is true

SECTION B (6 × 2 = 12 Marks)

Q21. Define momentum and write its SI unit. On what factors does momentum depend? **[2]**

Q22. A particle has atomic number 17 and mass number 35. Calculate the number of electrons, protons, and neutrons in this atom. **[2]**

Q23. Why do gases neither have fixed shape nor fixed volume? **[2]**

Q24. What is the difference between xylem and phloem? Write one function of each. **[2]**

Q25. A car travels 60 km in the first hour and 80 km in the second hour. Calculate its average speed. **[2]**

Q26. State the law of conservation of momentum with an example. **[2]**

SECTION C (7 × 3 = 21 Marks)

Q27. (a) What is latent heat of fusion? Give its value for ice. **[3]**

(b) Why does ice at 0°C have more cooling effect than water at 0°C?

(c) Convert 300 K to Celsius scale.

Q28. (a) Define solubility. What is a saturated solution? **[3]**

(b) A solution contains 40 g of common salt dissolved in 320 g of water. Calculate the concentration in terms of mass percentage.

Q29. (a) State the law of conservation of mass. **[3]**

(b) 4.4 g of CO_2 contains how many molecules?

(c) How many moles of water are present in 9 g of water?

[Given: C = 12 u, O = 16 u, H = 1 u]

Q30. OR **[3]**

(a) What are isobars? Give one example.

(b) Write the electronic configuration of chlorine (atomic number = 17).

(c) An atom has 11 protons and 12 neutrons. What is its atomic number and mass number?

Q31. (a) What is the function of nuclear membrane? **[3]**

(b) Name the organelle that helps in the formation of lysosomes.

(c) Why do plant cells have large vacuoles?

Q32. OR **[3]**

(a) What is diffusion? Give one example from everyday life.

(b) Why is plasma membrane called selectively permeable membrane?

(c) What is the difference between diffusion and osmosis?

Q33. (a) Write two differences between meristematic tissue and permanent tissue. **[3]**

(b) Name the tissue that stores fat in our body.

(c) Where are apical meristems located in plants?

Q34. A car accelerates uniformly from 18 km/h to 72 km/h in 10 seconds. Calculate: **[3]**

(a) The acceleration of the car in m/s^2

(b) The distance covered by the car during this time

Q35. OR **[3]**

(a) Draw a velocity-time graph for uniform motion.

(b) What does the area under velocity-time graph represent?

(c) A body moving with velocity 10 m/s comes to rest in 5 seconds. Calculate retardation.

SECTION D (3 × 5 = 15 Marks)

Q36. (a) State Newton's second law of motion. **[5]**

(b) Derive the relation F = ma from Newton's second law.

(c) A force of 10 N acts on a body of mass 2 kg for 5 seconds. If the body is initially at rest, calculate:

(i) The acceleration produced

(ii) The final velocity attained

OR

(a) State Newton's third law of motion with three examples.

(b) Explain why it is difficult for a fireman to hold a hose which ejects large amount of water at a high velocity.

(c) A bullet of mass 50 g is fired from a gun of mass 2 kg with a velocity of 200 m/s. Calculate the recoil velocity of the gun.

Q37. (a) State Archimedes' principle. **[5]**

(b) Why does a body lose weight when immersed in a liquid?

(c) A stone weighs 500 N in air and 300 N when fully immersed in water. Calculate:

(i) Loss in weight

(ii) Upthrust

(iii) Volume of stone (Take density of water = 1000 kg/m³, g = 10 m/s²)

OR

(a) Define free fall. Write three equations of motion for a freely falling body.

(b) A stone is dropped from a cliff of height 80 m. Calculate:

(i) Time taken to reach the ground

(ii) Velocity with which it hits the ground

[Take g = 10 m/s²]

Q38. (a) Draw a neat labeled diagram of animal cell showing any five organelles. **[5]**

(b) Write three differences between plant cell and animal cell.

(c) Why do Amoeba and Paramecium not have contractile vacuoles?

OR

(a) What are meristematic tissues? Name three types of meristematic tissues based on location.

(b) Draw labeled diagrams of:

(i) Parenchyma tissue

(ii) Sclerenchyma tissue

(c) Write one function of each tissue drawn above.

SECTION E (3 × 4 = 12 Marks)

CASE STUDY 1: BUOYANCY AND ARCHIMEDES' PRINCIPLE

During a swimming lesson, students learned about buoyancy. The instructor explained that when a person enters water, they feel lighter. This happens because water exerts an upward force called buoyant force or upthrust. Ships float on water despite being made of steel because they displace large volume of water. According to Archimedes' principle, when a body is partially or completely immersed in a fluid, it experiences an upward buoyant force equal to the weight of the fluid displaced by it. This principle explains why some objects float while others sink. An object floats if its density is less than the density of the liquid, and it sinks if its density is greater than that of the liquid.

