📚 MATH LOVE INSTITUTE

Education as a Service (EaaS)

SAMPLE PAPER - SET 1

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 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.

SECTION A (20 × 1 = 20 Marks)

Q1. Which of the following is a chemical change? **[1]**

(a) Melting of ice
(b) Dissolution of sugar in water
(c) Burning of magnesium ribbon
(d) Sublimation of camphor

Q2. The number of electrons in an atom of Chlorine (atomic number = 17) with valency 1 is: **[1]**

(a) 17
(b) 18
(c) 16
(d) 35

Q3. A car accelerates uniformly from 18 km/h to 36 km/h in 5 seconds. The acceleration of the car is: **[1]**

(a) 1 m/s^2
(b) 2 m/s^2
(c) 3.6 m/s^2
(d) 0.5 m/s^2

Q4. The cell organelle responsible for releasing energy is: **[1]**

(a) Ribosome
(b) Mitochondria
(c) Golgi apparatus
(d) Lysosome

Q5. An object weighing 10 kg is raised to a height of 5 m above the ground. Its potential energy is ($g = 10\ m/s^2$): **[1]**

(a) 50 J
(b) 100 J
(c) 250 J
(d) 500 J

Q6. Which of the following is NOT a characteristic of sound waves? **[1]**

(a) They require a medium to travel
(b) They are longitudinal waves
(c) They can travel through vacuum
(d) They show reflection

Q7. The SI unit of momentum is: **[1]**

(a) kg m/s
(b) $kg\ m/s^2$
(c) $kg\ m^2/s$
(d) $N\ s^2$

Q8. The molecular formula of glucose is $C_6H_{12}O_6$. The molecular mass of glucose is: **[1]**

(a) 180 u
(b) 172 u
(c) 168 u
(d) 176 u

Q9. Tyndall effect is observed in: **[1]**

(a) True solutions
(b) Colloidal solutions
(c) Suspensions only
(d) Both (b) and (c)

Q10. Which type of tissue helps in movement of body parts? **[1]**

(a) Epithelial tissue
(b) Connective tissue
(c) Muscular tissue
(d) Nervous tissue

Q11. The universal law of gravitation was given by: **[1]**

(a) Galileo
(b) Isaac Newton
(c) Albert Einstein
(d) Johannes Kepler

Q12. The number of neutrons in $_{19}K^{39}$ is: **[1]**

(a) 19
(b) 20
(c) 39
(d) 58

Q13. Meristematic tissue is responsible for: **[1]**

(a) Protection of plant organs
(b) Growth in plants
(c) Storage of food
(d) Conduction of water

Q14. The frequency of a wave is 500 Hz and its wavelength is 0.5 m. The speed of the wave is: **[1]**

(a) 100 m/s
(b) 250 m/s
(c) 500 m/s
(d) 1000 m/s

Q15. The process of evaporation causes: **[1]**

(a) Heating
(b) Cooling
(c) No temperature change
(d) Increase in pressure

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):** The mass of a substance remains constant during a physical change.
Reason (R): Physical changes are temporary and reversible. **[1]**

Q17. **Assertion (A):** The velocity-time graph of a uniformly moving object is a straight line parallel to the time axis.
Reason (R): In uniform motion, the velocity of an object remains constant. **[1]**

Q18. **Assertion (A):** Newton's third law of motion is also called the law of action and reaction.
Reason (R): For every action, there is an equal and opposite reaction. **[1]**

Q19. **Assertion (A):** The nucleus of a cell is known as the control center of the cell.
Reason (R): Nucleus contains chromosomes which carry genes responsible for heredity. **[1]**

Q20. **Assertion (A):** Isotopes have same atomic number but different mass numbers.
Reason (R): Isotopes have the same number of protons but different number of neutrons. **[1]**

SECTION B (6 × 2 = 12 Marks)

Q21. Differentiate between prokaryotic and eukaryotic cells. Give one example of each. **[2]**

Q22. An object starting from rest travels 20 m in the first 2 s and 160 m in the next 4 s. Calculate the velocity after 6 seconds. **[2]**

OR

A train starting from rest attains a velocity of 72 km/h in 5 minutes. Find the acceleration of the train.

