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Education as a Service (EaaS)

SAMPLE PAPER - SET 8

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 kinetic energy of a body of mass m moving with velocity v is:** [1]
- (a) mv^2
 - (b) $\frac{1}{2}mv$
 - (c) $\frac{1}{2}mv^2$
 - (d) $2mv^2$
- Q2. The law of conservation of mass was given by:** [1]
- (a) Dalton
 - (b) Lavoisier
 - (c) Proust
 - (d) Avogadro
- Q3. Avogadro's number is equal to:** [1]
- (a) 6.022×10^{21}
 - (b) 6.022×10^{23}
 - (c) 6.022×10^{24}
 - (d) 6.022×10^{22}
- Q4. The valency of carbon in CH_4 is:** [1]
- (a) 1
 - (b) 2
 - (c) 3
 - (d) 4
- Q5. Which cell organelle is known as the "suicidal bag" of the cell?** [1]
- (a) Golgi apparatus
 - (b) Lysosome
 - (c) Ribosome
 - (d) Mitochondria

Q6. Which animal tissue connects muscles to bones? [1]

- (a) Areolar tissue
- (b) Adipose tissue
- (c) Tendon
- (d) Ligament

Q7. The area under acceleration-time graph gives: [1]

- (a) Distance
- (b) Velocity
- (c) Change in velocity
- (d) Displacement

Q8. One joule is equal to: [1]

- (a) $1 \text{ N} \times 1 \text{ m}$
- (b) $1 \text{ kg} \times 1 \text{ m/s}$
- (c) 1 N/m
- (d) $1 \text{ kg} \times 1 \text{ m}$

Q9. An object is thrown vertically upward. At the highest point, its: [1]

- (a) Velocity and acceleration both are zero
- (b) Velocity is zero but acceleration is not zero
- (c) Velocity is not zero but acceleration is zero
- (d) Both velocity and acceleration are not zero

Q10. The frequency of ultrasound is: [1]

- (a) Less than 20 Hz
- (b) Between 20 Hz to 20,000 Hz
- (c) Greater than 20,000 Hz
- (d) Equal to 20,000 Hz

Q11. Which of the following is a physical change? [1]

- (a) Burning of coal
- (b) Digestion of food
- (c) Melting of ice
- (d) Rusting of iron

Q12. Isotopes are atoms of the same element having: [1]

- (a) Same mass number but different atomic number
- (b) Same atomic number but different mass number
- (c) Different atomic and mass numbers
- (d) Same atomic and mass numbers

Q13. The process by which white blood cells engulf bacteria is called: [1]

- (a) Osmosis
- (b) Diffusion
- (c) Phagocytosis
- (d) Plasmolysis

Q14. Which tissue provides flexibility to plants? [1]

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

Q15. The unit of power is: [1]

- (a) Joule
- (b) Newton
- (c) Watt
- (d) Pascal

Q16. ASSERTION-REASON TYPE QUESTIONS

[1]

Assertion (A): Kinetic energy of an object is directly proportional to the square of its velocity.

Reason (R): Kinetic energy = $\frac{1}{2}mv^2$.

- (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): One mole of any substance contains 6.022×10^{23} particles.

Reason (R): This number is called Avogadro's number.

- (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

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Q18. ASSERTION-REASON TYPE QUESTIONS

[1]

Assertion (A): Lysosomes are called suicidal bags of the cell.

Reason (R): Lysosomes contain digestive enzymes that can digest cell components.

- (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

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Q19. ASSERTION-REASON TYPE QUESTIONS**[1]****Assertion (A):** Sound cannot travel through vacuum.**Reason (R):** Sound requires a material medium to travel.

- (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):** The law of definite proportions states that a pure compound always contains same elements in the same proportion by mass.**Reason (R):** This law was proposed by Joseph Proust.

- (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

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SECTION B (6 × 2 = 12 Marks)

- Q21.** Define kinetic energy and potential energy. Write their formulas. **[2]**
- Q22.** State the law of definite proportions with one example. **[2]**
- Q23.** What is a mole? How many molecules are present in 1 mole of oxygen gas? **[2]**
- Q24.** Name the organelle that is called the "powerhouse of the cell" and explain why. **[2]**
- Q25.** What is the function of ligaments and tendons? Write one difference between them. **[2]**
- Q26.** Calculate the speed of sound in air if a sound wave has frequency 256 Hz and wavelength 1.3 m. **[2]**

SECTION C (7 × 3 = 21 Marks)

Q27. (a) Define uniform circular motion. **[3]**

(b) Give two examples of uniform circular motion.

