



INDIAN SCHOOL AL WADI AL KABIR



Class: IX	DEPARTMENT OF SCIENCE -2026-27 SUBJECT: BIOLOGY	DATE 02/05/2026
WORKSHEET NO:1 WITH ANSWERS	TOPIC: CELL: THE BUILDING BLOCK OF LIFE -PART 1	A4 FILE FORMAT
CLASS & SEC:	NAME OF THE STUDENT:	ROLL NO.

I. OBJECTIVE TYPE QUESTIONS (1 MARK):

1. A group of scientists is studying early Earth environments near hot springs. They observe calcium carbonate deposits forming around these springs and hypothesize that such environments may have played a role in the origin of life.

Based on this observation, which of the following best explains the possible significance of these deposits?

- A) They supplied essential nutrients directly to the earliest cells
- B) They formed protective structures that could enclose organic molecules and support the development of early cell membranes
- C) They released oxygen into the atmosphere, enabling aerobic respiration
- D) They led to the extinction of heat-loving organisms (thermophiles)

2. A student places a cell in a solution containing water, oxygen, and large starch molecules. After some time, the student observes that water and oxygen have entered the cell, but starch molecules have not. What does this observation indicate about the nature of the plasma membrane?

- A) It allows all substances to pass through freely
- B) It blocks all substances completely
- C) It allows some substances to pass while blocking others
- D) It only allows gases to pass through

3. If the eyepiece of a microscope has a magnification of 10X and the objective lens has a magnification of 40X, what is the total magnification?

- A) 40X
- B) 50X
- C) 400X
- D) 4000X

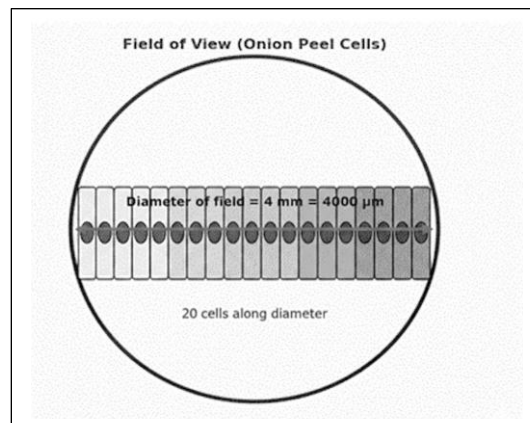
4. A botanist explains that trees remain upright even during strong winds due to a structural feature in plant cells. However, animal cells do not have this feature because animals need flexibility for movement. Which statement best explains this difference?

- A) Plant cells lack movement, so they need a rigid outer layer for support
- B) Animal cells require rigidity for protection against wind
- C) Plant cells are always smaller than animal cells
- D) Both plant and animal cells have identical outer coverings

5. A student tries to observe two very close dots on a paper held at a distance of 25 cm from the eye. The dots appear as a single point when the distance between them is very small, but become distinguishable when the separation increases. What is the minimum distance between the two dots at which the student can see them as separate?

- A) 0.1 mm
- B) 1 mm
- C) 10 mm
- D) 100 mm

6. In an experiment to measure cell size, the diameter of the field of view is 4 mm (4000 μm) and 20 onion peel cells are counted along the diameter. What is the estimated size of one cell?



