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**Education as a Service (EaaS)**

**SAMPLE PAPER - SET 2**

**SESSION: 2025-26**

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

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 **GENERAL INSTRUCTIONS:**

1. This question paper contains **38 questions**. All questions are compulsory.
2. The question paper is divided into **FIVE sections – Section A, B, C, D and E**.
3. **Section A:** Question numbers 1 to 20 are Multiple Choice Questions (MCQs) and Assertion-Reason type questions of 1 mark each.
4. **Section B:** Question numbers 21 to 26 are Very Short Answer (VSA) type questions, carrying 2 marks each.
5. **Section C:** Question numbers 27 to 32 are Short Answer (SA) type questions, carrying 3 marks each.
6. **Section D:** Question numbers 33 to 35 are Long Answer (LA) type questions carrying 5 marks each.
7. **Section E:** Question numbers 36 to 38 are case-based/data-based questions with sub-parts, carrying 4 marks each.
8. There is **no overall choice**. However, an internal choice has been provided in some questions.
9. Draw neat and labeled diagrams wherever required.
10. Use of calculators is not permitted.

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**SECTION A (20 × 1 = 20 Marks)**

- Q1.** The temperature at which a liquid converts into vapour is called: [1]
- (a) Melting point
  - (b) Boiling point
  - (c) Freezing point
  - (d) Sublimation point
- Q2.** Which of the following methods can be used to separate a mixture of salt and water? [1]
- (a) Filtration
  - (b) Evaporation
  - (c) Sedimentation
  - (d) Centrifugation

**Q3.** The value of universal gravitational constant  $G$  is: [1]

- (a)  $6.67 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2}$
- (b)  $9.8 \text{ m/s}^2$
- (c)  $3 \times 10^8 \text{ m/s}$
- (d)  $6.022 \times 10^{23}$

**Q4.** Chloroplast is found in which type of cells? [1]

- (a) Animal cells only
- (b) Plant cells only
- (c) Both plant and animal cells
- (d) Prokaryotic cells

**Q5.** If the mass of a body is doubled and its velocity is halved, the kinetic energy will: [1]

- (a) Remain the same
- (b) Become double
- (c) Become half
- (d) Become one-fourth

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**Q6.** The audible range of frequency for human beings is: [1]

- (a) 20 Hz to 20,000 Hz
- (b) Less than 20 Hz
- (c) More than 20,000 Hz
- (d) 1 Hz to 100 Hz

**Q7.** According to Newton's third law, if a book exerts a force on a table, then: [1]

- (a) The table exerts no force on the book
- (b) The table exerts a smaller force on the book
- (c) The table exerts an equal and opposite force on the book
- (d) The table exerts a greater force on the book

**Q8.** The mass of 0.2 mole of water ( $\text{H}_2\text{O}$ ) is: [1]

- (a) 3.6 g
- (b) 18 g
- (c) 36 g
- (d) 0.18 g

**Q9.** A heterogeneous mixture of solid and liquid particles which settle down on standing is called: [1]

- (a) Colloid
- (b) Solution
- (c) Suspension
- (d) Emulsion

**Q10.** Which tissue helps in transportation of water in plants? [1]

- (a) Parenchyma
- (b) Collenchyma
- (c) Xylem
- (d) Phloem

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**Q11.** The acceleration due to gravity on the surface of moon is approximately: [1]

- (a)  $1.6 \text{ m/s}^2$
- (b)  $9.8 \text{ m/s}^2$
- (c)  $19.6 \text{ m/s}^2$
- (d)  $0.98 \text{ m/s}^2$

**Q12.** Two isotopes of chlorine are  ${}_{17}\text{Cl}^{35}$  and  ${}_{17}\text{Cl}^{37}$ . They differ in: [1]

- (a) Number of protons
- (b) Number of electrons
- (c) Number of neutrons
- (d) Atomic number

**Q13.** The tissue that stores fat in our body is: [1]

- (a) Epithelial tissue
- (b) Adipose tissue
- (c) Muscular tissue
- (d) Nervous tissue

**Q14.** The echo of a sound is heard after 0.5 seconds. If the speed of sound in air is 340 m/s, the distance of the reflecting surface is: [1]

- (a) 85 m
- (b) 170 m
- (c) 340 m
- (d) 680 m

**Q15.** Dry ice is solid: [1]

- (a) Water
- (b) Carbon dioxide
- (c) Ammonia
- (d) Nitrogen

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**ASSERTION-REASON TYPE QUESTIONS (Q16-Q20):**

For questions 16 to 20, two statements are given - one labelled as **Assertion (A)** and the other as **Reason (R)**. Select the correct answer from the codes (a), (b), (c) and (d) as given below:

- (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

**Q16. Assertion (A):** Evaporation causes cooling.

**Reason (R):** Particles absorb energy from surroundings during evaporation. [1]

**Q17. Assertion (A):** A ball thrown upwards comes back to the ground.

**Reason (R):** The gravitational force of Earth attracts all objects towards it. [1]

**Q18. Assertion (A):** Momentum is a vector quantity.

**Reason (R):** Momentum is the product of mass and velocity. [1]

**Q19. Assertion (A):** Plasma membrane is called a selectively permeable membrane.

**Reason (R):** Plasma membrane allows only selected substances to pass through it. [1]

**Q20. Assertion (A):** Dalton's atomic theory states that atoms are indivisible.

**Reason (R):** Atoms can be subdivided into electrons, protons, and neutrons. [1]

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**SECTION B ( $6 \times 2 = 12$  Marks)**

**Q21.** Define osmosis. Give one example of osmosis in plant cells. [2]

**Q22.** A body of mass 5 kg is moving with a velocity of 10 m/s. Calculate its momentum. If the velocity is doubled, what will be the new momentum? [2]

**OR**

A force of 20 N acts on a body and changes its velocity from 10 m/s to 30 m/s in 4 seconds. Calculate the mass of the body.