(c) What provides the necessary centripetal force for a satellite revolving around Earth?

Q28. (a) What are isotopes? Give two examples. **[3]**

(b) Write two uses of isotopes.

(c) Why do isotopes of an element have same chemical properties?

Q29. (a) Convert 5 moles of water into number of molecules. **[3]**

(b) Find the number of moles in 88 g of CO₂.

(c) Calculate the mass of 0.5 mole of oxygen gas (O₂).

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

Q30. OR **[3]**

Calculate the molecular mass of the following compounds:

(a) Glucose (C₆H₁₂O₆)

(b) Sulphuric acid (H₂SO₄)

(c) Ammonium sulphate [(NH₄)₂SO₄]

[Given: C = 12, H = 1, O = 16, S = 32, N = 14 u]

Q31. (a) Draw a labeled diagram of a prokaryotic cell. **[3]**

(b) Name one organism that has prokaryotic cells.

(c) Why are these cells called prokaryotic?

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Q32. OR **[3]**

(a) What is plasmolysis? Draw a diagram to show plasmolysis in a plant cell.

(b) In which solution does plasmolysis occur?

(c) Give one example from daily life where plasmolysis is used.

Q33. (a) Differentiate between aerenchyma and chlorenchyma. **[3]**

(b) Write one function of each.

(c) In which part of the plant is chlorenchyma found?

Q34. A body of mass 5 kg initially at rest is acted upon by a force of 20 N. Calculate: [3]

- (a) The acceleration produced
- (b) The velocity acquired after 10 seconds
- (c) The distance covered in 10 seconds

Q35. OR [3]

- (a) An object moves along a straight line with uniform velocity. Draw its distance-time graph.
- (b) What information do we get from the slope of distance-time graph?
- (c) A body covers 200 m in 40 seconds. Calculate its speed.

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SECTION D (3 × 5 = 15 Marks)

Q36. (a) State the law of conservation of energy. [5]

- (b) Derive the relation between kinetic energy and momentum.
- (c) A body of mass 20 kg is moving with a velocity of 10 m/s. Calculate:
 - (i) Its kinetic energy
 - (ii) Its momentum

OR

- (a) Define work and write its SI unit. When is work said to be done?
- (b) A force of 100 N is applied on an object at an angle of 60° to the horizontal. If the object moves 5 m in the direction of force, calculate the work done.
- (c) A man weighing 60 kg climbs a staircase to a height of 5 m in 10 seconds. Calculate the power developed. [$g = 10 \text{ m/s}^2$]

- Q37.** (a) State the law of conservation of mass. Who proposed this law? [5]
(b) Explain how the law can be verified experimentally.
(c) A compound contains 4.07% hydrogen, 24.27% carbon and 71.65% chlorine by mass. Calculate its empirical formula.
[Given: H = 1 u, C = 12 u, Cl = 35.5 u]

OR

- (a) What is meant by the term 'chemical formula'? Write the rules for writing chemical formulas.
(b) Write the chemical formulas of:
(i) Calcium carbonate
(ii) Magnesium hydroxide
(iii) Aluminium oxide
(c) Calculate the formula unit mass of calcium carbonate. [Ca = 40, C = 12, O = 16 u]

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- Q38.** (a) Draw a well-labeled diagram of a plant cell showing nucleus, mitochondria, chloroplast, cell wall, and vacuole. [5]
(b) Write the function of each organelle drawn.
(c) Why do plant cells have cell wall but animal cells do not?

OR

- (a) What are complex permanent tissues? Name two types of complex permanent tissues.
(b) Draw labeled diagrams showing structure of xylem and phloem.
(c) Write two differences between xylem and phloem.
(d) Which component of xylem is dead and which is living?

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SECTION E (3 × 4 = 12 Marks)

CASE STUDY 1: WORK AND ENERGY IN DAILY LIFE

Ravi pushes a heavy box across the floor with a force of 200 N. The box moves 3 meters in the direction of the force. His friend asks him why he feels tired even when the box

stops moving. The teacher explains that work is done only when a force causes displacement. The energy Ravi uses gets converted into kinetic energy of the box and heat energy due to friction. When the box stops, all kinetic energy has been converted to heat and sound. The concept of work and energy is fundamental to understanding how forces cause motion and how energy transforms from one form to another. Work is defined as the product of force and displacement in the direction of force. Energy exists in various forms and can be converted from one form to another, but the total energy in an isolated system remains constant.