- A) 20 μm
- B) 200 μm
- C) 2000 μm
- D) 20 mm

7. Observe the figures given below and choose the correct sequence:

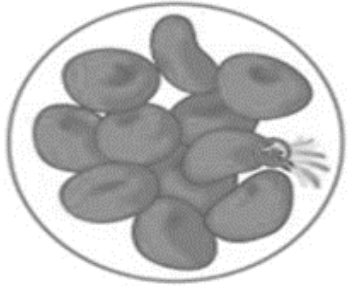


Fig i

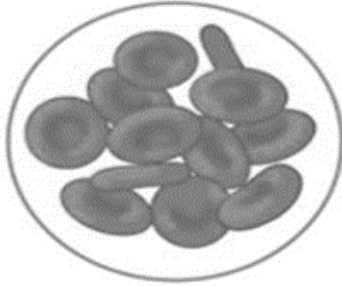


Fig ii

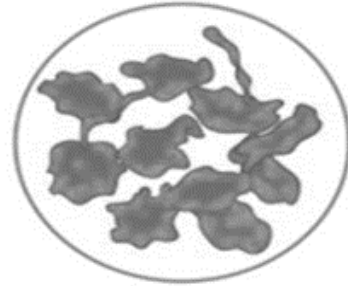


Fig iii

- A) Fig i. Hypotonic solution, Fig ii. Hypertonic solution, Fig iii. Isotonic solution
- B) Fig i. Hypertonic solution, Fig ii. Isotonic solution, Fig iii. Hypotonic solution
- C) Fig i. Hypertonic solution, Fig ii. Hypotonic solution, Fig iii. Isotonic solution
- D) Fig i. Hypotonic solution, Fig ii. Isotonic solution, Fig iii. Hypertonic solution

For the questions 8 to 11, two statements are given-one labelled Assertion (A) and the other labelled Reason(R). Select the correct answer to these questions from the options (A), (B), (C) and (D) as given below:

- A) Both A and R are true and R is the correct explanation of the assertion.
- B) Both A and R are true but R is not the correct explanation of the assertion.
- C) A is true but R is false.
- D) A is false but R is true.

8. **Assertion (A):** A potato piece kept in plain water swells.

Reason (R): Water enters the potato cells by osmosis through the selectively permeable cell membrane.

9. **Assertion (A):** Electron microscopes reveal finer details of cell structure than light microscopes.

Reason (R): Electron microscopes use visible light to produce highly magnified images.

10. **Assertion (A):** Animal cells have a rigid cell wall to maintain their shape.

Reason (R): Animal cells shrink in concentrated sugar solution because they lack a cell wall.

11. **Assertion (A):** Bacteria are classified as unicellular organisms.

Reason (R): Each bacterium is made up of a single cell.

II. VERY SHORT QUESTIONS (2 MARKS):

12. Who proposed the cell theory? What are its main postulates?
13. Hot springs such as those in the Puga Valley provide extreme environmental conditions similar to early Earth.
- a) Name the type of organisms found in these hot springs.
 - b) Explain why hot spring environments are considered suitable for studying the origin of life on Earth.
14. Distinguish between Diffusion and osmosis.
15. Describe the structure of the cell membrane according to the 'fluid-mosaic model'.
16. Two beakers, A and B, contain plain water and a concentrated sugar solution respectively. Equal pieces of carrot are placed in both beakers for a few hours and then removed. Explain the changes observed in their size or appearance after being kept in the two different solutions.

III. SHORT ANSWER QUESTIONS (3 MARKS):

17. Define and differentiate between hypotonic, isotonic, and hypertonic solutions.
18. Perform the following osmosis experiment and answer the related questions:

Take four peeled potato halves and scoop each one out to make potato cups. One of these potato cups should be made from a boiled potato. Put each potato cup in a trough containing water.”

Then, follow these steps:

Cup A: Leave empty.

Cup B: Add 1 tsp sugar.

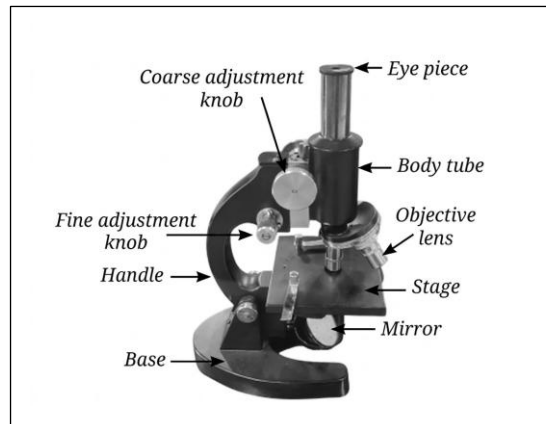
Cup C: Add 1 tsp salt.

Cup D: Add 1 tsp sugar to a boiled potato.

- a) Why does water collect in the hollowed portions of cups B and C?
- b) Why is potato A included in the experiment?

c) Why does water not collect in the hollowed-out portions of A and D?

19. A labelled diagram of a light microscope is given. Briefly describe each part shown in the diagram.



20. Describe how oxygen (O_2) and carbon dioxide (CO_2) diffuse through the cell membrane.

IV. LONG ANSWER TYPE QUESTIONS (5 MARKS):

21. Explain how the size of an onion peel cell can be estimated using a microscope.

22. A student prepares slides of onion peel cells and cheek cells and observes them under a microscope. Later, both slides are placed in a 20% sugar solution and observed again after some time. Answer the following:

- How do onion peel cells appear under the microscope?
- How do cheek cells appear under the microscope?
- What change is observed in plant cells after placing them in a sugar solution?
- What change is observed in cheek cells after placing them in a sugar solution?
- What causes the difference in their response?