**Q23.** What is meant by concentration of a solution? How can we express it? [2]

**Q24.** State the universal law of gravitation. Write its mathematical form. [2]

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**Q25.** Calculate the formula unit mass of:

(i)  $\text{CaCO}_3$  (Calcium carbonate)

(ii)  $\text{NaCl}$  (Sodium chloride)

(Given: Ca = 40 u, C = 12 u, O = 16 u, Na = 23 u, Cl = 35.5 u) [2]

**Q26.** Differentiate between striated, smooth, and cardiac muscles (any two points). [2]

**OR**

What is plasmolysis? Draw a neat diagram showing a plasmolysed cell.

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**SECTION C ( $6 \times 3 = 18$  Marks)**

**Q27.** (a) Convert the following temperatures to Celsius scale:

(i) 300 K

(ii) 573 K

(b) At what temperature do the Celsius and Fahrenheit scales show the same reading? [3]

**Q28.** A stone is dropped from a height of 20 m.

(a) How long will it take to reach the ground?

(b) What will be its velocity when it hits the ground?

(Take  $g = 10 \text{ m/s}^2$ ) [3]

**OR**

A body is thrown vertically upwards with a velocity of 30 m/s. Calculate:

(a) Maximum height reached

(b) Time taken to reach maximum height

(Take  $g = 10 \text{ m/s}^2$ )

**Q29.** (a) What is meant by a pure substance?

(b) Explain any two methods of separating the components of a mixture with examples. [3]

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**Q30.** (a) What are valence electrons? Write the valence electrons for elements with atomic numbers 11 and 17.

(b) Explain how the valency of an element is determined from its electronic configuration. [3]

**Q31.** Explain the structure and function of the endoplasmic reticulum. Draw a labelled diagram showing rough and smooth ER. [3]

**OR**

Describe the structure and function of the Golgi apparatus with a neat labelled diagram.

**Q32.** (a) Define power. Write its SI unit.

(b) A boy of mass 40 kg climbs up a staircase in 20 seconds. If the staircase has 20 steps each of height 15 cm, calculate the power developed by the boy. (Take  $g = 10 \text{ m/s}^2$ ) [3]

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**SECTION D (3 × 5 = 15 Marks)**

**Q33.** (a) Explain the interconversion of states of matter with the help of a diagram showing the effect of temperature and pressure.

(b) What happens when:

(i) Camphor is heated

(ii) Ice is heated at  $0^{\circ}\text{C}$

(iii) Steam is cooled

[5]

**Q34.** (a) State and explain Dalton's atomic theory with its postulates.

(b) Calculate:

(i) Mass of one atom of oxygen ( $\text{O} = 16 \text{ u}$ )

(ii) Number of molecules in 88 g of carbon dioxide (Molecular mass of  $\text{CO}_2 = 44 \text{ u}$ )

[5]

**OR**

(a) Write Bohr's model of an atom with its postulates.

(b) Draw the atomic structure of:

(i) Sodium ( $Z = 11$ )

(ii) Chlorine ( $Z = 17$ )

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**Q35.** (a) State and prove the law of conservation of momentum with the help of Newton's third law.

(b) A bullet of mass 20 g is fired from a gun of mass 5 kg with a velocity of 500 m/s.

Calculate the recoil velocity of the gun.

[5]

**OR**

(a) Explain the different types of connective tissues found in animals with their functions and location.

(b) Draw a well-labelled diagram of blood showing its components.

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**SECTION E ( $3 \times 4 = 12$  Marks)**

**Q36. CASE STUDY 1: SEPARATION OF MIXTURES**

In a chemistry laboratory, students were given a mixture containing sand, salt, and

ammonium chloride. They were asked to separate these components. The teacher explained that different separation techniques can be used based on the properties of substances. Ammonium chloride can be separated by sublimation as it directly converts from solid to gas. Salt can be dissolved in water while sand remains insoluble. Finally, salt can be recovered by evaporation.

**Based on the above information, answer the following questions:**

(i) What is sublimation? Name two other substances that sublime. [1]

(ii) Which separation technique would you use to separate sand from salt solution? [1]

**OR**

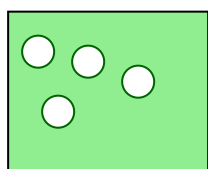
What property of salt makes it possible to recover it from the solution?

(iii) Describe the complete process to separate all three components from the given mixture in proper sequence. [2]

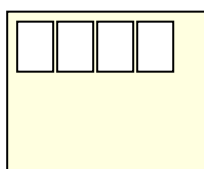
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### Q37. CASE STUDY 2: PLANT AND ANIMAL TISSUES

During a biology practical class, students observed different types of tissues under a microscope. In plant tissues, they observed that some tissues had thin walls and large intercellular spaces (parenchyma), while others had thickened walls at corners (collenchyma). In animal tissues, they noticed epithelial tissue covering body surfaces, connective tissue joining different tissues, and specialized tissues like blood. Each tissue is adapted to perform specific functions efficiently.