Q23. Define the following:
(i) Colloid
(ii) Suspension **[2]**

Q24. State Newton's second law of motion. Give its mathematical form. **[2]**

Q25. Calculate the number of atoms in each of the following:
(i) 2 moles of oxygen atoms
(ii) 0.5 mole of carbon atoms
(Given: Avogadro's number = 6.022×10^{23}) **[2]**

Q26. What is apical meristem? Where is it located? Mention its function. **[2]**

OR

Draw a well-labelled diagram of a nerve cell.

SECTION C (6 × 3 = 18 Marks)

Q27. Explain how the three states of matter differ from each other on the basis of:
(i) Arrangement of particles
(ii) Kinetic energy
(iii) Intermolecular force **[3]**

Q28. Derive the equation of motion: $v^2 = u^2 + 2as$ using the velocity-time graph. **[3]**

OR

The brakes applied to a car produce an acceleration of 6 m/s² in the opposite direction to the motion. If the car takes 2 s to stop after the application of brakes, calculate the distance travelled by the car during this time.

Q29. (a) State the law of conservation of mass.
(b) 2.4 g of magnesium is burnt in a closed container to form magnesium oxide. What will be the mass of magnesium oxide formed? Explain. **[3]**

Q30. (a) Draw the structure of an atom showing the distribution of electrons in K, L, and M shells for the element with atomic number 13.
(b) Write the electronic configuration of this element. **[3]**

Q31. Describe the structure and function of mitochondria. Draw a well-labelled diagram. **[3]**

OR

Explain the various types of simple permanent tissues found in plants with their functions.

Q32. (a) State the law of conservation of energy.
(b) A body of mass 2 kg is thrown vertically upwards with a kinetic energy of 490 J. Calculate the height at which the kinetic energy becomes half of the original value. (g = 9.8 m/s²) **[3]**

SECTION D (3 × 5 = 15 Marks)

Q33. (a) State Newton's three laws of motion with examples.

(b) A force of 10 N acts on a body of mass 2 kg for 3 seconds, initially at rest. Calculate:

(i) The velocity acquired by the body

(ii) The distance covered in 3 seconds **[5]**

Q34. (a) Explain Rutherford's gold foil experiment and the observations made. What conclusions did he draw?

(b) Differentiate between valency and atomic number.

(c) Write the electronic configuration of Argon (atomic number = 18). **[5]**

OR

(a) Explain the three sub-atomic particles present in an atom with their characteristics.

(b) Find the number of protons, electrons, and neutrons in the following:

(i) $_{17}Cl^{35}$

(ii) $_{20}Ca^{40}$

Q35. (a) What are communicable diseases? Name any two diseases caused by microorganisms.

(b) Explain how diseases spread through:

(i) Air

(ii) Water

(iii) Physical contact

(c) What are the principles of prevention of diseases? **[5]**

OR

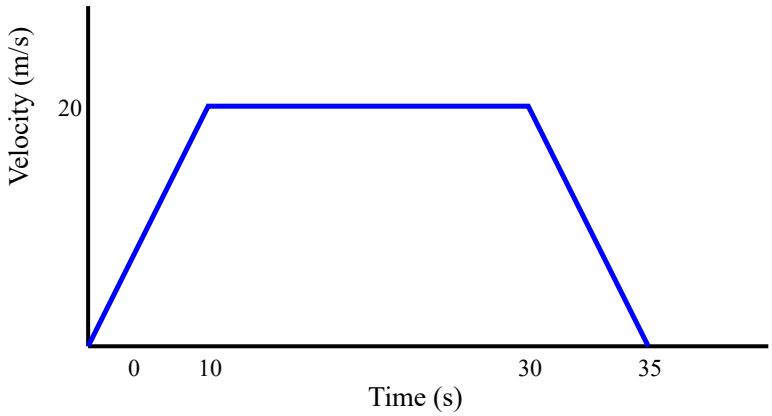
(a) Differentiate between parenchyma, collenchyma, and sclerenchyma on the basis of their cell wall, function, and location.

(b) Draw a neat labelled diagram of stomata.

SECTION E (3 × 4 = 12 Marks)

Q36. CASE STUDY 1: MOTION OF A CYCLIST

A cyclist starts from rest and accelerates uniformly for 10 seconds, reaching a velocity of 20 m/s. He then maintains this velocity for the next 20 seconds. Finally, he applies brakes and comes to rest in 5 seconds.