(i) What is buoyant force? [1 mark]

(ii) Why does a ship made of iron float on water while an iron nail sinks? [1 mark]

OR

State the condition for an object to float in a liquid. [1 mark]

(iii) A piece of cork weighing 0.2 N floats on water. Calculate the volume of cork submerged in water. [Density of water = 1000 kg/m³, g = 10 m/s²] [2 marks]

CASE STUDY 2: OSMOSIS AND CELL MEMBRANE

A biology student placed a raisin (dried grape) in pure water and observed it for 2 hours. The raisin swelled up and became turgid. When another raisin was placed in concentrated sugar solution, it shrank and became flaccid. This phenomenon occurs due to osmosis - the movement of water molecules through a semi-permeable membrane from a region of higher water concentration to a region of lower water concentration. The plasma membrane of cells acts as a semi-permeable membrane. When a cell is placed in a hypotonic solution (lower solute concentration), water enters the cell by osmosis causing it to swell. In a hypertonic solution (higher solute concentration), water moves out causing the cell to shrink. In an isotonic solution, there is no net movement of water.

(i) Define osmosis. [1 mark]

(ii) Why did the raisin swell in pure water? [1 mark]

OR
What is a hypertonic solution? [1 mark]

(iii) If a plant cell is placed in distilled water, what will happen to it? Explain with reason. [2 marks]

CASE STUDY 3: SOUND AND ECHO

During a field trip to mountains, students observed that when they shouted, they could hear their own voice after some time. The teacher explained that this is called echo - the phenomenon of hearing the same sound again after reflection from a distant obstacle. For echo to be heard, the minimum distance between the source of sound and the reflecting surface should be 17.2 m (considering speed of sound in air as 344 m/s and time gap between original sound and echo should be at least 0.1 s for human ear to

distinguish). This is why we don't hear echo in a small room. Sound waves are mechanical waves that require a medium to travel and cannot propagate through vacuum. The speed of sound varies in different media - it is maximum in solids and minimum in gases.

(i) What is an echo? [1 mark]

(ii) Calculate the minimum distance required to hear an echo if speed of sound in air is 340 m/s. [1 mark]

OR

Why is echo not heard in a small room? [1 mark]

(iii) A person shouts in a valley and hears the echo after 4 seconds. If the speed of sound is 340 m/s, how far away is the reflecting surface? [2 marks]

*** END OF QUESTION PAPER ***

Total Marks: 80

All the Best!

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🔑 DETAILED ANSWER KEY 🔑

CBSE CLASS 9 SCIENCE - SAMPLE PAPER 7

Complete Step-by-Step Solutions with Marking Scheme

Prepared by Expert Faculty of Math Love Institute

SECTION A - ANSWERS (20 × 1 = 20 Marks)

OBJECTIVE TYPE QUESTIONS - ANSWERS:

Q.No.	Answer	Q.No.	Answer	Q.No.	Answer	Q.No.	Answer
Q1	(b)	Q6	(b)	Q11	(a)	Q16	(a)
Q2	(b)	Q7	(c)	Q12	(b)	Q17	(a)
Q3	(c)	Q8	(b)	Q13	(c)	Q18	(a)
Q4	(d)	Q9	(a)	Q14	(b)	Q19	(a)
Q5	(a)	Q10	(a)	Q15	(c)	Q20	(a)

KEY EXPLANATIONS:

Q1. Newton (N) is the SI unit of force. 1 Newton = 1 kg m/s²

Q4. Rutherford's alpha scattering experiment discovered the nucleus - the dense, positively charged center of atom.

Q9. Universal gravitational constant $G = 6.7 \times 10^{-11}$ N m² kg^{-2} (constant everywhere)

Q10. 1 kWh = 1000 W × 3600 s = 3,600,000 J = 3.6×10^6 J

Q13. H_2SO_4 has: 2 H + 1 S + 4 O = 7 atoms total

ASSERTION-REASON ANSWERS:

Q16: (a) - Equal distances in equal time intervals creates uniform speed, making distance-time graph a straight line.
Q17: (a) - Weight = mg varies with g, mass remains constant - this explains why they're different.
Q18: (a) - Particle size determines separation method - colloids pass through filters due to small size.
Q19: (a) - Cristae provide large surface area for ATP-producing enzymes, making it the powerhouse.
Q20: (a) - Since friction opposes motion, work done against it (force × displacement) is always positive.

SECTION B - ANSWERS (6 × 2 = 12 Marks)

Q21. ANSWER:

> **Marking Scheme:** 1 mark for definition + ½ mark for unit + ½ mark for factors

Solution:

Momentum: Momentum is the quantity of motion possessed by a moving body. It is the product of mass and velocity of the body.