Parenchyma



Epithelial

**Based on the above information, answer the following questions:**

- (i) What is the main function of parenchyma tissue in plants? [1]
- (ii) Name the tissue that connects bone to bone and muscle to bone. [1]

**OR**

What is the function of epithelial tissue in animals?

- (iii) Why is blood considered a connective tissue? Explain with two reasons. [2]

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**Q38. CASE STUDY 3: FREE FALL**

A physics teacher demonstrated the concept of free fall by dropping objects from different heights. She explained that when objects fall freely under gravity, they experience uniform acceleration equal to  $g$  ( $9.8 \text{ m/s}^2$ ). The teacher dropped a stone from the top of a building of height 45 m. She asked students to calculate various parameters of motion. Air resistance was neglected for simplicity.

**Based on the above information, answer the following questions:**

- (i) What is the initial velocity of the stone when it is dropped? [1]
- (ii) Calculate the time taken by the stone to reach the ground. (Take  $g = 10 \text{ m/s}^2$ ) [1]

**OR**

Calculate the velocity of the stone when it reaches the ground. (Take  $g = 10 \text{ m/s}^2$ )

- (iii) Calculate the velocity of the stone after 2 seconds of fall and the distance covered during this time. (Take  $g = 10 \text{ m/s}^2$ ) [2]

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 **ANSWER KEY WITH DETAILED SOLUTIONS &  
MARKING SCHEME**

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

**Q1. Answer: (b) Boiling point**

**Marking Scheme:** 1 mark for correct answer

**Explanation:** Boiling point is the temperature at which a liquid changes into vapour (gas) throughout the bulk of the liquid. At this temperature, the vapour pressure equals atmospheric pressure.

**Q2. Answer: (b) Evaporation**

**Marking Scheme:** 1 mark for correct answer

**Explanation:** Evaporation is used to separate salt from water. When the salt solution is heated, water evaporates leaving behind solid salt.

**Q3. Answer: (a)  $6.67 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2}$**

**Marking Scheme:** 1 mark for correct answer

**Explanation:** The value of universal gravitational constant (G) is  $6.67 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2}$ . It is a universal constant with the same value everywhere in the universe.

**Q4. Answer: (b) Plant cells only**

**Marking Scheme:** 1 mark for correct answer

**Explanation:** Chloroplasts are present only in plant cells and some protists. They contain chlorophyll and are the site of photosynthesis. Animal cells do not have chloroplasts.

**Q5. Answer: (c) Become half**

**Marking Scheme:** 1 mark for correct answer

**Explanation:**

$$KE = \frac{1}{2}mv^2$$

$$\text{Initial KE} = \frac{1}{2}m \times v^2$$

$$\text{New mass} = 2m, \text{ New velocity} = v/2$$

$$\text{New KE} = \frac{1}{2} \times 2m \times (v/2)^2 = \frac{1}{2} \times 2m \times v^2/4 = \frac{1}{2}m \times v^2/2 = (\frac{1}{2}mv^2)/2$$

Therefore, KE becomes half.

**Q6. Answer: (a) 20 Hz to 20,000 Hz**

**Marking Scheme:** 1 mark for correct answer

**Explanation:** The audible range of frequency for human beings is 20 Hz to 20,000 Hz (20 kHz). Sounds below 20 Hz are called infrasonic and above 20,000 Hz are called ultrasonic.

**Q7. Answer: (c) The table exerts an equal and opposite force on the book**

**Marking Scheme:** 1 mark for correct answer

**Explanation:** According to Newton's third law, for every action there is an equal and opposite reaction. If the book exerts a force on the table, the table exerts an equal force in the opposite direction on the book.

**Q8. Answer: (a) 3.6 g**

**Marking Scheme:** 1 mark for correct answer

**Explanation:**

Molecular mass of  $\text{H}_2\text{O} = 2(1) + 16 = 18 \text{ g/mol}$

Mass of 1 mole of  $\text{H}_2\text{O} = 18 \text{ g}$

Mass of 0.2 mole =  $0.2 \times 18 = 3.6 \text{ g}$

**Q9. Answer: (c) Suspension**

**Marking Scheme:** 1 mark for correct answer

**Explanation:** A suspension is a heterogeneous mixture in which solid particles are dispersed in a liquid. These particles settle down when left undisturbed and can be separated by filtration.

**Q10. Answer: (c) Xylem**

**Marking Scheme:** 1 mark for correct answer

**Explanation:** Xylem is a complex permanent tissue that transports water and minerals from roots to all parts of the plant. It consists of vessels, tracheids, xylem parenchyma, and xylem fibres.

**Q11. Answer: (a)  $1.6 \text{ m/s}^2$**

**Marking Scheme:** 1 mark for correct answer

**Explanation:** The acceleration due to gravity on the moon is approximately  $1.6 \text{ m/s}^2$  or 1/6th of the acceleration due to gravity on Earth ( $9.8 \text{ m/s}^2$ ).

**Q12. Answer: (c) Number of neutrons**

**Marking Scheme:** 1 mark for correct answer

**Explanation:** Isotopes have the same atomic number (same number of protons and electrons) but different mass numbers (different number of neutrons).  ${}_{17}\text{Cl}^{35}$  has 18 neutrons while  ${}_{17}\text{Cl}^{37}$  has 20 neutrons.

**Q13. Answer: (b) Adipose tissue**

**Marking Scheme:** 1 mark for correct answer

**Explanation:** Adipose tissue is a type of connective tissue that stores fat in the body. It is found below the skin and between internal organs, providing insulation and energy storage.