Based on the above information, answer the following questions:

(i) Calculate the acceleration during the first 10 seconds. **[1]**

(ii) Calculate the retardation during braking. **[1]**

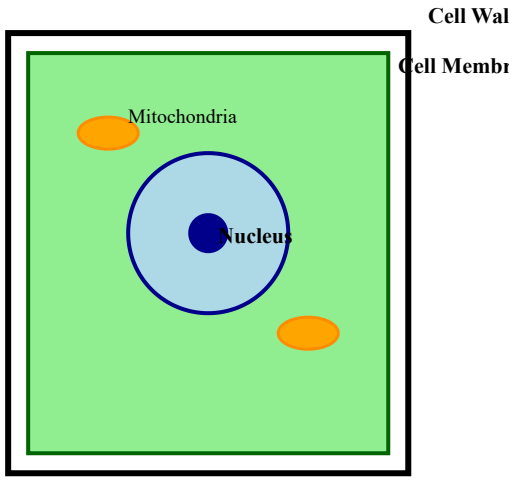
OR

What is the distance covered during the uniform velocity period?

(iii) Calculate the total distance covered by the cyclist during the entire journey. **[2]**

Q37. CASE STUDY 2: CELL STRUCTURE

Rama was observing a slide of an onion peel under a microscope in the biology laboratory. She noticed various cell organelles. Her teacher explained that each organelle has a specific function. The cell wall provides rigidity, the cell membrane controls the entry and exit of materials, the nucleus controls all cellular activities, and mitochondria provide energy.



Based on the above information, answer the following questions:

(i) Why is the nucleus called the control center of the cell? **[1]**

(ii) Name the cell organelle known as the powerhouse of the cell and give reason. **[1]**

OR

What is the function of the cell wall in plant cells?

(iii) Differentiate between the cell wall and cell membrane on the basis of their structure and permeability. **[2]**

Q38. CASE STUDY 3: SOUND PROPAGATION

During a thunderstorm, Ravi observed that he sees lightning first and hears thunder a few seconds later. His teacher explained that light travels much faster than sound. The speed of sound in air at 25°C is approximately 346 m/s, while the speed of light is 3×10^8 m/s. Sound waves require a medium to propagate and are longitudinal in nature.

Based on the above information, answer the following questions:

(i) Why do we see lightning before we hear thunder? **[1]**

(ii) If Ravi heard thunder 5 seconds after seeing the lightning, calculate the approximate distance of the thunderstorm from his location. **[1]**

OR

Why can't sound travel through vacuum?

(iii) Explain the difference between longitudinal and transverse waves with examples. **[2]**

H-1 Street 2, V V Vihar, Shankar Nagar, Raipur (C.G.)

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🎯 ANSWER KEY WITH DETAILED SOLUTIONS & MARKING SCHEME

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

Q1. Answer: (c) Burning of magnesium ribbon

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

Explanation: Burning of magnesium ribbon is a chemical change because it forms magnesium oxide (MgO), a new substance with different properties. The change is irreversible. Other options are physical changes.

Q2. Answer: (a) 17

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

Explanation: In a neutral atom, number of electrons = atomic number. For Chlorine, atomic number = 17, therefore number of electrons = 17.

Q3. Answer: (a) 1 m/s²

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

Explanation:
Initial velocity (u) = 18 km/h = 18 × (5/18) = 5 m/s
Final velocity (v) = 36 km/h = 36 × (5/18) = 10 m/s
Time (t) = 5 s
Acceleration (a) = (v - u)/t = (10 - 5)/5 = 1 m/s²

Q4. Answer: (b) Mitochondria

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

Explanation: Mitochondria are called the powerhouse of the cell as they release energy in the form of ATP through cellular respiration.

Q5. Answer: (d) 500 J

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

Explanation:
Potential Energy (PE) = mgh
PE = 10 kg × 10 m/s² × 5 m = 500 J

Q6. Answer: (c) They can travel through vacuum

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

Explanation: Sound waves are mechanical waves and require a material medium (solid, liquid, or gas) to propagate. They cannot travel through vacuum.