Formula: Momentum (p) = mass (m) × velocity (v)

SI Unit: kilogram meter per second (kg m/s) or kg m s^{-1}

Factors on which momentum depends:
1. **Mass of the body** - Greater the mass, greater the momentum
2. **Velocity of the body** - Greater the velocity, greater the momentum

Note: Momentum is a vector quantity (has both magnitude and direction).

Q22. ANSWER:

Marking Scheme: ½ mark each for electrons, protons, neutrons + ½ mark for calculation

Solution:

Given:
Atomic number (Z) = 17
Mass number (A) = 35

Number of protons = Atomic number = 17

Number of electrons = Number of protons = 17
(In neutral atom, electrons equal protons)

Number of neutrons = Mass number - Atomic number
Number of neutrons = 35 - 17 = **18**

This is **Chlorine (Cl)** atom: 17 protons, 17 electrons, 18 neutrons

Q23. ANSWER:

Marking Scheme: 1 mark for each reason

Solution:

Gases neither have fixed shape nor fixed volume because:

Reason 1 - No Fixed Shape:
• Gas particles have very weak intermolecular forces of attraction
• Particles move freely and randomly in all directions

• They take the shape of the container they are kept in
• Therefore, gases have no fixed shape

Reason 2 - No Fixed Volume:
• Gas particles have maximum kinetic energy
• Large intermolecular spaces exist between particles
• Particles can be compressed or expanded
• They occupy the entire volume of the container
• Therefore, gases have no fixed volume

Conclusion: Due to high kinetic energy, negligible intermolecular forces, and large spaces between particles, gases are highly compressible and have neither fixed shape nor fixed volume.

Q24. ANSWER:

Marking Scheme: 1 mark for difference + 1 mark for functions

Solution:

Difference between Xylem and Phloem:

Xylem	**Phloem**
Conducts water and minerals	Conducts food (sugars)
Unidirectional flow (upward)	Bidirectional flow (up and down)
Made of dead cells (except xylem parenchyma)	Made of living cells
Thick-walled lignified cells	Thin-walled cells

Function of Xylem:
Transports water and dissolved minerals from roots to all parts of the plant (stem,

leaves, flowers, fruits). Also provides mechanical support due to thick lignified walls.

Function of Phloem:
Transports prepared food (mainly sucrose) from leaves (where photosynthesis occurs) to all parts of the plant - both upward and downward direction. This process is called translocation.

Q25. ANSWER:

> **Marking Scheme:** 1 mark for formula + 1 mark for calculation

Solution:

Given:
Distance in first hour, $d_1 = 60$ km
Distance in second hour, $d_2 = 80$ km
Total time, $t = 2$ hours

Total distance = $d_1 + d_2$
Total distance = 60 + 80 = 140 km

Average speed = Total distance / Total time
Average speed = 140 / 2
Average speed = 70 km/h

The average speed of the car is 70 km/h.

Q26. ANSWER:

> **Marking Scheme:** 1 mark for law + 1 mark for example

Solution:

Law of Conservation of Momentum:

In an isolated system (where no external force acts), the total momentum before collision equals the total momentum after collision. In other words, the total momentum of a system remains constant if no external force acts on it.

Mathematically:
$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$

Example - Recoil of Gun:
• Before firing: Both gun and bullet are at rest, so total momentum = 0
• After firing: Bullet moves forward with high velocity, gun recoils backward
• Forward momentum of bullet = Backward momentum of gun
• Therefore, total momentum remains zero
• This explains why gun kicks back when bullet is fired

Other examples: Rocket propulsion, collision of billiard balls, explosion of bombs

SECTION C - ANSWERS (7 × 3 = 21 Marks)

Q27. ANSWER:

Marking Scheme: 1 mark for each part

Solution:

(a) Latent Heat of Fusion:
The amount of heat energy required to change 1 kg of a solid into liquid at its melting point without any change in temperature is called latent heat of fusion.

Value for ice: Latent heat of fusion of ice = 3.34×10^5 J/kg or 334 kJ/kg or 80 cal/g

(b) Why ice at 0°C has more cooling effect than water at 0°C:
Ice at 0°C has more cooling effect because:
• Ice absorbs large amount of heat energy (latent heat of fusion = 334 kJ/kg) from

surroundings to convert into water at 0°C

• Water at 0°C does not absorb this extra latent heat

• Therefore, ice removes more heat from surroundings, producing greater cooling effect

• Total heat absorbed by ice = Latent heat + Heat to raise temperature

• Total heat absorbed by water = Only heat to raise temperature

(c) Convert 300 K to Celsius:

Formula: °C = K - 273

°C = 300 - 273

°C = 27°C

Q28. ANSWER:

Marking Scheme: 1 mark for definitions + 2 marks for calculation

Solution:

(a) Definitions:

Solubility: The maximum amount of solute that can be dissolved in 100 g of solvent at a given temperature is called solubility.