**Q14. Answer: (a) 85 m**

**Marking Scheme:** 1 mark for correct answer

**Explanation:**

Total distance travelled by sound = Speed  $\times$  Time =  $340 \times 0.5 = 170$  m

This is the distance to the reflecting surface and back.

Distance of reflecting surface =  $170/2 = 85$  m

**Q15. Answer: (b) Carbon dioxide**

**Marking Scheme:** 1 mark for correct answer

**Explanation:** Dry ice is solid carbon dioxide ( $\text{CO}_2$ ). It directly converts from solid to gas (sublimation) at  $-78.5^\circ\text{C}$  without passing through the liquid state.

**ASSERTION-REASON ANSWERS (Q16-Q20)**

**Q16. Answer: (a) Both A and R are true and R is the correct explanation of A**

**Marking Scheme:** 1 mark for correct answer

**Explanation:** Evaporation causes cooling because particles need energy to overcome intermolecular forces and escape as vapor. This energy is absorbed from the surroundings, causing cooling. R correctly explains A.

**Q17. Answer: (a) Both A and R are true and R is the correct explanation of A**

**Marking Scheme:** 1 mark for correct answer

**Explanation:** A ball thrown upwards comes back due to gravitational force. Earth's gravity attracts all objects towards its center. R correctly explains A.

**Q18. Answer: (b) Both A and R are true but R is NOT the correct explanation of A**

**Marking Scheme:** 1 mark for correct answer

**Explanation:** Momentum is a vector quantity because it has both magnitude and direction. While R is true ( $\text{momentum} = \text{mass} \times \text{velocity}$ ), it doesn't explain why momentum is a vector. Momentum is a vector because velocity is a vector.

**Q19. Answer: (a) Both A and R are true and R is the correct explanation of A**

**Marking Scheme:** 1 mark for correct answer

**Explanation:** Plasma membrane is selectively permeable because it allows only certain substances to pass through while blocking others. R correctly explains A.

**Q20. Answer: (c) A is true but R is false**

**Marking Scheme:** 1 mark for correct answer

**Explanation:** Dalton's atomic theory did state that atoms are indivisible (A is true). However, R is false because according to Dalton, atoms cannot be subdivided. Modern atomic theory proved this wrong by discovering subatomic particles.

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

**Q21. Answer:**

**Marking Scheme:**

- Definition - 1 mark
- Example - 1 mark

**Solution:**

**Osmosis:** Osmosis is the movement of water molecules from a region of higher water concentration (dilute solution) to a region of lower water concentration (concentrated solution) through a semi-permeable membrane.

**Example in plant cells:** When a plant cell is placed in a hypotonic solution (dilute), water enters the cell by osmosis, making the cell turgid. This process is responsible for maintaining turgidity in plant cells.

**Q22. Answer:**

**Marking Scheme:**

- Initial momentum - 1 mark
- New momentum - 1 mark

**Solution:**

Mass,  $m = 5 \text{ kg}$

Initial velocity,  $v = 10 \text{ m/s}$

Initial momentum =  $m \times v = 5 \times 10 = \mathbf{50 \text{ kg m/s}}$

When velocity is doubled,  $v' = 20 \text{ m/s}$

New momentum =  $m \times v' = 5 \times 20 = \mathbf{100 \text{ kg m/s}}$

Therefore, momentum also doubles when velocity is doubled.

**OR Solution:**

Given:

Force,  $F = 20 \text{ N}$

Initial velocity,  $u = 10 \text{ m/s}$

Final velocity,  $v = 30 \text{ m/s}$

Time,  $t = 4 \text{ s}$

Acceleration,  $a = (v - u)/t = (30 - 10)/4 = 5 \text{ m/s}^2$

Using  $F = ma$

$20 = m \times 5$

$m = 20/5$

**$m = 4 \text{ kg}$**

**Q23. Answer:****Marking Scheme:**

- Definition - 1 mark
- Expression - 1 mark

**Solution:**

**Concentration of solution:** The concentration of a solution is the amount of solute present in a given amount of solution or solvent.

**Expression:** Concentration can be expressed in various ways:

1. **Mass by mass percentage:**

$$= (\text{Mass of solute} / \text{Mass of solution}) \times 100$$

2. **Mass by volume percentage:**

$$= (\text{Mass of solute} / \text{Volume of solution}) \times 100$$

3. **Volume by volume percentage:**

$$= (\text{Volume of solute} / \text{Volume of solution}) \times 100$$

**Q24. Answer:**

**Marking Scheme:**

- Statement - 1 mark
- Mathematical form - 1 mark

**Solution:**

**Universal Law of Gravitation:**

Every object in the universe attracts every other object with a force which is directly proportional to the product of their masses and inversely proportional to the square of the distance between their centers.