Q7. Answer: (a) kg m/s

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

Explanation: Momentum = mass × velocity. SI unit = kg × m/s = kg m/s (also equal to N s)

Q8. Answer: (a) 180 u

Marking Scheme: 1 mark for correct answer

Explanation:
Molecular mass of $C_6H_{12}O_6$ = (6 × 12) + (12 × 1) + (6 × 16)
= 72 + 12 + 96 = 180 u

Q9. Answer: (b) Colloidal solutions

Marking Scheme: 1 mark for correct answer

Explanation: Tyndall effect is the scattering of light by colloidal particles. It is characteristic of colloids and not observed in true solutions.

Q10. Answer: (c) Muscular tissue

Marking Scheme: 1 mark for correct answer

Explanation: Muscular tissue is responsible for movement of body parts through contraction and relaxation of muscle fibers.

Q11. Answer: (b) Isaac Newton

Marking Scheme: 1 mark for correct answer

Explanation: Sir Isaac Newton gave the universal law of gravitation in 1687.

Q12. Answer: (b) 20

Marking Scheme: 1 mark for correct answer

Explanation:
Number of neutrons = Mass number - Atomic number = 39 - 19 = 20

Q13. Answer: (b) Growth in plants

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

Explanation: Meristematic tissue consists of actively dividing cells responsible for growth in plants.

Q14. Answer: (b) 250 m/s

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

Explanation:
Speed (v) = frequency × wavelength = 500 Hz × 0.5 m = 250 m/s

Q15. Answer: (b) Cooling

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

Explanation: During evaporation, particles absorb energy from the surroundings, causing a cooling effect.

ASSERTION-REASON ANSWERS (Q16-Q20)

Q16. 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: Both statements are true. However, the reason given is not the correct explanation of why mass remains constant. Mass remains constant because of the law of conservation of mass.

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: In uniform motion, velocity remains constant, so the velocity-time graph is a straight line parallel to time axis. R correctly explains A.

Q18. Answer: (a) Both A and R are true and R is the correct explanation of A

Marking Scheme: 1 mark for correct answer

Explanation: Newton's third law states that for every action there is an equal and opposite reaction. R correctly explains A.

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: The nucleus is the control center because it contains chromosomes with genes that control heredity and cellular activities. R correctly explains A.

Q20. Answer: (a) Both A and R are true and R is the correct explanation of A

Marking Scheme: 1 mark for correct answer

Explanation: Isotopes have the same atomic number (same protons) but different mass numbers due to different numbers of neutrons. R correctly explains A.

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

Q21. Answer:

Marking Scheme:
• Differences - 1 mark
• Examples - 1 mark

Solution:

Differences between Prokaryotic and Eukaryotic Cells:

Prokaryotic Cell	Eukaryotic Cell
No well-defined nucleus	Well-defined nucleus with nuclear membrane
No membrane-bound organelles	Membrane-bound organelles present

Examples:
Prokaryotic cell: Bacteria, Blue-green algae
Eukaryotic cell: Plant cell, Animal cell

Q22. Answer:

Marking Scheme:
• Correct formula - ½ mark
• Calculation - 1 mark
• Final answer - ½ mark

Solution:
Total distance covered = 20 + 160 = 180 m
Total time = 2 + 4 = 6 s
Since the body starts from rest, u = 0
Using $s = ut + \frac{1}{2}at^2$

$180 = 0 + ½ \times a \times 36$

$180 = 18a$

$a = 10\ m/s^2$

Using $v = u + at$

$v = 0 + 10 \times 6$

$v = 60$ m/s

OR Solution:

Initial velocity, $u = 0$

Final velocity, $v = 72$ km/h $= 72 \times (5/18) = 20$ m/s

Time, $t = 5$ minutes $= 5 \times 60 = 300$ s

Using $a = (v - u)/t$

$a = (20 - 0)/300$

$a = 0.067\ m/s^2$ or $1/15\ m/s^2$

Q23. Answer:

Marking Scheme:

- Definition of Colloid - 1 mark
- Definition of Suspension - 1 mark

Solution:

(i) Colloid: A colloid is a heterogeneous mixture in which the particle size ranges from 1 nm to 1000 nm. The particles do not settle down and cannot be separated by filtration. Example: milk, fog.

(ii) Suspension: A suspension is a heterogeneous mixture in which the particle size is larger than 1000 nm. The particles settle down after some time and can be separated by filtration. Example: muddy water, chalk in water.

Q24. Answer:

Marking Scheme:
• Statement of law - 1 mark
• Mathematical form - 1 mark

Solution:

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.