Saturated Solution: A solution in which no more solute can be dissolved at a given temperature is called saturated solution. It contains maximum amount of solute at that temperature.

(b) Calculation of concentration:

Given:

Mass of solute (salt) = 40 g

Mass of solvent (water) = 320 g

Mass of solution = Mass of solute + Mass of solvent

Mass of solution = 40 + 320 = 360 g

Mass percentage = (Mass of solute / Mass of solution) × 100

Mass percentage = (40 / 360) × 100
Mass percentage = 0.111 × 100
Mass percentage = 11.11%

The concentration of the solution is 11.11% by mass.

Q29. ANSWER:

Marking Scheme: 1 mark for each part

Solution:

(a) Law of Conservation of Mass:
The law of conservation of mass states that mass can neither be created nor destroyed in a chemical reaction. The total mass of reactants before reaction equals the total mass of products after reaction.

OR

In a chemical reaction, the sum of masses of reactants is equal to the sum of masses of products.

(b) Number of molecules in 4.4 g CO_2:

Molecular mass of CO_2 = 12 + (2 × 16) = 44 u
Molar mass of CO_2 = 44 g/mol

Number of moles = Mass / Molar mass
Number of moles = 4.4 / 44 = 0.1 mole

1 mole contains 6.022×10^{23} molecules
0.1 mole contains = $0.1 \times 6.022 \times 10^{23}$
= 6.022×10^{22} molecules

(c) Number of moles in 9 g water:

Molecular mass of H_2O = (2 × 1) + 16 = 18 u
Molar mass of H_2O = 18 g/mol

Number of moles = Mass / Molar mass
Number of moles = 9 / 18
Number of moles = 0.5 mole

Q30. OR ANSWER:

Marking Scheme: 1 mark for each part

Solution:

(a) Isobars:
Isobars are atoms of different elements having the same mass number but different atomic numbers.

Example:
• Argon-40 ($_{18}Ar^{40}$) and Calcium-40 ($_{20}Ca^{40}$)
• Both have mass number = 40
• Argon has atomic number 18, Calcium has atomic number 20

Other examples: C-14 and N-14, Ar-40 and K-40

(b) Electronic configuration of Chlorine:
Atomic number of Chlorine = 17
Number of electrons = 17

Distribution in shells:
K shell: 2 electrons
L shell: 8 electrons

M shell: 7 electrons

Electronic configuration: 2, 8, 7
OR in notation: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$

(c) Atomic number and mass number:

Number of protons = 11
Number of neutrons = 12

Atomic number = Number of protons = 11

Mass number = Number of protons + Number of neutrons
Mass number = 11 + 12 = **23**

This is **Sodium (Na)** atom.

Q31. ANSWER:

Marking Scheme: 1 mark for each part

Solution:

(a) Function of Nuclear Membrane:
• Separates the contents of nucleus from the cytoplasm
• Regulates the passage of molecules (proteins, RNA) between nucleus and cytoplasm
• Protects genetic material (DNA) from damage
• Contains nuclear pores for selective transport
• Maintains shape and structure of nucleus

(b) Organelle that forms lysosomes:
Golgi apparatus (Golgi complex/Golgi body) helps in the formation of lysosomes. It packages digestive enzymes in membrane-bound vesicles which become lysosomes.

(c) Why plant cells have large vacuoles:
Plant cells have large vacuoles because:

• **Storage:** Store water, minerals, nutrients, and waste products
• **Turgor pressure:** Maintain rigidity and provide mechanical support to the cell by keeping it turgid
• **Space filling:** Increase cell size without requiring much cytoplasm
• **Maintain shape:** Push cytoplasm and organelles against cell wall
• The large central vacuole can occupy up to 90% of cell volume in mature plant cells

Q32. OR ANSWER:

Marking Scheme: 1 mark for each part

Solution:

(a) Diffusion with example:
Diffusion is the process by which molecules of a substance move from a region of higher concentration to a region of lower concentration until uniform distribution is achieved.

Everyday example:
When incense stick is lit in one corner of a room, its fragrance spreads throughout the room due to diffusion of aromatic molecules in air.