**Mathematical Form:**

$$F = G \times (m_1 \times m_2) / r^2$$

Where,

F = Gravitational force between two objects

G = Universal gravitational constant ( $6.67 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2}$ )

$m_1, m_2$  = Masses of the two objects

r = Distance between the centers of the two objects

### Q25. Answer:

#### Marking Scheme:

- CaCO<sub>3</sub> calculation - 1 mark
- NaCl calculation - 1 mark

#### Solution:

##### (i) Formula unit mass of CaCO<sub>3</sub>:

$$\begin{aligned} &= 1(\text{Ca}) + 1(\text{C}) + 3(\text{O}) \\ &= 1(40) + 1(12) + 3(16) \\ &= 40 + 12 + 48 \\ &= \mathbf{100\ u} \end{aligned}$$

##### (ii) Formula unit mass of NaCl:

$$\begin{aligned} &= 1(\text{Na}) + 1(\text{Cl}) \\ &= 1(23) + 1(35.5) \\ &= \mathbf{58.5\ u} \end{aligned}$$

### Q26. Answer:

#### Marking Scheme:

- Any two differences - 2 marks (1 mark each)

#### Solution:

Striated Muscle	Smooth Muscle	Cardiac Muscle
Cylindrical, multinucleated cells with striations	Spindle-shaped, uninucleated cells without striations	Cylindrical, branched cells with striations
Voluntary (under conscious control)	Involuntary (not under conscious control)	Involuntary (not under conscious control)

Found attached to bones	Found in internal organs like stomach, intestine	Found only in the heart
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**OR Solution:**

**Plasmolysis:** Plasmolysis is the process in which the cell membrane of a plant cell shrinks away from the cell wall due to loss of water when placed in a hypertonic solution (concentrated solution).

[Diagram showing:]

- Cell wall (rigid, outer layer)
- Shrunken cell membrane pulled away from cell wall
- Reduced cytoplasm
- Nucleus
- Space between cell wall and cell membrane

**Marking Scheme for diagram:**

- Proper diagram - 1 mark
- Labels - 1 mark

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## SECTION C - ANSWERS (6 × 3 = 18 Marks)

**Q27. Answer:**

**Marking Scheme:**

- (a)(i) Conversion - ½ mark
- (a)(ii) Conversion - ½ mark
- (b) Answer with explanation - 2 marks

**Solution:**

(a) Formula:  $^{\circ}\text{C} = \text{K} - 273$

**(i) Converting 300 K to Celsius:**

$$^{\circ}\text{C} = 300 - 273 = 27^{\circ}\text{C}$$

**(ii) Converting 573 K to Celsius:**

$$^{\circ}\text{C} = 573 - 273 = 300^{\circ}\text{C}$$

**(b) Temperature at which Celsius and Fahrenheit show same reading:**

Let the temperature be  $x$ .

Using the formula:  $^{\circ}\text{F} = (9/5)^{\circ}\text{C} + 32$

When  $^{\circ}\text{C} = ^{\circ}\text{F} = x$

$$x = (9/5)x + 32$$

$$x - (9/5)x = 32$$

$$(5x - 9x)/5 = 32$$

$$-4x/5 = 32$$

$$x = -40$$

Therefore, at  $-40^{\circ}$ , both Celsius and Fahrenheit scales show the same reading.

### Q28. Answer:

#### Marking Scheme:

- (a) Time calculation -  $1\frac{1}{2}$  marks
- (b) Velocity calculation -  $1\frac{1}{2}$  marks

#### Solution:

Given:

Initial velocity,  $u = 0$  (stone is dropped)

Height,  $h = 20$  m

Acceleration due to gravity,  $g = 10$  m/s<sup>2</sup>

**(a) Time to reach ground:**

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

$$20 = 0 + \frac{1}{2} \times 10 \times t^2$$

$$20 = 5t^2$$

$$t^2 = 4$$

$$t = 2 \text{ seconds}$$

**(b) Velocity when it hits the ground:**

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

$$v^2 = 0 + 2 \times 10 \times 20$$

$$v^2 = 400$$

$$v = 20 \text{ m/s}$$

**OR Solution:**

Given:

Initial velocity,  $u = 30 \text{ m/s}$  (upward)

Final velocity at maximum height,  $v = 0$

Acceleration,  $a = -g = -10 \text{ m/s}^2$  (negative because opposite to motion)

**(a) Maximum height reached:**

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

$$0 = (30)^2 + 2(-10)s$$

$$0 = 900 - 20s$$

$$20s = 900$$

$$s = 45 \text{ m}$$

**(b) Time to reach maximum height:**

Using  $v = u + at$

$$0 = 30 + (-10)t$$

$$10t = 30$$

$$t = 3 \text{ seconds}$$

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**Q29. Answer:**

**Marking Scheme:**

- (a) Definition - 1 mark
- (b) Two methods with examples - 2 marks (1 mark each)

**Solution:**

**(a) Pure Substance:**

A pure substance is a material that contains only one type of particle. It has a fixed

composition and definite properties. Pure substances can be elements or compounds. Examples: Pure water, pure gold, sodium chloride.

**(b) Two methods of separating mixtures:**

**1. Filtration:**

Used to separate insoluble solid particles from a liquid. The mixture is poured through filter paper which allows the liquid to pass through but retains the solid particles.

**Example:** Separating sand from water, separating tea leaves from tea.

**2. Distillation:**

Used to separate two miscible liquids with different boiling points or to obtain pure solvent from a solution. The mixture is heated and vapors are condensed back to liquid.

**Example:** Separating acetone and water, obtaining pure water from salt solution, separation of petroleum fractions.

**Q30. Answer:**

**Marking Scheme:**

- (a) Definition and examples - 1½ marks
- (b) Explanation - 1½ marks

**Solution:**

**(a) Valence Electrons:**

Valence electrons are the electrons present in the outermost shell of an atom. They participate in chemical bonding and determine the chemical properties of an element.

**For atomic number 11 (Sodium):**

Electronic configuration: 2, 8, 1

Number of valence electrons = 1

**For atomic number 17 (Chlorine):**

Electronic configuration: 2, 8, 7

Number of valence electrons = 7

**(b) Determining Valency:**

Valency is determined by the number of electrons an atom needs to gain, lose, or share to complete its outermost shell (octet).