(i) Calculate the work done by Ravi in pushing the box. [1 mark]

(ii) Why does Ravi not do any work when he pushes against a wall that doesn't move? [1 mark]

OR

What happens to the kinetic energy of the box when it stops moving? [1 mark]

(iii) A porter lifts a luggage of 20 kg from the ground and puts it on his head 2 m above the ground. Calculate:

(a) The work done by the porter

(b) The potential energy gained by the luggage [$g = 10 \text{ m/s}^2$] [2 marks]

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CASE STUDY 2: MOLE CONCEPT IN CHEMISTRY

A chemistry teacher was explaining the concept of mole to students. She told them that a mole is the amount of substance that contains as many particles as there are atoms in 12 grams of carbon-12. This number is called Avogadro's number and equals 6.022×10^{23} . She gave an example: "Just like a dozen means 12, a mole means 6.022×10^{23} particles." The mole concept helps us count atoms and molecules which are too small and numerous to count individually. The molar mass of a substance in grams is numerically equal to its atomic or molecular mass in u. For example, the atomic mass of carbon is 12 u, so the molar mass is 12 g/mol. This means 12 g of carbon contains 6.022×10^{23} atoms. The mole concept is essential for stoichiometric calculations in chemistry.

(i) Define molar mass. [1 mark]

(ii) How many molecules are present in 2 moles of water? [1 mark]

OR

Calculate the number of moles in 64 g of oxygen (O₂). [Molar mass of O₂ = 32 g/mol] [1 mark]

(iii) A sample contains 3.011×10^{23} molecules of ammonia (NH₃). Calculate:

(a) Number of moles of ammonia

(b) Mass of ammonia sample [Molar mass of NH₃ = 17 g/mol] [2 marks]

CASE STUDY 3: ANIMAL TISSUES AND THEIR FUNCTIONS

During a biology practical class, students observed different types of animal tissues under a microscope. Their teacher explained that animal tissues are broadly classified into four types: epithelial tissue, connective tissue, muscular tissue, and nervous tissue. Epithelial tissue covers body surfaces and lines body cavities, providing protection and helping in absorption. Connective tissue connects different tissues and organs - blood is a fluid connective tissue that transports substances, while bone provides structural support. Muscular tissue is responsible for movement - skeletal muscles are attached to bones, cardiac muscles form the heart, and smooth muscles are found in internal organs. Nervous tissue transmits electrical signals and coordinates body activities. The teacher emphasized that each tissue type has a specific structure suited to its function, demonstrating the principle of "structure determines function" in biology.

(i) Name the tissue that transports oxygen and nutrients in the body. [1 mark]

(ii) Which type of muscle tissue is found in the heart? [1 mark]

OR

What is the function of epithelial tissue? [1 mark]

(iii) Explain the structure and function of nervous tissue. Draw a labeled diagram of a neuron. [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 8

Complete Step-by-Step Solutions with Marking Scheme
Prepared by Expert Faculty of Math Love Institute

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

OBJECTIVE TYPE QUESTIONS - ANSWERS:

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

KEY EXPLANATIONS:

Q1. $KE = \frac{1}{2}mv^2$ (kinetic energy formula)

Q2. Antoine Lavoisier proposed the law of conservation of mass in 1789.

Q3. Avogadro's number = 6.022×10^{23} (particles in one mole)

Q6. Tendons connect muscles to bones; Ligaments connect bones to bones.

Q8. 1 Joule = 1 Newton × 1 meter (work = force × distance)

Q9. At highest point: $v = 0$, but $a = g$ (downward) $\neq 0$

Q12. Isotopes: Same atomic number (protons), different mass number (neutrons)

ASSERTION-REASON ANSWERS:

Q16: (a) - Formula proves proportionality to v^2

Q17: (a) - Definition and naming are directly connected

Q18: (a) - Enzymes capability explains the "suicidal" name

Q19: (a) - Need for medium explains inability to travel in vacuum

Q20: (b) - Both true but naming the scientist doesn't explain the law

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

Q21. ANSWER:

Marking Scheme: 1 mark for each definition with formula

Solution:

Kinetic Energy: The energy possessed by a body by virtue of its motion is called kinetic energy.

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

Where $m = \text{mass}$, $v = \text{velocity}$

Potential Energy: The energy possessed by a body by virtue of its position or configuration is called potential energy.

Formula: $PE = mgh$

Where $m = \text{mass}$, $g = \text{acceleration due to gravity}$, $h = \text{height}$

Q22. ANSWER:

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

Solution:

Law of Definite Proportions: A pure chemical compound always contains the same elements combined together in a fixed ratio by mass, irrespective of its source or method of preparation.