Mathematical Form:
$F = ma$
Where,
F = Force applied (in Newton)
m = Mass of the body (in kg)
a = Acceleration produced (in m/s^2)

Q25. Answer:

Marking Scheme:
• (i) Correct calculation - 1 mark
• (ii) Correct calculation - 1 mark

Solution:

(i) Number of atoms in 2 moles of oxygen:
Number of atoms = Number of moles × Avogadro's number
$= 2 \times 6.022 \times 10^{23}$
$\mathbf{= 12.044 \times 10^{23}}$ **atoms**

(ii) Number of atoms in 0.5 mole of carbon:
Number of atoms $= 0.5 \times 6.022 \times 10^{23}$
$\mathbf{= 3.011 \times 10^{23}}$ **atoms**

Q26. Answer:

Marking Scheme:
• Definition - ½ mark
• Location - ½ mark
• Function - 1 mark

Solution:

Apical Meristem: It is the meristematic tissue located at the growing tips (apex) of roots and stems.

Location: Present at the tips of roots, shoots, and branches.

Function: It is responsible for the increase in length of roots and stems (primary growth).

OR Solution:
[Diagram of nerve cell showing]
- Cell body with nucleus
- Dendrites
- Axon
- Nerve endings
- Myelin sheath

Marking Scheme for diagram:
• Correct structure - 1 mark
• Proper labelling - 1 mark

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

Q27. Answer:

Marking Scheme:
• Arrangement of particles - 1 mark
• Kinetic energy - 1 mark
• Intermolecular force - 1 mark

Solution:

Property	Solid	Liquid	Gas
Arrangement of particles	Particles are closely packed in a regular pattern with very little space between them	Particles are close together but have more space and can move around	Particles are far apart with large spaces between them and move freely
Kinetic energy	Lowest kinetic energy; particles only vibrate at their fixed positions	Moderate kinetic energy; particles have more energy to move	Highest kinetic energy; particles move very rapidly in all directions
Intermolecular force	Very strong intermolecular forces of attraction	Weaker intermolecular forces compared to solids	Weakest or negligible intermolecular forces

Q28. Answer:

Marking Scheme:
• Drawing velocity-time graph - 1 mark
• Derivation steps - 1½ marks
• Final equation - ½ mark

Solution:

Consider a body with initial velocity 'u' and final velocity 'v' after time 't', moving with uniform acceleration 'a'.

From the velocity-time graph:

Distance covered (s) = Area under the graph

s = Area of trapezium OABC

s = ½ (sum of parallel sides) × height

s = ½ (OA + BC) × OC

s = ½ (u + v) × t ... (i)

From first equation of motion: $v = u + at$

Therefore, $t = (v - u)/a$ ... (ii)

Substituting (ii) in (i):

$s = ½ (u + v) \times (v - u)/a$

$s = (v^2 - u^2)/2a$

$2as = v^2 - u^2$

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

Hence proved.

OR Solution:

Given:

Initial velocity, u = 0 (car stops)

Final velocity, v = 0 (after braking)

Acceleration, $a = -6$ m/s² (retardation)

Time, t = 2 s

First, we need to find initial velocity before braking:

Using $v = u + at$

$0 = u + (-6) \times 2$

$u = 12$ m/s

Now, distance covered during braking:

Using $s = ut + ½at^2$

$s = 12 \times 2 + ½ \times (-6) \times 4$

$s = 24 - 12$

s = 12 m

Q29. Answer:

Marking Scheme:
- (a) Statement of law - 1 mark
- (b) Correct mass value - 1 mark
- (b) Explanation - 1 mark

Solution:

(a) Law of Conservation of Mass:
Mass can neither be created nor destroyed in a chemical reaction. The total mass of reactants is equal to the total mass of products.

(b) When 2.4 g of magnesium is burnt in a closed container, it reacts with oxygen to form magnesium oxide.

$2Mg + O_2 \rightarrow 2MgO$

According to the law of conservation of mass, the total mass remains constant.
Mass of Mg + Mass of O_2 = Mass of MgO

Since oxygen is present in the closed container, it will react with magnesium. The mass of magnesium oxide formed will be **greater than 2.4 g** because it includes the mass of oxygen that combined with magnesium.