- If valence electrons  $\leq 4$ : Valency = Number of valence electrons

Example: Carbon has 4 valence electrons, so valency = 4

- If valence electrons  $> 4$ : Valency =  $8 - \text{Number of valence electrons}$

Example: Oxygen has 6 valence electrons, so valency =  $8 - 6 = 2$

**Q31. Answer:**

**Marking Scheme:**

- Structure description - 1 mark
- Function - 1 mark
- Diagram with labels - 1 mark

**Solution:**

**Endoplasmic Reticulum (ER):**

**Structure:**

- Large network of membrane-bound tubes and sheets
- Extends from cell membrane to nuclear membrane
- Two types: Rough ER (with ribosomes) and Smooth ER (without ribosomes)
- Rough ER has a studded appearance due to attached ribosomes
- Smooth ER has a smooth tubular appearance

**Functions:**

**Rough ER:**

- Synthesis and transport of proteins
- Provides surface for protein synthesis

**Smooth ER:**

- Synthesis of lipids and steroids
- Detoxification of drugs and poisons
- Storage and release of calcium ions

[Diagram showing: Nuclear membrane, Rough ER with ribosomes, Smooth ER without ribosomes, Labels for both types]

**OR Solution:****Golgi Apparatus:****Structure:**

- Consists of a system of membrane-bound sacs called cisternae
- Usually 5-8 cisternae arranged parallelly
- Has two faces: cis face (receiving side) and trans face (shipping side)
- Surrounded by vesicles

**Functions:**

- Modification and packaging of proteins received from ER
- Formation of lysosomes
- Synthesis of cell wall in plants
- Secretion of materials from cell
- Formation of acrosome in sperm cells

[Diagram showing: Stack of cisternae, Cis face, Trans face, Vesicles, Labels]

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**Q32. Answer:****Marking Scheme:**

- (a) Definition and unit - 1 mark
- (b) Calculation - 2 marks

**Solution:****(a) Power:**

Power is defined as the rate of doing work or the rate at which energy is transferred or consumed.

Power = Work done / Time taken

**SI unit:** Watt (W) or Joule per second (J/s)

**(b) Given:**

Mass of boy,  $m = 40 \text{ kg}$

Time,  $t = 20 \text{ s}$

Number of steps = 20

Height of each step =  $15 \text{ cm} = 0.15 \text{ m}$

$g = 10 \text{ m/s}^2$

Total height climbed,  $h = 20 \times 0.15 = 3 \text{ m}$

Work done against gravity =  $mgh$

$W = 40 \times 10 \times 3$

$W = 1200 \text{ J}$

Power = Work / Time

$P = 1200 / 20$

**P = 60 W or 60 Watt**

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

**Q33. Answer:**

**Marking Scheme:**

- (a) Explanation with diagram - 3 marks
- (b) Three transformations - 2 marks

**Solution:**

**(a) Interconversion of States of Matter:**

Matter exists in three states: solid, liquid, and gas. These states can be interconverted by changing temperature or pressure.

**Effect of Temperature:**

- **Melting/Fusion:** Solid → Liquid (heating)
- **Vaporization:** Liquid → Gas (heating)
- **Sublimation:** Solid → Gas (heating)
- **Freezing:** Liquid → Solid (cooling)
- **Condensation:** Gas → Liquid (cooling)
- **Deposition:** Gas → Solid (cooling)

**Effect of Pressure:**

- Increasing pressure can convert gas to liquid or liquid to solid
- Decreasing pressure can convert solid to gas (sublimation)

[Diagram showing circular interconversion: SOLID ↔ LIQUID ↔ GAS with arrows labeled with processes]

**(b) What happens when:**

**(i) Camphor is heated:**

Camphor undergoes sublimation, i.e., it directly converts from solid state to gaseous state without passing through the liquid state. The vapors can be collected and cooled to get back solid camphor.

**(ii) Ice is heated at 0°C:**

At 0°C (melting point), ice absorbs heat energy (latent heat of fusion) and converts into water without any change in temperature. The temperature remains constant at 0°C until all ice melts.

**(iii) Steam is cooled:**

When steam is cooled, it undergoes condensation and converts into liquid water. During this process, latent heat of vaporization is released.

**Marking Scheme:**

- (a) Postulates - 3 marks
- (b)(i) Mass calculation - 1 mark
- (b)(ii) Number of molecules - 1 mark

**Solution:****(a) Dalton's Atomic Theory:****Main Postulates:**

1. **Atoms are indivisible:** All matter is made up of tiny indivisible particles called atoms, which cannot be created or destroyed in a chemical reaction.
2. **Atoms of same element are identical:** All atoms of a given element are identical in mass and chemical properties. Atoms of different elements have different masses and properties.
3. **Atoms combine in simple ratios:** Atoms combine in the ratio of small whole numbers to form compounds.
4. **Conservation of atoms:** The relative number and kinds of atoms remain constant in a given compound.