This law was proposed by Joseph Proust.

Example:

Pure water (H₂O) always contains hydrogen and oxygen in the ratio 1:8 by mass.

- 18 g of water contains 2 g hydrogen and 16 g oxygen
- Ratio = 2:16 = 1:8
- This ratio remains constant whether water is obtained from river, well, sea, or prepared in laboratory

Q23. ANSWER:

Marking Scheme: 1 mark for definition + 1 mark for number

Solution:

Mole: One mole is the amount of substance that contains as many particles (atoms, molecules, or ions) as there are atoms in exactly 12 grams of carbon-12.

OR

One mole of any substance contains 6.022×10^{23} particles (Avogadro's number).

Number of molecules in 1 mole of oxygen gas:

1 mole of O₂ = 6.022×10^{23} molecules

This is applicable to any substance - 1 mole always contains Avogadro's number of particles.

Q24. ANSWER:

Marking Scheme: 1 mark for naming + 1 mark for reason

Solution:

Organelle: Mitochondria

Why called "powerhouse of the cell":

Mitochondria are called the powerhouse of the cell because:

- They produce energy in the form of ATP (adenosine triphosphate)
- ATP is the energy currency of the cell
- This energy production occurs through cellular respiration
- Glucose and oxygen are converted into CO₂, water, and energy
- The energy released is stored in ATP molecules
- ATP provides energy for all cellular activities

The more energy a cell needs, the more mitochondria it contains (e.g., muscle cells).

Q25. ANSWER:

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

Solution:

Functions:

Ligaments: Connect bone to bone at joints, providing stability and limiting excessive movement.

Tendons: Connect muscles to bones, transmitting the force generated by muscle contraction to bones, enabling movement.

Difference:

Ligaments	Tendons
Connect bone to bone	Connect muscle to bone
Made of elastic fibers (flexible)	Made of inelastic fibers (non-flexible)
Allow movement at joints	Enable body movement

Q26. ANSWER:

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

Solution:

Given:

Frequency, $f = 256 \text{ Hz}$

Wavelength, $\lambda = 1.3 \text{ m}$

Formula:

Speed of sound (v) = Frequency (f) \times Wavelength (λ)

$$v = f \times \lambda$$

Calculation:

$$v = 256 \times 1.3$$

$$v = 332.8 \text{ m/s}$$

The speed of sound in air is 332.8 m/s (approximately 343 m/s at 20°C).

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SECTION C - ANSWERS (7 \times 3 = 21 Marks)

Q27. ANSWER:

Marking Scheme: 1 mark for each part

Solution:

(a) Uniform Circular Motion:

When a body moves in a circular path with constant speed, its motion is called uniform circular motion. Although speed is constant, velocity keeps changing due to continuous change in direction.

(b) Two examples:

1. Motion of Earth around the Sun
2. Motion of electrons around the nucleus
3. Motion of a stone tied to a string when whirled in a circle
4. Motion of a satellite around Earth
5. Rotation of blades of a fan

(c) Centripetal force for satellite:

The gravitational force of attraction between Earth and the satellite provides the necessary centripetal force for the satellite to revolve around Earth in a circular orbit.



Q28. ANSWER:

Marking Scheme: 1 mark for each part

Solution:

(a) Isotopes:

Isotopes are atoms of the same element having the same atomic number (same number of protons) but different mass numbers (different number of neutrons).

Examples:

1. Carbon-12 (${}_6\text{C}^{12}$) and Carbon-14 (${}_6\text{C}^{14}$)
2. Hydrogen-1 (${}_1\text{H}^1$), Deuterium (${}_1\text{H}^2$), Tritium (${}_1\text{H}^3$)
3. Chlorine-35 (${}_{17}\text{Cl}^{35}$) and Chlorine-37 (${}_{17}\text{Cl}^{37}$)

(b) Uses of isotopes:

1. **Medical field:** Cobalt-60 is used in treatment of cancer, Iodine-131 for thyroid treatment
2. **Agriculture:** Radioactive isotopes used to study nutrient uptake in plants
3. **Carbon dating:** Carbon-14 used to determine age of fossils
4. **Energy production:** Uranium-235 used in nuclear reactors

(c) Same chemical properties:

Isotopes of an element have the same chemical properties because:

- They have the same number of electrons
- Chemical properties depend on electron configuration
- Same number of valence electrons means same reactivity
- Different neutrons don't affect chemical behavior

