Revise, Reflect, Refine

1. Differentiate between the following pairs based on the clues in parentheses:

(i) Cell membrane and cell wall (permeability)
(ii) RER and SER (structure)
(iii) Chloroplasts and chromoplasts (pigments)

Answer:

(i) Cell membrane vs. Cell wall - permeability

Cell membrane	Cell wall (Permeability)
It is selectively permeable - allows only certain substances to pass through.	It is fully permeable allows water and most dissolved minerals to freely pass through.
Controls what enters and exits the cell.	Does not control the movement of substances; acts as a structural support only.

(ii) RER vs. SER – Structure

RER	SER (Structure)
Has ribosomes attached on its surface, giving it a rough appearance under electron microscope.	Mainly involved in protein synthesis and secretion.
No ribosomes on its surface, SO it looks smooth under electron microscope..	Involved in synthesis and storage of fats and hormones.

(iii) Chloroplasts vs. Chromoplasts – Pigments

Chloroplasts	Chromoplasts (Pigments)
Contain the green pigment chlorophyll.	Found in leaves and green parts; responsible for photosynthesis.
Contain pigments other than chlorophyll yellow, orange, or red pigments.	Found in flowers and fruits; responsible for bright attractive colours to attract pollinators.

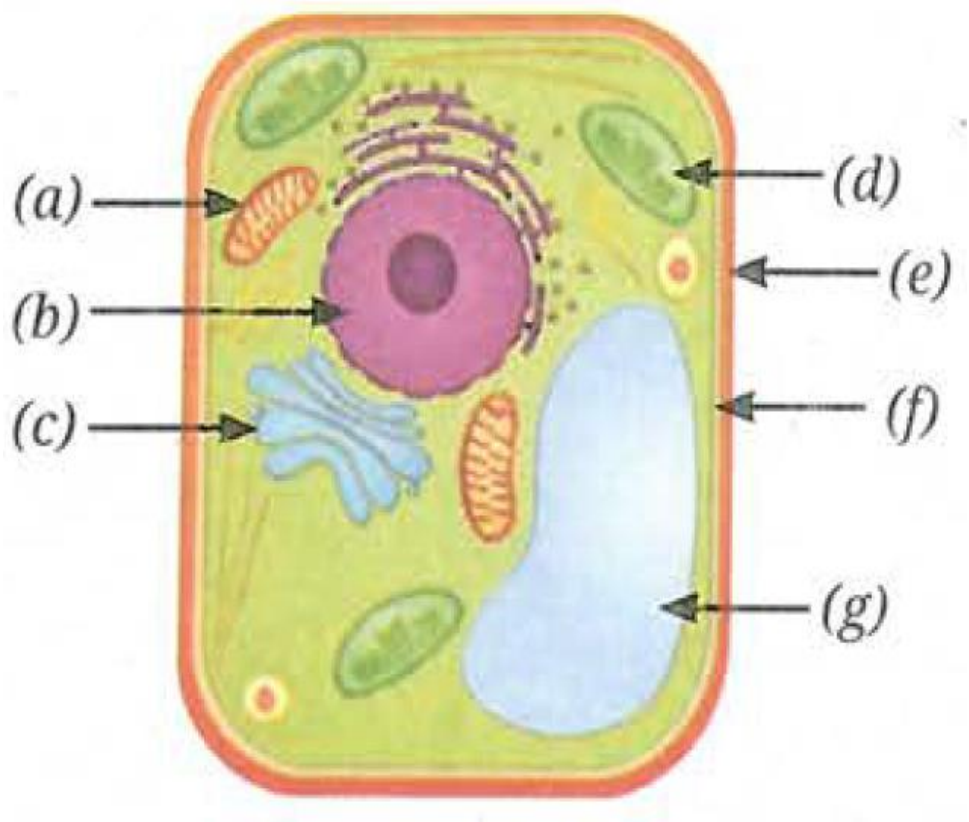
2. Two similar animal ells are placed in two different solutions:

• Cell X is paced in pure water
• Cell Y is placed in a concentrated salt solution.
Cells are observed after some time. Cell X swells and Cell Y shrinks Which statement provides the correct explanation for the above observation?
(i) Salt molecules moved into Cell Y, causing it to shrink.
(ii) Water moved into Cell X and more water moved out of Cell Y than the salt solution entered in it.
(iii) Water moved into Cell C and moved out of Cell Y through the cell membrane.
(iv) Solute movement caused osmosis in both cells.

Answer:
(iii) Water moved into Cell X and moved out of Cell Y through the cell membrane.
Explanation: The cell membrane is selectively permeable. It allows water to pass through by the process of osmosis. Water always moves from a region of higher water concentration (lower solute) to lower water concentration (higher solute).
• **Cell X in pure water**: Pure water has a higher water concentration than inside the cell. So water moves into Cell X → cell swells.
• **Cell Y in concentrated salt solution**: The salt solution has

less water than inside the cell. So water moves out of Cell Y → cell shrinks.

3. Look at the diagram of cell in Fig. 2.20 Identify the parts labelled from (a) to (g) and correctly match them with their functions given below:



(i) Controlling all the activities of a cell.
(ii) Site of cellular respiration.
(iii) Storage organelle that also provides rigidity to the cell.
(iv) Separates the cell contents from surroundings.
(v) Provides structural rigidity to the cell.
(vi) Packs and stores materials received from ER.
(vii) Helps in manufacturing food.