The exact mass will be: 2.4 g + mass of oxygen consumed = mass of MgO
If we calculate: 2.4 g Mg reacts with 1.6 g O_2 to give 4.0 g MgO

Q30. Answer:

Marking Scheme:
- (a) Correct atomic structure diagram - 2 marks
- (b) Electronic configuration - 1 mark

Solution:

(a) Atomic number 13 means the element is Aluminium (Al).
It has 13 electrons distributed as: K = 2, L = 8, M = 3

[Diagram showing:]
- Nucleus with 13+ (13 protons and 14 neutrons)
- K shell with 2 electrons
- L shell with 8 electrons
- M shell with 3 electrons

(b) Electronic Configuration:
K - 2, L - 8, M - 3
OR 2, 8, 3

Q31. Answer:

Marking Scheme:
• Structure description - 1 mark
• Function - 1 mark
• Diagram with labels - 1 mark

Solution:

Mitochondria:

Structure:
• Double membrane-bound organelle
• Outer membrane is smooth and porous
• Inner membrane is folded to form cristae
• Matrix is present inside the inner membrane containing enzymes
• Contains its own DNA and ribosomes

Function:
• Site of cellular respiration
• Produces ATP (energy currency of the cell)
• Called the powerhouse of the cell
• Releases energy from glucose through aerobic respiration

[Diagram showing mitochondria with labels: Outer membrane, Inner membrane, Cristae, Matrix, Ribosome, DNA]

OR Solution:

Types of Simple Permanent Tissues in Plants:

1. Parenchyma:
• Thin-walled living cells with intercellular spaces
• Functions: Storage of food, provides buoyancy
• Found in soft parts of plants

2. Collenchyma:
• Living cells with thickened corners
• Functions: Provides mechanical support and flexibility
• Found in leaf stalks and young stems

3. Sclerenchyma:
• Dead cells with thick lignified walls
• Functions: Provides mechanical strength
• Found in stems, veins of leaves, hard covering of seeds and nuts

Q32. Answer:

Marking Scheme:
• (a) Statement of law - 1 mark
• (b) Correct approach - 1 mark
• (b) Calculation and answer - 1 mark

Solution:

(a) Law of Conservation of Energy:
Energy can neither be created nor destroyed but can be transformed from one form to another. The total energy of an isolated system remains constant.

(b) Given:
Mass, m = 2 kg
Initial kinetic energy, KE = 490 J
$g = 9.8\ m/s^2$

At the point where KE becomes half:
KE at that point = 490/2 = 245 J

Loss in KE = Initial KE - Final KE
= 490 - 245 = 245 J

This loss in KE is converted to PE:
PE gained = mgh = 245 J
$2 \times 9.8 \times h = 245$
$19.6h = 245$
$h = 245/19.6$
h = 12.5 m

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

Q33. Answer:

Marking Scheme:
- (a) Three laws with examples - 3 marks (1 mark each)
- (b)(i) Velocity calculation - 1 mark
- (b)(ii) Distance calculation - 1 mark

Solution:

(a) Newton's Three Laws of Motion:

First Law (Law of Inertia):
A body at rest will remain at rest, and a body in motion will continue to move with uniform velocity unless acted upon by an external force.

Example: A book lying on a table remains at rest until someone picks it up. A moving bicycle continues to move even after we stop pedaling.

Second Law:
The rate of change of momentum is directly proportional to the applied force and takes place in the direction of the force.
F = ma
Example: A greater force is needed to push a loaded truck than an empty one.

Third Law:
For every action, there is an equal and opposite reaction.
Example: When we jump from a boat to the shore, the boat moves backward. The recoil of a gun when fired.

(b) Given:
Force, F = 10 N
Mass, m = 2 kg
Time, t = 3 s
Initial velocity, u = 0 (at rest)

(i) Finding acceleration:
F = ma
10 = 2 × a
a = 5 m/s²

Using v = u + at
v = 0 + 5 × 3
v = 15 m/s

(ii) Finding distance:
Using s = ut + ½at²
s = 0 + ½ × 5 × 9
s = ½ × 45
s = 22.5 m

Q34. Answer:

Marking Scheme:
- (a) Experiment description - 1 mark
- (a) Observations - 1 mark
- (a) Conclusions - 1 mark
- (b) Differentiation - 1 mark
- (c) Electronic configuration - 1 mark

Solution:

(a) Rutherford's Gold Foil Experiment:

Experiment:
Rutherford bombarded a thin gold foil with fast-moving alpha particles (α-particles). A fluorescent screen was placed around the foil to detect the scattered particles.