Q29. ANSWER:

Marking Scheme: 1 mark for each part

Solution:

(a) Convert 5 moles of water to molecules:

$$1 \text{ mole} = 6.022 \times 10^{23} \text{ molecules}$$

$$5 \text{ moles} = 5 \times 6.022 \times 10^{23}$$

$$= \mathbf{3.011 \times 10^{24} \text{ molecules}}$$

(b) Number of moles in 88 g of CO₂:

$$\text{Molecular mass of CO}_2 = 12 + (2 \times 16) = 44 \text{ u}$$

$$\text{Molar mass} = 44 \text{ g/mol}$$

$$\text{Number of moles} = \text{Mass} / \text{Molar mass}$$

$$\text{Number of moles} = 88 / 44$$

$$= \mathbf{2 \text{ moles}}$$

(c) Mass of 0.5 mole of O₂:

$$\text{Molecular mass of O}_2 = 2 \times 16 = 32 \text{ u}$$

Molar mass = 32 g/mol

Mass = Number of moles \times Molar mass

Mass = 0.5×32

= **16 g**

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Q30. OR ANSWER:

Marking Scheme: 1 mark for each calculation

Solution:

(a) Glucose ($C_6H_{12}O_6$):

Molecular mass = $(6 \times 12) + (12 \times 1) + (6 \times 16)$

= $72 + 12 + 96$

= **180 u**

(b) Sulphuric acid (H_2SO_4):

Molecular mass = $(2 \times 1) + (1 \times 32) + (4 \times 16)$

= $2 + 32 + 64$

= **98 u**

(c) Ammonium sulphate [$(NH_4)_2SO_4$]:

Molecular mass = $(2 \times 14) + (8 \times 1) + (1 \times 32) + (4 \times 16)$

= $28 + 8 + 32 + 64$

= **132 u**

Q31. ANSWER:

Marking Scheme: $1\frac{1}{2}$ marks for diagram + $\frac{1}{2}$ mark each for parts b and c

Solution:

(a) Diagram of Prokaryotic Cell:

[Students should draw with labels:]

- Cell wall (protective outer layer)
- Plasma membrane (inside cell wall)
- Cytoplasm (jelly-like substance)
- Nucleoid region (circular DNA without membrane)
- Ribosomes (for protein synthesis)
- Plasmids (small circular DNA)
- Flagellum (for movement)
- Pili (hair-like structures)

(b) Organism with prokaryotic cells:

Bacteria (E. coli, Streptococcus), Blue-green algae (Nostoc, Anabaena), Cyanobacteria

(c) Why called prokaryotic:

These cells are called prokaryotic because they lack a well-defined nucleus. The genetic material (DNA) is not enclosed within a nuclear membrane but lies freely in the cytoplasm in a region called nucleoid. "Pro" means primitive and "karyon" means nucleus.



Q32. OR ANSWER:

Marking Scheme: 1 mark for each part including diagram

Solution:

(a) Plasmolysis:

Plasmolysis is the shrinking of cytoplasm away from the cell wall when a plant cell is placed in a hypertonic solution (solution with higher solute concentration).

[Diagram should show:]

- Normal turgid cell
- Cell in hypertonic solution showing cytoplasm shrunk away from cell wall
- Labels: Cell wall, Plasma membrane, Cytoplasm, Vacuole, Space between membrane

and wall

(b) Solution where plasmolysis occurs:

Plasmolysis occurs when a plant cell is placed in a **hypertonic solution** (concentrated salt or sugar solution where solute concentration is higher outside than inside the cell).

(c) Example from daily life:

When vegetables are placed in salt water for making pickles, they lose water and shrink due to plasmolysis. Salt creates a hypertonic environment, causing water to move out of vegetable cells.



Q33. ANSWER:

Marking Scheme: 1 mark for each part

Solution:

(a) Difference between Aerenchyma and Chlorenchyma:

Aerenchyma	Chlorenchyma
Parenchyma with large air cavities	Parenchyma with chloroplasts
Provides buoyancy	Performs photosynthesis
Found in aquatic plants	Found in leaves and green stems
No chloroplasts	Contains chloroplasts

(b) Functions:

Aerenchyma: Provides buoyancy to aquatic plants helping them float, facilitates gas exchange in waterlogged conditions

Chlorenchyma: Performs photosynthesis by trapping light energy and converting CO₂ and water into glucose and oxygen

(c) Location of chlorenchyma:

Chlorenchyma is mainly found in:

- Mesophyll of leaves (between upper and lower epidermis)
- Green stems
- Any green part of the plant exposed to light



Q34. ANSWER:

Marking Scheme: 1 mark for each part

Solution:

Given:

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

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

Time, $t = 10 \text{ seconds}$

Initial velocity, $u = 0 \text{ (at rest)}$

(a) Acceleration:

$$F = ma$$

$$20 = 5 \times a$$

$$a = 20/5$$

$$a = 4 \text{ m/s}^2$$

(b) Velocity after 10 seconds:

$$v = u + at$$

$$v = 0 + 4 \times 10$$

$$v = 40 \text{ m/s}$$

(c) Distance covered:

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

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

$$s = 2 \times 100$$

$$s = 200 \text{ m}$$

Q35. OR ANSWER:

Marking Scheme: 1 mark for each part

Solution:

(a) Distance-time graph for uniform velocity:

[Students should draw:]

- X-axis: Time (s)
- Y-axis: Distance (m)
- A straight line passing through origin with positive slope
- Label: "Uniform velocity"

For uniform velocity, distance increases uniformly with time, so graph is a straight line.

(b) Information from slope:

The slope of distance-time graph gives the **speed** (or velocity) of the object.

$$\text{Slope} = \text{Distance} / \text{Time} = \text{Speed}$$

Steeper slope means higher speed

(c) Calculate speed:

Given:

$$\text{Distance, } d = 200 \text{ m}$$

$$\text{Time, } t = 40 \text{ seconds}$$

$$\text{Speed} = \text{Distance} / \text{Time}$$

$$\text{Speed} = 200 / 40$$

$$\text{Speed} = 5 \text{ m/s}$$

Q36. ANSWER:

Total Marks: 5

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

(a) Law of Conservation of Energy:

Energy can neither be created nor destroyed; it can only be transformed from one form to another. The total energy of an isolated system remains constant.

In all transformations, the total amount of energy before transformation equals the total amount after transformation.

(b) Relation between KE and Momentum:

We know:

$$\text{Kinetic Energy (KE)} = \frac{1}{2}mv^2 \dots(1)$$

$$\text{Momentum (p)} = mv \dots(2)$$

From equation (2): $v = p/m$

Substituting in equation (1):

$$\text{KE} = \frac{1}{2}m(p/m)^2$$

$$\text{KE} = \frac{1}{2}m \times p^2/m^2$$

$$\text{KE} = \frac{1}{2} \times p^2/m$$

$$\text{KE} = p^2/2m$$

OR

$$p^2 = 2m \times \text{KE}$$

$$p = \sqrt{(2m \times \text{KE})}$$

(c) Calculations:

Given:

Mass, $m = 20 \text{ kg}$

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

(i) Kinetic Energy:

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

$$KE = \frac{1}{2} \times 20 \times (10)^2$$

$$KE = 10 \times 100$$

$$KE = 1000 \text{ J}$$

(ii) Momentum:

$$p = mv$$

$$p = 20 \times 10$$

$$p = 200 \text{ kg m/s}$$

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OR Solution:

Total Marks: 5

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

(a) Work - Definition and Unit:

Work: Work is said to be done when a force acts on a body and the body moves in the direction of the force.

Mathematically: $W = F \times s \times \cos \theta$

Where F = force, s = displacement, θ = angle between force and displacement

SI Unit: Joule (J) or Newton-meter (N m)

$$1 \text{ Joule} = 1 \text{ N} \times 1 \text{ m}$$

Work is done when:

- Force is applied on an object
- Object moves in direction of force
- Both conditions must be satisfied

(b) Work done calculation:

Given:

Force, $F = 100 \text{ N}$

Angle, $\theta = 60^\circ$

Displacement, $s = 5 \text{ m}$

$$W = F \times s \times \cos \theta$$

$$W = 100 \times 5 \times \cos 60^\circ$$

$$W = 500 \times 0.5$$

$$W = 250 \text{ J}$$

(c) Power calculation:

Given:

Mass = 60 kg

Height, $h = 5 \text{ m}$

Time, $t = 10 \text{ seconds}$

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

Work done = mgh

$$W = 60 \times 10 \times 5$$

$$W = 3000 \text{ J}$$

Power = Work / Time

$$P = 3000 / 10$$

$$P = 300 \text{ W}$$

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Q37. ANSWER:

Total Marks: 5

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

(a) Law of Conservation of Mass:

Matter can neither be created nor destroyed in a chemical reaction. The total mass of reactants before reaction is equal to the total mass of products after reaction.