**(b) Calculations:****(i) Mass of one atom of oxygen:**

Atomic mass of oxygen = 16 u

1 mole of oxygen =  $6.022 \times 10^{23}$  atoms = 16 g

Mass of 1 atom =  $16 \text{ g} / (6.022 \times 10^{23})$

=  $16 / (6.022 \times 10^{23}) \text{ g}$

=  $2.656 \times 10^{-23} \text{ g}$

**(ii) Number of molecules in 88 g of CO<sub>2</sub>:**

Molecular mass of CO<sub>2</sub> = 44 u

Number of moles = Given mass / Molecular mass

=  $88 / 44 = 2 \text{ moles}$

Number of molecules = Number of moles  $\times$  Avogadro's number  
=  $2 \times 6.022 \times 10^{23}$   
=  **$12.044 \times 10^{23}$  molecules or  $1.2044 \times 10^{24}$  molecules**

**OR Solution:**

**(a) Bohr's Model of Atom:**

**Postulates:**

1. **Stationary orbits:** Electrons revolve around the nucleus in fixed circular paths called orbits or shells with definite energy.
2. **Quantized energy:** Each orbit has a fixed energy level. The energy of an electron remains constant as long as it stays in that orbit.
3. **Energy absorption and emission:** An electron can move from one energy level to another by absorbing or emitting energy. When it jumps to a higher energy level, it absorbs energy. When it falls to a lower level, it emits energy in the form of electromagnetic radiation.
4. **Ground state:** The electrons occupy the lowest energy orbits available (ground state). The orbit closest to the nucleus (K shell) has the lowest energy.

**(b) Atomic Structures:**

**(i) Sodium (Z = 11):**

Electronic configuration: 2, 8, 1

[Diagram showing:]

- Nucleus with 11+ (11 protons, 12 neutrons)
- K shell: 2 electrons
- L shell: 8 electrons
- M shell: 1 electron

**(ii) Chlorine (Z = 17):**

Electronic configuration: 2, 8, 7

[Diagram showing:]

- Nucleus with 17+ (17 protons, 18 neutrons)

- K shell: 2 electrons
- L shell: 8 electrons
- M shell: 7 electrons

### Q35. Answer:

#### Marking Scheme:

- (a) Statement and proof - 3 marks
- (b) Calculation - 2 marks

#### Solution:

##### (a) Law of Conservation of Momentum:

**Statement:** In an isolated system (no external force), the total momentum before collision is equal to the total momentum after collision. The total momentum remains conserved.

##### Proof using Newton's Third Law:

Consider two objects A and B with masses  $m_1$  and  $m_2$  moving with initial velocities  $u_1$  and  $u_2$  respectively. After collision, their velocities become  $v_1$  and  $v_2$ .

Let  $F_{12}$  = Force exerted by A on B

$F_{21}$  = Force exerted by B on A

$t$  = Time of contact during collision

According to Newton's third law:

$$F_{12} = -F_{21} \dots (i)$$

Force = Rate of change of momentum

$$F_{12} = m_2(v_2 - u_2)/t \dots (ii)$$

$$F_{21} = m_1(v_1 - u_1)/t \dots (iii)$$

From (i), (ii), and (iii):

$$m_2(v_2 - u_2)/t = -m_1(v_1 - u_1)/t$$

$$m_2(v_2 - u_2) = -m_1(v_1 - u_1)$$

$$m_2v_2 - m_2u_2 = -m_1v_1 + m_1u_1$$

$$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$$

This proves that total initial momentum = total final momentum

Hence proved.

**(b) Given:**

Mass of bullet,  $m_1 = 20 \text{ g} = 0.02 \text{ kg}$

Velocity of bullet,  $v_1 = 500 \text{ m/s}$

Mass of gun,  $m_2 = 5 \text{ kg}$

Initial velocity of both = 0

Using conservation of momentum:

Total initial momentum = Total final momentum

$$0 = m_1v_1 + m_2v_2$$

$$0 = (0.02 \times 500) + (5 \times v_2)$$

$$0 = 10 + 5v_2$$

$$5v_2 = -10$$

$$v_2 = -2 \text{ m/s}$$

**Recoil velocity of gun = 2 m/s** (in opposite direction)

The negative sign indicates that the gun moves in the opposite direction to the bullet.

**OR Solution:**

**(a) Types of Connective Tissues in Animals:**

### **1. Areolar Tissue:**

- Structure: Cells and fibers loosely arranged in a semi-fluid matrix
- Function: Fills space between organs, supports internal organs
- Location: Between skin and muscles, around blood vessels and nerves

### **2. Adipose Tissue:**

- Structure: Cells filled with fat globules, less intercellular matrix
- Function: Storage of fat, insulation, cushioning

- Location: Below skin, around kidneys, between internal organs

### **3. Dense Regular Connective Tissue (Tendons & Ligaments):**

- Structure: Densely packed collagen fibers arranged parallelly
- Function: Tendons attach muscles to bones, ligaments connect bones to bones
- Location: Tendons at muscle-bone junction, ligaments at joints

### **4. Cartilage:**

- Structure: Widely spaced cells in a firm matrix containing proteins and sugars
- Function: Smoothens bone surfaces at joints, provides support and flexibility
- Location: Nose, ear, trachea, joints

### **5. Bone:**

- Structure: Hard matrix with calcium and phosphorus, cells embedded in matrix
- Function: Support, protection, movement, produces blood cells
- Location: Skeleton

### **6. Blood:**

- Structure: Fluid matrix (plasma) with RBC, WBC, and platelets
- Function: Transport of materials, defense against diseases
- Location: Blood vessels throughout body

### **(b) Diagram of Blood:**

[Diagram showing: Plasma (55%), RBCs (Red Blood Cells), WBCs (White Blood Cells), Platelets, with proper labels and proportions]

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

### **Q36. CASE STUDY 1 - ANSWERS:**

**Total Marks: 4**

**(i) What is sublimation? Name two other substances. [1 mark]**

**Solution:**

**Sublimation** is the process in which a solid directly converts into gas without passing through the liquid state on heating. On cooling, the gas directly converts back to solid without becoming liquid.