23. State the structure and functions of the cell wall in plant cells.

V. SOURCE BASED/CASE BASED QUESTION (4 MARKS):

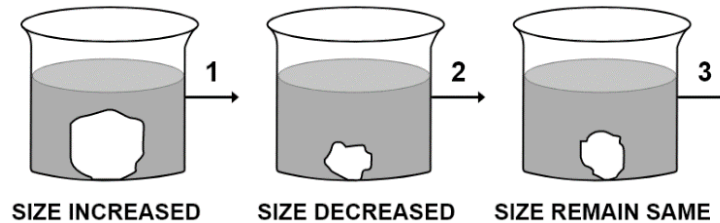
24. A candidate conducted an experiment to study osmosis by placing three potato cubes in three separate beakers containing different solutions. After 24 hours, the observations were as follows:

In Beaker 1, the potato cube increased in size.

In Beaker 2, the potato cube decreased in size.

In Beaker 3, the size of the potato cube remained unchanged.

The diagram provided represents the results of this experiment.



- Identify the technical terms for the types of solutions in Beakers 1, 2, and 3. Why does the potato cube in Beaker 3 remain unchanged in size?
- What are the specific features of the cell sap in root hairs that help in water absorption?
- Define osmosis and explain its significance in plant cells.
- How does the permeability of the cell membrane differ from that of the cell wall?

ANSWERS

I.	OBJECTIVE TYPE QUESTIONS (1 MARK):
1.	B) They formed protective structures that could enclose organic molecules and support the development of early cell membranes
2.	C) It allows some substances to pass while blocking others
3.	C) 400X
4.	A) Plant cells lack movement, so they need a rigid outer layer for support
5.	A) 0.1 mm
6.	B) 200 μm
7.	D) Fig i. Hypotonic solution, Fig ii. Isotonic solution, Fig iii. Hypertonic solution
II.	ASSERTION AND REASONING:
8.	A) Both A and R are true, and R is the correct explanation of A.
9.	C) Assertion is true, but Reason is false.

10.	D) Assertion is false, but Reason is true.		
11.	A) Both A and R are true, and R is the correct explanation of A.		
III.	VERY SHORT QUESTIONS (2 MARKS)		
12.	Matthias Schleiden, Theodor Schwann and Rudolf Virchow. Postulates of Cell theory are: <ul style="list-style-type: none"> • All living organisms are made up of one or more cells. • The cell is the basic unit of structure and function in living beings. • All cells arise from pre-existing cells. 		
13.	a) Thermophiles (heat-loving unicellular bacteria) b) Hot spring environments are considered suitable for studying the origin of life on Earth because they have very high temperatures and environmental conditions similar to those on the early Earth about 3.5 billion years ago.		
14.	Diffusion is the movement of particles from a higher concentration to a lower concentration without a membrane. Osmosis is the movement of water from a dilute solution (more water, less solute) to a concentrated solution (less water, more solute) through a selectively permeable membrane.		
15.	<ul style="list-style-type: none"> • The cell membrane has a lipid bilayer made of two layers of fat molecules with water-attracting heads facing outwards and water-repelling tails facing inwards, and proteins are embedded in it. • The molecules can move sideways, flip and rotate within the membrane, making it fluid. • Proteins in the membrane act like gatekeepers in helping substances pass through. • Since the molecules are arranged like tiles in a mosaic, it is called the fluid-mosaic model. 		
16.	In Beaker A (plain water), the carrot pieces swell because water enters the cells from the dilute solution through osmosis. In Beaker B (concentrated sugar solution), the carrot pieces shrink because water moves out of the cells into the concentrated solution through osmosis.		
IV	SHORT ANSWER QUESTIONS (3 MARKS):		
17.	Hypotonic solution If the medium surrounding the cell has a higher water concentration than the cell, meaning that the outside solution is very dilute, the cell will gain water by osmosis. Such a solution is known as a hypotonic solution.	Isotonic solution If the medium has exactly the same water concentration as the cell, there will be no net movement of water across the cell membrane. Such a solution is known as an isotonic solution.	Hypertonic solution If the medium has a lower concentration of water than the cell, meaning that it is a very concentrated solution, the cell will lose water by osmosis. Such a solution is known as a hypertonic solution.