Proposed by: Antoine Lavoisier in 1789

(b) Experimental Verification:**Experiment:**

1. Take silver nitrate solution in a conical flask
2. Take sodium chloride solution in an ignition tube
3. Hang the ignition tube in the flask carefully
4. Close the flask with a cork
5. Weigh the flask with its contents (W_1)
6. Tilt the flask to mix the solutions
7. White precipitate of AgCl forms
8. Weigh again (W_2)

Observation: $W_1 = W_2$

Conclusion: Total mass remains constant, verifying law of conservation of mass.

**(c) Empirical Formula Calculation:**

Given percentages:

H = 4.07%, C = 24.27%, Cl = 71.65%

Element	% Composition	Atomic Mass	Mole Ratio	Simplest Ratio
H	4.07	1	$4.07/1 = 4.07$	$4.07/0.677 \approx 6$
C	24.27	12	$24.27/12 = 2.02$	$2.02/0.677 \approx 3$
Cl	71.65	35.5	$71.65/35.5 = 2.02$	$2.02/0.677 \approx 3$

Dividing by smallest (0.677):

H : C : Cl = 6 : 3 : 3

Empirical Formula: $\text{C}_3\text{H}_6\text{Cl}_3$

OR Solution:

Total Marks: 5

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

(a) Chemical Formula:

A chemical formula represents the chemical composition of a substance using symbols and numerical subscripts.

Rules for writing chemical formulas:

1. Write symbols of elements present
2. Write valencies below the symbols
3. Cross-multiply valencies
4. Write the numbers as subscripts
5. Simplify if possible

Example: Aluminium oxide

- Al has valency 3, O has valency 2
- Cross multiply: Al_2O_3

(b) Chemical Formulas:

(i) Calcium carbonate:

- Ca has valency 2, CO_3 has valency 2
- Formula: CaCO_3

(ii) Magnesium hydroxide:

- Mg has valency 2, OH has valency 1
- Formula: Mg(OH)_2

(iii) Aluminium oxide:

- Al has valency 3, O has valency 2
- Formula: Al_2O_3

(c) Formula unit mass of CaCO_3 :

$$\text{CaCO}_3 = 1 \text{ Ca} + 1 \text{ C} + 3 \text{ O}$$

$$= 40 + 12 + (3 \times 16)$$

$$= 40 + 12 + 48$$

$$= 100 \text{ u}$$

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Q38. ANSWER:

Total Marks: 5

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

(a) Diagram of Plant Cell:

[Students should draw neat labeled diagram showing all five organelles clearly with proper labels]

(b) Functions:

1. Nucleus: Controls all cell activities, contains genetic material (DNA), responsible for heredity and cell division

2. Mitochondria: Produces energy (ATP) through cellular respiration, called powerhouse of cell

3. Chloroplast: Site of photosynthesis, converts light energy into chemical energy (glucose), contains chlorophyll

4. Cell Wall: Provides shape, rigidity, and mechanical support to plant cell, protects from mechanical damage

5. Vacuole: Stores water, minerals, waste products; maintains turgor pressure; provides mechanical support

(c) Why plant cells have cell wall:

Plant cells have cell wall because:

- Plants are stationary and need structural support
- Cell wall provides mechanical strength and rigidity
- Protects cell from osmotic bursting
- Maintains cell shape

Animal cells don't have cell wall because they have skeletal system for support and can move.

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OR Solution:

Total Marks: 5

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

(a) Complex Permanent Tissues:

Complex permanent tissues are made up of more than one type of cells working together as a unit to perform a specific function.

Two types:

1. Xylem
2. Phloem

(b) Diagrams:

[Students should draw labeled diagrams showing:]

XYLEM structure showing:

- Tracheids (dead cells with pointed ends)
- Vessels (dead cells with open ends)
- Xylem parenchyma (living cells)
- Xylem fibers (dead cells)

PHLOEM structure showing:

- Sieve tubes (living cells without nucleus)
- Companion cells (living cells with nucleus)
- Phloem parenchyma (living cells)
- Phloem fibers

(c) Two Differences:

Xylem	Phloem
Transports water and minerals	Transports food (sugars)
Unidirectional (upward only)	Bidirectional (up and down)
Mostly dead cells	Living cells
Thick lignified walls	Thin walls

(d) Living and Dead components:

Dead: Tracheids, Vessels, Xylem fibers

Living: Xylem parenchyma

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

Q39. CASE STUDY 1 - ANSWERS:

Total Marks: 4

(i) Calculate work done [1 mark]

Solution:

Given: $F = 200 \text{ N}$, $s = 3 \text{ m}$

Work = Force × Displacement

$$W = 200 \times 3$$

$$W = 600 \text{ J}$$

(ii) Why no work against wall? [1 mark]

Solution:

Ravi does no work when pushing against a wall because there is no displacement (movement). Work requires both force and displacement. Since the wall doesn't move (displacement = 0), $\text{Work} = F \times 0 = 0 \text{ J}$.