Other examples: Smell of food spreading, tea bag coloring water, perfume spreading

(b) Selective permeability of plasma membrane:
Plasma membrane is called selectively permeable because:
• It allows only certain substances to pass through it
• Small molecules (water, oxygen, CO_2) can pass easily
• Large molecules and charged particles require special channels or carriers
• It regulates what enters and exits the cell
• This selectivity maintains proper cell environment

(c) Difference between Diffusion and Osmosis:

Diffusion	Osmosis
Movement of any substance/particles	Movement of only water molecules
Occurs in any medium (solid, liquid, gas)	Occurs only in liquid medium
Does not require a membrane	Requires a semi-permeable membrane
Continues until uniform concentration	Continues until equilibrium is reached

Q33. ANSWER:

Marking Scheme: 1 mark for each part (½+½ for differences)

Solution:

(a) Differences between Meristematic and Permanent Tissue:

Meristematic Tissue	Permanent Tissue
Cells have ability to divide continuously	Cells have lost the ability to divide
Cells are small and cuboidal	Cells are large and varied in shape
No intercellular spaces	Intercellular spaces present
Thin cell walls	May have thin or thick walls
Vacuoles absent or very small	Large vacuoles present
Found at growing regions	Found throughout the plant

(b) Tissue that stores fat:

Adipose tissue stores fat in our body. It is a type of connective tissue where cells are filled with fat globules. Found below skin, around kidneys, and between organs.

(c) Location of Apical Meristems:

Apical meristems are located at the **growing tips** of plants:

• At the tip of roots (root apex)

• At the tip of stems and branches (shoot apex)

• These meristems are responsible for increase in length of plant (primary growth)

Q34. ANSWER:

Marking Scheme: 1½ marks for each part

Solution:

Given:

Initial velocity, u = 18 km/h = 18 × 5/18 = 5 m/s

Final velocity, v = 72 km/h = 72 × 5/18 = 20 m/s

Time, t = 10 seconds

(a) Acceleration:

Using first equation of motion:

$v = u + at$

$20 = 5 + a \times 10$

$20 - 5 = 10a$

$15 = 10a$

$a = 15/10$

$a = 1.5$ m/s²

The acceleration of the car is 1.5 m/s².

(b) Distance covered:

Using second equation of motion:

$s = ut + \frac{1}{2}at^2$

$s = (5 \times 10) + \frac{1}{2} \times 1.5 \times (10)^2$

$s = 50 + \frac{1}{2} \times 1.5 \times 100$

$s = 50 + 0.75 \times 100$

$s = 50 + 75$

s = 125 m

The distance covered by the car is 125 meters.

Alternative method using third equation:

$v^2 = u^2 + 2as$

$(20)^2 = (5)^2 + 2 \times 1.5 \times s$

$400 = 25 + 3s$

$3s = 375$

$s = 125$ m ✓

Q35. OR ANSWER:

Marking Scheme: 1 mark for each part

Solution:

(a) Velocity-time graph for uniform motion:

[Students should draw:]

• X-axis labeled as "Time (s)"

• Y-axis labeled as "Velocity (m/s)"

• A straight horizontal line parallel to time axis

• Label: "Uniform Motion - Constant Velocity"

In uniform motion, velocity remains constant, so the graph is a straight line parallel to the time axis.

(b) Area under velocity-time graph:

The area under velocity-time graph represents the **displacement** (or distance if motion is in one direction) covered by the moving object.

Area = velocity × time = displacement

(c) Calculate retardation:

Given:

Initial velocity, u = 10 m/s
Final velocity, v = 0 (comes to rest)
Time, t = 5 seconds

Retardation = (u - v) / t
Retardation = (10 - 0) / 5
Retardation = 10 / 5
Retardation = 2 m/s²

OR using acceleration formula:
a = (v - u) / t = (0 - 10) / 5 = -2 m/s²
Negative sign indicates retardation = 2 m/s²

SECTION D - ANSWERS (3 × 5 = 15 Marks)

Q36. ANSWER:

Total Marks: 5
Part (a): 1 mark | Part (b): 2 marks | Part (c): 2 marks (1+1)

(a) Newton's Second Law of Motion:
The rate of change of momentum of a body is directly proportional to the applied force and takes place in the direction of the force.

OR

The acceleration produced in a body is directly proportional to the force applied and inversely proportional to the mass of the body.

(b) Derivation of F = ma:

Let a body of mass m have initial velocity u. A force F acts on it for time t, changing its velocity to v.

Initial momentum = mu
Final momentum = mv
Change in momentum = mv - mu = m(v - u)

According to Newton's second law:
Force ∝ Rate of change of momentum
F ∝ (mv - mu) / t
F ∝ m(v - u) / t

We know acceleration a = (v - u) / t

Therefore: F ∝ ma
F = kma

When k = 1 (for unit force, mass, and acceleration):
F = ma

This is the required relation.