Observations:
1. Most of the α-particles passed through the gold foil without deflection
2. A few α-particles were deflected through small angles
3. Very few α-particles (1 in 20,000) were deflected back through large angles

Conclusions:
1. Most of the space in an atom is empty (as most particles passed through)
2. The positive charge is concentrated in a very small volume at the center called the nucleus
3. The nucleus is very dense and heavy
4. Electrons revolve around the nucleus in specific orbits

(b) Difference between Valency and Atomic Number:
Valency: The combining capacity of an element, determined by the number of electrons in the outermost shell.
Atomic Number: The number of protons present in the nucleus of an atom. It is unique for each element.

(c) Electronic Configuration of Argon (Z = 18):

K = 2, L = 8, M = 8

OR 2, 8, 8

OR Solution:

(a) Three Sub-atomic Particles:

1. Protons:

• Positively charged particles

• Present in the nucleus

• Mass ≈ 1 atomic mass unit (a.m.u.)

• Charge = +1

2. Neutrons:

• Neutral particles (no charge)

• Present in the nucleus

• Mass ≈ 1 atomic mass unit (a.m.u.)

• Charge = 0

3. Electrons:

• Negatively charged particles

• Revolve around the nucleus in orbits

• Mass ≈ 1/1840 of proton (negligible)

• Charge = -1

(b)

(i) $_{17}Cl^{35}$:

Atomic number = 17

Mass number = 35

Number of protons = 17

Number of electrons = 17

Number of neutrons = 35 - 17 = 18

(ii) $_{20}Ca^{40}$:

Atomic number = 20

Mass number = 40

Number of protons = 20

Number of electrons = 20

Number of neutrons = 40 - 20 = 20

Q35. Answer:

Marking Scheme:

- (a) Definition and diseases - 1 mark
- (b) Three modes of spread - 2 marks
- (c) Principles of prevention - 2 marks

Solution:

(a) Communicable Diseases:

Diseases that can be transmitted from an infected person to a healthy person are called communicable diseases.

Examples: Tuberculosis (TB), Cholera, Influenza, AIDS, Malaria

(b) How Diseases Spread:

(i) Through Air:

When an infected person coughs or sneezes, droplets containing disease-causing microbes are released into the air. These can be inhaled by healthy people.

Examples: Common cold, tuberculosis, pneumonia

(ii) Through Water:

Contaminated water containing disease-causing microorganisms can cause diseases when consumed.

Examples: Cholera, typhoid, hepatitis A, diarrhea

(iii) Through Physical Contact:

Direct contact with infected person or touching contaminated objects can spread diseases.

Examples: Skin diseases like ringworm, scabies, AIDS (through sexual contact)

(c) Principles of Prevention of Diseases:

1. **General hygiene:** Maintain personal cleanliness, keep surroundings clean
2. **Safe drinking water:** Drink boiled or filtered water
3. **Balanced diet:** Eat nutritious food to strengthen immune system
4. **Vaccination:** Get vaccinated against various diseases
5. **Avoid contact:** Keep away from infected persons
6. **Vector control:** Control mosquitoes and other disease-carrying organisms

OR Solution:

(a) Difference between Parenchyma, Collenchyma, and Sclerenchyma:

Feature	Parenchyma	Collenchyma	Sclerenchyma
Cell Wall	Thin-walled, made of cellulose	Thickened at corners due to cellulose and pectin	Thick-walled, lignified (hard)
Function	Storage of food, photosynthesis, provides buoyancy	Provides mechanical support with flexibility	Provides mechanical strength and rigidity
Location	Found in all soft parts - leaves, fruits, flowers, roots	Below epidermis in stems and leaf stalks	Stems, veins of leaves, hard coverings of seeds and nuts
Living/Dead	Living cells	Living cells	Dead cells

(b) Diagram of Stomata:

[Diagram showing: Guard cells, Stomatal pore, Epidermal cells, Chloroplasts in guard cells]

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

Q36. CASE STUDY 1 - ANSWERS:

Total Marks: 4

(i) Calculate the acceleration during the first 10 seconds. [1 mark]

Solution:
Initial velocity, u = 0 m/s (starts from rest)
Final velocity, v = 20 m/s
Time, t = 10 s