18.	<p>(i) Water gathers in the hollowed portions of set-up B and C because water enters the potato as a result of osmosis. Since the medium surrounding the cell has a higher water concentration than the cell, the water moves inside by osmosis. Hence, water gathers in the hollowed portions of the potato cup.</p> <p>(ii) Potato A in the experiment acts as a control set-up.</p> <p>(iii) Water does not gather in the hollowed portions of potato A because potato cup A is empty.</p> <p>(iv) Water is not able to enter potato D because the potato used here is boiled. Boiling denatures the proteins present in the cell membrane and thus, disrupts the cell membrane. For osmosis, a semi-permeable membrane is required, which is disrupted in this case. Therefore, osmosis will not occur. Hence, water does not enter the boiled potato cup.</p>
19.	<p>Key Parts of a Light Microscope: Eyepiece: The lens you look through. Body Tube: Connects the eyepiece to the objective lenses. Objective Lens: Lenses of varying powers that magnify the specimen. Stage: The flat platform where the slide is placed. Mirror: Reflects light upward through the specimen. Adjustment Knobs: Used to focus the image (Coarse and Fine adjustment).</p>
20.	<p>a) CO₂ is a cellular waste which accumulates in high concentrations inside the cell and needs to be excreted out. In the cell's external environment, the concentration of CO₂ is low as compared to inside of the cell. CO₂ tends to move out by the process of diffusion. Similarly, O₂ enters the cell by the process of diffusion when the level or concentration of O₂ inside the cell decreases with respect to the outside. Thus, diffusion plays an important role in gaseous exchange between the cells as well as the cell and its external environment.</p>
V.	<p>LONG ANSWER TYPE QUESTIONS (5 MARKS):</p>
21.	<ul style="list-style-type: none"> • A transparent ruler with millimetre markings is placed on the microscope stage, and the diameter of the circular field of view is observed through the eyepiece and measured in mm. • The diameter is converted from millimetre (mm) to micrometre (µm). • The ruler is removed and an onion peel slide is placed on the stage of the microscope. • The number of cells along the diameter of the field of view in one straight line is counted. • The size of one cell is estimated using the formula: Diameter of field of view (in µm) ÷ Number of cells along the diameter.
22.	<p>a) Onion peel cells are box-shaped and regularly arranged. b) Cheek cells are irregularly arranged. c) Plant cells lose water by osmosis; their inner content shrinks, but the cell wall maintains their shape. d) Cheek cells shrink considerably in the sugar solution. e) The difference is because plant cells have a rigid cell wall, whereas animal cells do not have a cell wall.</p>
23.	<ul style="list-style-type: none"> • The cell wall is an additional rigid covering present outside the cell membrane in plant cells. • It is permeable, allowing water and some dissolved minerals to pass through it.

	<ul style="list-style-type: none"> • It helps plant cells remain firm and maintain their shape even when they lose water. • It provides structural support, helping plants stay upright and withstand environmental stresses like wind and rain.
VI	SOURCE BASED/CASE BASED QUESTION (4 MARKS):
24.	<p>a) Beaker 1: Hypotonic solution (the solution has a lower solute concentration than the potato cells → water enters → cube swells)</p> <p>Beaker 2: Hypertonic solution (the solution has a higher solute concentration than the potato cells → water leaves → cube shrinks)</p> <p>Beaker 3: Isotonic solution (the solution has the same solute concentration as the potato cells → no net movement of water → cube remains the same size)</p> <p>Reason: In Beaker 3, since the solution is isotonic, there is no net gain or loss of water, so the potato cube remains unchanged.</p> <p>b) The cell sap of root hair has a higher concentration of salts as compared to the outside soil water.</p> <p>c) Osmosis is the movement of water through a selectively permeable membrane from a dilute solution (more water, less solute) to a concentrated solution (less water, more solute). It is important in plant cells because it helps in the absorption of water from the soil into root cells.</p> <p>d) The cell membrane is selectively permeable, allowing only some substances to pass through it. The cell wall is permeable, allowing water and some dissolved minerals to pass through it.</p>

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