OR: What happens to KE when box stops? [1 mark]

Solution:

When the box stops, its kinetic energy is converted into:

- Heat energy (due to friction with floor)
- Sound energy (noise while moving)

Energy is not destroyed, only transformed into other forms.

(iii) Porter calculations [2 marks]

Marking Scheme: 1 mark for each part

Solution:

Given:

Mass, $m = 20 \text{ kg}$

Height, $h = 2 \text{ m}$

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

(a) Work done:

$$W = F \times s = mgh$$

$$W = 20 \times 10 \times 2$$

$$\mathbf{W = 400 \text{ J}}$$

(b) Potential energy gained:

$$PE = mgh$$

$$PE = 20 \times 10 \times 2$$

$$\mathbf{PE = 400 \text{ J}}$$

Note: Work done = PE gained (both are 400 J)

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Q40. CASE STUDY 2 - ANSWERS:

Total Marks: 4

(i) Define molar mass [1 mark]

Solution:

Molar mass is the mass of one mole of a substance expressed in grams per mole (g/mol). It is numerically equal to the atomic or molecular mass expressed in unified atomic mass units (u).

(ii) Molecules in 2 moles of water [1 mark]

Solution:

$$1 \text{ mole} = 6.022 \times 10^{23} \text{ molecules}$$

$$2 \text{ moles} = 2 \times 6.022 \times 10^{23}$$

$$= \mathbf{1.2044 \times 10^{24} \text{ molecules}}$$

OR: Number of moles in 64 g O₂ [1 mark]

Solution:

$$\text{Number of moles} = \text{Mass} / \text{Molar mass}$$

$$\text{Number of moles} = 64 / 32$$

$$= \mathbf{2 \text{ moles}}$$

(iii) Ammonia calculations [2 marks]

Marking Scheme: 1 mark for each part

Solution:

Given:

$$\text{Number of molecules} = 3.011 \times 10^{23}$$

$$\text{Avogadro's number} = 6.022 \times 10^{23}$$

$$\text{Molar mass of NH}_3 = 17 \text{ g/mol}$$

(a) Number of moles:

$$\text{Number of moles} = \text{Number of molecules} / \text{Avogadro's number}$$

$$= (3.011 \times 10^{23}) / (6.022 \times 10^{23})$$

$$= \mathbf{0.5 \text{ moles}}$$

(b) Mass of ammonia:

$$\text{Mass} = \text{Number of moles} \times \text{Molar mass}$$

$$\begin{aligned}\text{Mass} &= 0.5 \times 17 \\ &= \mathbf{8.5 \text{ g}}\end{aligned}$$

Q41. CASE STUDY 3 - ANSWERS:

Total Marks: 4

(i) Tissue that transports O₂ and nutrients [1 mark]

Solution:

Blood (a fluid connective tissue) transports oxygen and nutrients throughout the body.

(ii) Muscle in heart [1 mark]

Solution:

Cardiac muscle tissue is found in the heart. It is involuntary and shows rhythmic contraction and relaxation throughout life.

OR: Function of epithelial tissue [1 mark]

Solution:

Epithelial tissue functions include:

- Protection of underlying tissues
- Absorption of substances (in intestine)
- Secretion of substances (in glands)
- Sensation (in sensory organs)

(iii) Nervous tissue structure and function [2 marks]

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

Solution:

Structure of Nervous Tissue:

- Composed of neurons (nerve cells) and neuroglia (supporting cells)
- Neurons have three parts:
 1. Cell body (cyton) - contains nucleus

2. Dendrites - receive signals
 3. Axon - transmits signals
- Long axons covered with myelin sheath
 - Axon terminals have synaptic knobs

Function:

- Receives stimuli from environment
- Transmits electrical impulses rapidly
- Coordinates and controls body activities
- Processes information in brain

[Diagram should show labeled neuron with cell body, nucleus, dendrites, axon, myelin sheath, and axon terminals]

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 **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

This comprehensive sample paper focuses on high-priority numerical problems, mole concept, work-energy, and tissue functions for CBSE Class 9 Science 2025-26.

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