Using a = (v - u)/t
a = (20 - 0)/10
a = 2 m/s²

(ii) Calculate the retardation during braking. [1 mark]

Solution:
Initial velocity, u = 20 m/s
Final velocity, v = 0 m/s
Time, t = 5 s

Using a = (v - u)/t
a = (0 - 20)/5
a = -4 m/s² (retardation = 4 m/s²)

OR: What is the distance covered during the uniform velocity period? [1 mark]

Solution:
During uniform motion:
Velocity = 20 m/s (constant)
Time = 20 s

Distance = velocity × time
= 20 × 20
= 400 m

(iii) Calculate the total distance covered by the cyclist. [2 marks]

Marking Scheme: ½ mark for each distance + ½ mark for total

Solution:

Distance in first 10 seconds (acceleration):

$s_1 = ut + \frac{1}{2}at^2$

$s_1 = 0 + \frac{1}{2} \times 2 \times 100$

$s_1 = 100$ m

Distance in next 20 seconds (uniform motion):

s_2 = velocity × time

$s_2 = 20 \times 20 = 400$ m

Distance in last 5 seconds (retardation):

$s_3 = ut + \frac{1}{2}at^2$

$s_3 = 20 \times 5 + \frac{1}{2} \times (-4) \times 25$

$s_3 = 100 - 50 = 50$ m

Total distance = $s_1 + s_2 + s_3$

= 100 + 400 + 50

= 550 m

Q37. CASE STUDY 2 - ANSWERS:

Total Marks: 4

(i) Why is the nucleus called the control center of the cell? [1 mark]

Solution:

The nucleus is called the control center of the cell because it contains chromosomes which have genes that control all the activities of the cell. It regulates cell growth, metabolism, and reproduction by controlling protein synthesis.

(ii) Name the cell organelle known as the powerhouse and give reason. [1 mark]

Solution:

Mitochondria is known as the powerhouse of the cell because it releases energy in the form of ATP (Adenosine Triphosphate) through the process of cellular respiration. This ATP is used for various cellular activities.

OR: What is the function of the cell wall in plant cells? [1 mark]

Solution:

The cell wall in plant cells provides rigidity, structural support, and protection to the cell. It maintains the shape of the cell and prevents it from bursting when water enters the cell.

(iii) Differentiate between cell wall and cell membrane. [2 marks]

> **Marking Scheme:** 1 mark for each difference (2 differences required)

Solution:

Cell Wall	Cell Membrane
Thick and rigid structure made of cellulose	Thin and flexible structure made of lipids and proteins
Fully permeable (allows all substances to pass)	Selectively permeable (allows only selected substances to pass)
Present only in plant cells	Present in both plant and animal cells
Non-living structure	Living structure

Q38. CASE STUDY 3 - ANSWERS:

> **Total Marks: 4**

(i) Why do we see lightning before we hear thunder? [1 mark]

Solution:

We see lightning before we hear thunder because light travels much faster than

sound. Light travels at approximately 3×10^8 m/s while sound travels at only 346 m/s in air. Therefore, light reaches us first.

(ii) Calculate the approximate distance of the thunderstorm. [1 mark]

Solution:
Given:
Time taken = 5 seconds
Speed of sound = 346 m/s

Distance = Speed × Time
= 346 × 5
= 1730 m or 1.73 km

OR: Why can't sound travel through vacuum? [1 mark]

Solution:
Sound cannot travel through vacuum because sound waves are mechanical waves that require a material medium (solid, liquid, or gas) to propagate. In vacuum, there are no particles present to vibrate and transmit the sound energy.

(iii) Explain the difference between longitudinal and transverse waves. [2 marks]

> **Marking Scheme:** 1 mark for each type with example

Solution:

Longitudinal Waves:
In longitudinal waves, the particles of the medium vibrate parallel to the direction of wave propagation. The wave travels through compressions and rarefactions.
Example: Sound waves, waves in a spring

Transverse Waves:
In transverse waves, the particles of the medium vibrate perpendicular to the direction of wave propagation. The wave travels through crests and troughs.
Example: Light waves, water waves, waves in a string

📚 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.

H-1 Street 2, V V Vihar, Shankar Nagar, Raipur (C.G.)

📱 +91-7869553517 | 🌐 www.mathlove.in | 📍