(c) Calculations:

Given:
Force, F = 10 N
Mass, m = 2 kg
Time, t = 5 seconds
Initial velocity, u = 0 (at rest)

(i) Acceleration produced:
F = ma
10 = 2 × a
a = 10/2
a = 5 m/s²

(ii) Final velocity:
v = u + at
v = 0 + 5 × 5
v = 25 m/s

OR Solution:

Total Marks: 5
Part (a): 2 marks | Part (b): 1 mark | Part (c): 2 marks

(a) Newton's Third Law with Examples:

Newton's Third Law: For every action, there is an equal and opposite reaction. The forces of action and reaction are always equal in magnitude, opposite in direction, and act on different bodies.

Three Examples:

1. Recoil of Gun:
When a bullet is fired from a gun, the gun exerts a forward force on the bullet (action). Simultaneously, the bullet exerts an equal and opposite force on the gun (reaction), causing it to recoil backward.

2. Walking:
When we walk, we push the ground backward with our feet (action). The ground pushes our feet forward with equal force (reaction), allowing us to move forward.

3. Rowing a Boat:
When rowing, we push water backward with oars (action). Water pushes the oars and boat forward with equal force (reaction), making the boat move forward.

(b) Fireman and water hose:
It is difficult for a fireman to hold a hose ejecting large amount of water at high velocity because:
• Water rushes out with high velocity (action force)
• According to Newton's third law, water exerts equal and opposite force on the hose (reaction force)
• This reaction force pushes the hose backward with great force
• The fireman must apply large force to hold the hose steady
• Higher the velocity of water, greater is the backward force

(c) Recoil velocity calculation:

Given:
Mass of bullet, $m_1 = 50\ g = 0.05\ kg$
Mass of gun, $m_2 = 2\ kg$
Velocity of bullet, $v_1 = 200\ m/s$
Recoil velocity of gun, $v_2 = ?$

Initially both at rest:
$u_1 = u_2 = 0$

By law of conservation of momentum:
$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$
$0 + 0 = (0.05 \times 200) + (2 \times v_2)$
$0 = 10 + 2v_2$
$2v_2 = -10$
$v_2 = -5\ m/s$

Recoil velocity = 5 m/s (in opposite direction)

Negative sign indicates gun moves in direction opposite to bullet.

Q37. ANSWER:

Total Marks: 5
Part (a): 1 mark | Part (b): 1 mark | Part (c): 3 marks (1+1+1)

(a) Archimedes' Principle:
When a body is partially or completely immersed in a fluid (liquid or gas), it experiences an upward force called buoyant force, which is equal to the weight of the fluid displaced by the immersed part of the body.

Mathematically:
Buoyant force = Weight of fluid displaced = ρ_fluid × V_displaced × g

(b) Why body loses weight in liquid:

A body loses weight when immersed in a liquid because:

• The liquid exerts an upward buoyant force (upthrust) on the immersed body

• This buoyant force acts in upward direction

• Weight acts downward

• Apparent weight = Actual weight - Buoyant force

• Since buoyant force opposes weight, the body appears lighter

• The loss in weight equals the buoyant force

(c) Calculations:

Given:

Weight in air = 500 N

Weight in water = 300 N

Density of water, $\rho = 1000$ kg/m³

$g = 10$ m/s²

(i) Loss in weight:

Loss in weight = Weight in air - Weight in water

Loss in weight = 500 - 300

Loss in weight = 200 N

(ii) Upthrust:

Upthrust (Buoyant force) = Loss in weight

Upthrust = 200 N

(iii) Volume of stone:

Buoyant force = Weight of water displaced

$200 = \rho \times V \times g$

$200 = 1000 \times V \times 10$

$200 = 10000 \times V$

$V = 200/10000$

$V = 0.02$ m³

OR $V = 20 \times 10^{-3}$ m³ = 20 liters

OR Solution:

> **Total Marks: 5**
> Part (a): 2 marks | Part (b): 3 marks (1½ + 1½)

(a) Free Fall and Equations:

Free Fall: Motion of a body under the influence of gravity alone, with no other forces acting on it, is called free fall. During free fall, the only acceleration is due to gravity (g).

Three equations of motion for freely falling body:
(Taking downward direction as positive)

1. First equation: $v = u + gt$
2. Second equation: $s = ut + \frac{1}{2}gt^2$
3. Third equation: $v^2 = u^2 + 2gs$

Where:
u = initial velocity
v = final velocity
g = acceleration due to gravity = 10 m/s²
t = time
s = distance fallen

(b) Calculations:

Given:
Height, h = s = 80 m
Initial velocity, u = 0 (dropped)
g = 10 m/s²

(i) Time to reach ground:
Using $s = ut + \frac{1}{2}gt^2$
$80 = 0 + \frac{1}{2} \times 10 \times t^2$
$80 = 5t^2$

$t^2 = 80/5$

$t^2 = 16$

t = 4 seconds

(ii) Final velocity:

Using $v = u + gt$

$v = 0 + 10 \times 4$

v = 40 m/s

Alternative method using third equation:

$v^2 = u^2 + 2gs$

$v^2 = 0 + 2 \times 10 \times 80$

$v^2 = 1600$

$v = 40$ m/s ✓

Q38. ANSWER:

Total Marks: 5

Part (a): 2 marks | Part (b): 2 marks | Part (c): 1 mark

(a) Diagram of Animal Cell:

[Students should draw neat labeled diagram showing:]

1. **Plasma membrane** - outer boundary
2. **Nucleus** - with nuclear membrane and nucleolus
3. **Mitochondria** - powerhouse
4. **Golgi apparatus** - packaging organelle
5. **Endoplasmic reticulum** - smooth and rough
6. **Ribosomes** - protein synthesis
7. **Lysosomes** - digestive enzymes
8. **Centrosome with centrioles**
9. **Cytoplasm**
10. Small vacuoles (if any)

(b) Three differences between Plant and Animal Cell:

Plant Cell	Animal Cell
1. Cell Wall: Present (made of cellulose)	Absent
2. Chloroplasts: Present (for photosynthesis)	Absent
3. Vacuoles: One large central vacuole	Many small vacuoles or absent
4. Shape: Fixed rectangular shape	Irregular or round shape
5. Centrioles: Absent (in most)	Present
6. Plastids: Present	Absent

(c) Contractile vacuoles in Amoeba and Paramecium:

The statement in the question appears incorrect. **Amoeba and Paramecium DO HAVE contractile vacuoles.**

Correct Answer:

Amoeba and Paramecium (freshwater protozoans) HAVE contractile vacuoles because:

• They live in hypotonic environment (freshwater)

• Water continuously enters their body by osmosis

• Contractile vacuoles collect excess water and expel it out

• This maintains osmotic balance and prevents bursting

• Marine protozoans don't have contractile vacuoles as they live in isotonic environment

OR Solution:

Total Marks: 5

Part (a): 1½ marks | Part (b): 2 marks | Part (c): 1½ marks

(a) Meristematic Tissues:

Meristematic tissues are plant tissues consisting of actively dividing cells. These cells have the ability to divide continuously and produce new cells.

Characteristics: Small cuboidal cells, thin cell walls, dense cytoplasm, prominent nucleus, no intercellular spaces, no vacuoles.

Three types based on location:

1. Apical Meristem:
• Located at tips of roots and shoots
• Responsible for increase in length (primary growth)

2. Lateral Meristem (Cambium):
• Located on the sides of stems and roots
• Responsible for increase in thickness (secondary growth)

3. Intercalary Meristem:
• Located at the base of leaves or internodes
• Helps in elongation of internodes

(b) Diagrams:

(i) PARENCHYMA TISSUE:
[Students should draw showing:]
• Round or oval shaped cells
• Thin cell walls
• Large intercellular spaces
• Prominent nucleus
• Large vacuole
• Living cells
• Labels: cell wall, nucleus, cytoplasm, vacuole, intercellular space

(ii) SCLERENCHYMA TISSUE:
[Students should draw showing:]
• Long, narrow cells with pointed ends
• Very thick, lignified walls
• No intercellular spaces
• Dead cells (no nucleus/protoplasm)
• Small lumen (cavity)
• Labels: thick lignified wall, lumen, no living contents

(c) Functions:

PARENCHYMA:

• Storage of food materials (starch, proteins, oils)

• When contains chlorophyll: performs photosynthesis

• Provides turgidity and support

• In aquatic plants: provides buoyancy

SCLERENCHYMA:

• Provides mechanical strength and rigidity to plant parts

• Makes plants hard and stiff

• Provides support to mature plant organs

• Found in seed coats, nutshells, stems

SECTION E - ANSWERS (3 × 4 = 12 Marks)

Q39. CASE STUDY 1 - ANSWERS:

Total Marks: 4

(i) What is buoyant force? [1 mark]

Solution:

Buoyant force (or upthrust) is the upward force exerted by a fluid (liquid or gas) on an object when it is partially or completely immersed in it. This force opposes the weight of the object and makes it appear lighter in the fluid.

(ii) Why ship floats but iron nail sinks? [1 mark]

Solution:

A ship made of iron floats while an iron nail sinks because:

• Ship is hollow with large volume, so it displaces large amount of water

• Weight of water displaced by ship > Weight of ship

• Therefore, buoyant force > Weight, so ship floats

• Iron nail is solid with small volume, displaces small amount of water

• Weight of water displaced < Weight of nail
• Therefore, buoyant force < Weight, so nail sinks

Conclusion: It's not the material but the density and volume that matters.

OR: Condition for floating [1 mark]

Solution:
For an object to float in a liquid:
• **Density condition:** Density of object must be less than density of liquid
OR
• **Force condition:** Buoyant force on object must be equal to or greater than the weight of object

When these conditions are met, the object will float; otherwise it will sink.