**Two other substances that sublime:**

1. Camphor
  2. Naphthalene (moth balls)
- Also: Iodine, dry ice (solid CO<sub>2</sub>)

**(ii) Which technique to separate sand from salt solution? [1 mark]**

**Solution:**

**Filtration** technique would be used to separate sand from salt solution. Sand (insoluble solid) remains on the filter paper while the salt solution (filtrate) passes through.

**OR: What property of salt makes recovery possible? [1 mark]**

**Solution:**

Salt is **soluble in water but non-volatile**. This means salt dissolves in water but does not evaporate. When the solution is heated, water evaporates leaving behind solid salt, which can be recovered.

**(iii) Describe the complete separation process. [2 marks]**

**Marking Scheme:** ½ mark for each step (4 steps)

**Solution:**

**Step-by-step separation process:**

**Step 1:** Take the mixture of sand, salt, and ammonium chloride in a china dish and place it inside an inverted funnel. Heat the dish gently.

**Step 2:** Ammonium chloride will sublime (convert to gas) and deposit on the cooler parts of the inverted funnel. Collect the sublimed ammonium chloride by scraping it from the funnel.

**Step 3:** Add water to the remaining mixture of sand and salt. Stir well. Salt will

dissolve in water while sand remains insoluble.

**Step 4:** Filter the mixture using filter paper and funnel. Sand will remain on the filter paper (residue) and salt solution will pass through as filtrate.

**Step 5:** Evaporate the salt solution by heating. Water will evaporate and solid salt will be left behind.

Thus, all three components are separated successfully.

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### Q37. CASE STUDY 2 - ANSWERS:

**Total Marks: 4**

**(i) Main function of parenchyma tissue. [1 mark]**

**Solution:**

The main function of parenchyma tissue is **storage of food**. It also helps in photosynthesis (when it contains chlorophyll), provides buoyancy to aquatic plants, and fills spaces between other tissues.

**(ii) Tissue connecting bone to bone and muscle to bone. [1 mark]**

**Solution:**

- **Ligament** connects bone to bone
- **Tendon** connects muscle to bone

Both are types of dense connective tissue with great strength but limited flexibility.

**OR: Function of epithelial tissue. [1 mark]**

**Solution:**

The main functions of epithelial tissue are:

- **Protection:** Protects underlying tissues from mechanical injury, harmful chemicals, and invasion of microorganisms
- **Absorption:** Absorbs nutrients in the intestine
- **Secretion:** Secretes substances like hormones, enzymes, mucus

**(iii) Why is blood considered a connective tissue? [2 marks]**

**Marking Scheme:** 1 mark for each reason

**Solution:**

Blood is considered a connective tissue because of the following reasons:

**Reason 1:** Like all connective tissues, blood connects and binds different parts of the body. It connects all body tissues by transporting materials (oxygen, nutrients, hormones, waste products) between different parts of the body.

**Reason 2:** Blood has cells (RBCs, WBCs, platelets) suspended in a fluid matrix called plasma, similar to other connective tissues that have cells in a matrix. The plasma serves as the intercellular matrix.

**Reason 3:** Blood originates from the same embryonic tissue (mesoderm) as other connective tissues, confirming its classification as connective tissue.

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### **Q38. CASE STUDY 3 - ANSWERS:**

**Total Marks: 4**

**(i) Initial velocity when stone is dropped. [1 mark]**

**Solution:**

The initial velocity of the stone when it is dropped is **0 m/s** (zero) because the stone is released from rest (dropped, not thrown).

**(ii) Calculate time to reach ground. [1 mark]**

**Solution:**

Given:

Height,  $h = s = 45 \text{ m}$

Initial velocity,  $u = 0$

Acceleration,  $g = 10 \text{ m/s}^2$

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

$$45 = 0 + \frac{1}{2} \times 10 \times t^2$$

$$45 = 5t^2$$

$$t^2 = 9$$

**t = 3 seconds**

**OR: Calculate velocity when reaching ground. [1 mark]**

**Solution:**

Given:

Height,  $s = 45 \text{ m}$

Initial velocity,  $u = 0$

Acceleration,  $g = 10 \text{ m/s}^2$

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

$$v^2 = 0 + 2 \times 10 \times 45$$

$$v^2 = 900$$

**v = 30 m/s**

**(iii) Calculate velocity and distance after 2 seconds. [2 marks]**

**Marking Scheme:** 1 mark for velocity + 1 mark for distance

**Solution:**

Given:

Initial velocity,  $u = 0$

Time,  $t = 2 \text{ s}$

Acceleration,  $g = 10 \text{ m/s}^2$

**Velocity after 2 seconds:**

Using  $v = u + gt$

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

**v = 20 m/s**

**Distance covered in 2 seconds:**

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

$$s = 0 + \frac{1}{2} \times 10 \times 4$$

$$s = 5 \times 4$$

$$s = 20 \text{ m}$$

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## END OF ANSWER KEY

**Total Marks: 80**

Section A: 20 marks | Section B: 12 marks | Section C: 18 marks

Section D: 15 marks | Section E: 12 marks | Internal Choice: 3 marks

This comprehensive answer key follows strict CBSE marking schemes and includes detailed step-by-step solutions for better understanding and scoring.

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