(iii) Calculate volume of cork submerged [2 marks]

> **Marking Scheme:** 1 mark for method + 1 mark for calculation

Solution:

Given:
Weight of cork = 0.2 N
Density of water, $\rho = 1000$ kg/m³
$g = 10$ m/s²

When cork floats:
Weight of cork = Buoyant force
Weight of cork = Weight of water displaced

$0.2 = \rho \times V \times g$
$0.2 = 1000 \times V \times 10$
$0.2 = 10000 \times V$
$V = 0.2 / 10000$
$V = 0.00002$ m³
$V = 2 \times 10^{-5}$ m³

OR V = 0.02 liters OR 20 cm³

The volume of cork submerged in water is 2×10^{-5} m³.

Q40. CASE STUDY 2 - ANSWERS:

Total Marks: 4

(i) Define osmosis [1 mark]

Solution:
Osmosis is the spontaneous movement of water molecules (or solvent molecules) from a region of higher water concentration (or lower solute concentration) to a region of lower water concentration (or higher solute concentration) through a semi-permeable membrane.

(ii) Why did raisin swell in pure water? [1 mark]

Solution:
The raisin swelled in pure water because:
• Pure water is a hypotonic solution (higher water concentration)
• Raisin cells have concentrated sugar solution (lower water concentration)
• Water moved into raisin cells by osmosis through the semi-permeable membrane
• This process is called endosmosis
• Cells absorbed water and swelled up, becoming turgid

OR: What is hypertonic solution? [1 mark]

Solution:
A **hypertonic solution** is a solution that has higher solute concentration (or lower water concentration) compared to the cell contents or another solution. When a cell is placed in a hypertonic solution, water moves out of the cell by osmosis, causing the cell to shrink (plasmolysis in plant cells).

(iii) Plant cell in distilled water [2 marks]

Marking Scheme: 1 mark for explanation + 1 mark for reasoning

Solution:

If a plant cell is placed in distilled water (pure water):

What happens:
• The plant cell will swell and become turgid
• Water enters the cell by osmosis (endosmosis)
• Cell membrane pushes against the rigid cell wall
• Cell becomes fully turgid but does not burst

Reason:
• Distilled water is hypotonic (higher water concentration) compared to cell sap
• Water moves from higher concentration (outside) to lower concentration (inside cell)
• This movement occurs through the semi-permeable plasma membrane
• The rigid cell wall prevents the cell from bursting
• This creates turgor pressure which provides mechanical support to plant

Note: If it were an animal cell (without cell wall), it would burst due to excessive water intake. But plant cells are protected by the rigid cell wall.

Q41. CASE STUDY 3 - ANSWERS:

Total Marks: 4

(i) What is an echo? [1 mark]

Solution:
An **echo** is the repetition of sound caused by the reflection of sound waves from a hard surface such as a wall, mountain, or building. It is heard after a time interval from the original sound.

(ii) Calculate minimum distance for echo [1 mark]

Solution:
Given:
Speed of sound in air, v = 340 m/s

Minimum time interval for hearing echo = 0.1 s

In 0.1 s, sound travels to the obstacle and back:
Total distance = Speed × Time
Total distance = 340 × 0.1 = 34 m

This is the total distance (to obstacle and back):
Distance to obstacle = Total distance / 2
Minimum distance = 34 / 2 = 17 m

The minimum distance required to hear echo is 17 meters.

OR: Why no echo in small room? [1 mark]

Solution:
Echo is not heard in a small room because:
• Minimum distance required for echo = 17 m
• Walls of small room are closer than 17 m
• Sound reflects back in less than 0.1 seconds
• Human ear cannot distinguish sounds separated by less than 0.1 s
• Original sound and reflected sound merge together
• Therefore, we don't hear a distinct echo

Instead, we may hear reverberation (prolonged sound due to multiple reflections).

(iii) Calculate distance to reflecting surface [2 marks]

> **Marking Scheme:** 1 mark for method + 1 mark for calculation

Solution:

Given:
Time to hear echo, t = 4 seconds
Speed of sound, v = 340 m/s

In 4 seconds, sound travels to the obstacle and returns back:
Total distance = Speed × Time
Total distance = 340 × 4
Total distance = 1360 m

Since sound travels to the obstacle and back:

Distance to reflecting surface = Total distance / 2

Distance to reflecting surface = 1360 / 2

Distance = 680 m

The reflecting surface (valley wall) is 680 meters away from the person.

📚 END OF ANSWER KEY 📚

Total Marks: 80

Section A: 20 marks | Section B: 12 marks | Section C: 21 marks

Section D: 15 marks | Section E: 12 marks

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