Answer:

Function	Label	Part
(i) Controlling all the activities of a cell	(b)	Nucleus
(ii) Site of cellular respiration	(a)	Mitochondria
(iii) Storage organelle that also provides rigidity to the cell.	(g)	Vacuole
(iv) Separates the cell contents from surroundings.	(f)	Cell membrane
(v) Provides structural rigidity to the cell.	(e)	Cell wall
(vi) Packs and stores materials received from ER.	(c)	Golgi apparatus
(vii) Helps in manufacturing food.	(d)	Chloroplast

4. Which of the following option(s) of the pairs of cell organelles are correctly placed under the given categories?

Option	Present in the plant cells	Abset in the animal cell
(i)	Leucoplast	Cell wall
(ii)	Mitochondria	Ribosome
(iii)	Cell wall	Golgi apparatus
(iv)	Lysosome	Endoplasmic reticulum

Answer:

Option	Present in the plant cells	Abset in the animal cell	Correct
(i)	Leucoplast	Cell wall	Correct
(ii)	Mitochondria	Ribosome	Wrong – Ribosome is present in animal cells too
(iii)	Cell wall	Golgi apparatus	Wrong - Golgi apparatus is present in animal cells
(iv)	Lysosome	Endoplasmic reticulum	Wrong - ER is present in animal cells too

5. Two students, Renu and Rohit, were having a discussion on the plastids. Renu emphasised that all parts of the plants, even roots, contain plastids.

However, Rohit did not agree with the statement and told her that plastids are absent in plant roots since the roots are underground and do not need to perform photosynthesis. Who is correct? Justify your answer.

Answer:
Rohit is partially correct, but Renu is more accurate overall.

Justification:

- Plastids are of three types: Chloroplasts (green, for photosynthesis), Chromoplasts (coloured, in flowers/fruits), and Leucoplasts (colourless, for storage).
- Roots do NOT contain chloroplasts (they cannot do photosynthesis as they are underground and have no access to light). In this sense, Rohit is right.
- However, roots do contain leucoplasts — colourless plastids that store starch, oils or proteins. For example, potato and taro roots store starch in leucoplasts.
- Therefore, Renu is correct in saying all plant parts contain plastids – roots contain leucoplasts, even though they lack chloroplasts.

6. Mitochondria and chloroplasts are two important organelles in a plant cell. Discuss how these two organelles are structurally and functionally similar to each other, and different from each other.

Answer:

Feature	Mitochondria	Chloroplasts
Number of membranes	Double membrane (inner outer)	Double membrane(inner + outer)
Own DNA & Ribosomes	Yes-has its own DNA and ribosomes	Yes-has its own DNA and ribosomes
Inner membrane	Folded into finger-like projections alled cristae	Folded into finger-like projections alled cristae
Semi-fluid interior	site of chemical reactions	site of chemical reactions
Main function	Cellular respiration produces ATP (energy) by breaking down glucose	Photosynthesis - produces food (glucose) using sunlight
Found in	All eukaryotic cells (plant and animal)	Only in plant cells (and algae)
Pigment	None	Contains chlorophyll

7. Which of the following pairs of cell organelles contains DNA?

(i) Chloroplasts, Ribosomes
(ii) Mitochondria, Nucleus
(iii) Golgi bodies, Ribosomes
(iv) Nucleus, Lysosomes

Answer:
(ii) Mitochondria and Nucleus
Explanation:
• *Nucleus* — Contains chromosomes made of DNA. It is the main store of genetic information in a eukaryotic cell.
• *Mitochondria* — Has its own circular DNA (similar to bacteria). This is why mitochondria can make some of their own proteins.
• *Chloroplasts* also have DNA, but that option is not given here with the correct pair. Ribosomes, Golgi bodies and Lysosomes do NOT contain DNA.

8. A researcher carried out an experiment in which she took two carrots of similar size. She placed one carrot in plain water and the other carrot in concentrated salt solution (Fig. 2.21). After 24 hours she recorded her observations.

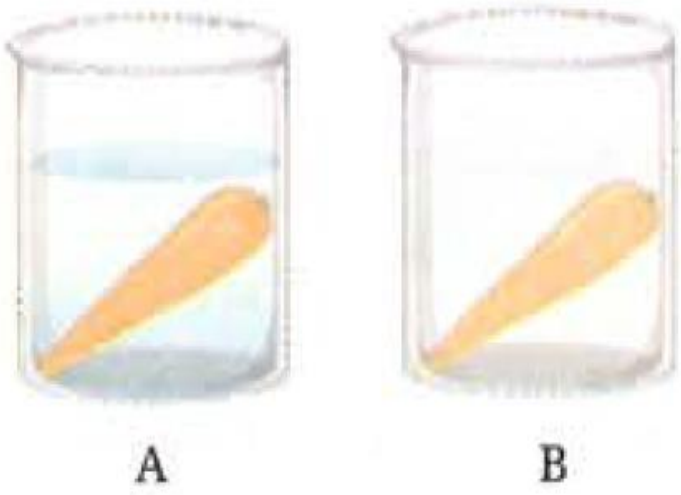


Fig. 2.21: Experimental set-up having carrot
(a) in plain water; and
(b) in salt solution

(i) What hypothesis does she want to test through this experiment?

Answer:
Hypothesis: The researcher wants to test: "The cell membrane is selectively permeable and water moves across it by osmosis — from a dilute solution to a concentrated solution." Specifically, she is testing how different concentrations of external solutions affect the firmness of plant tissue through osmosis.

(ii) What would you suggest for the improvement of this experiment?

Answer:
Improvements

• Use equal-sized carrot pieces and measure initial and final weight/length for quantitative comparison.
• Add a third carrot piece in an isotonic solution (same concentration as inside the cell) as a control — it should show no change.
• Record observations at multiple time intervals (e.g., every 30 minutes) to track the rate of change.
• Maintain constant temperature throughout the experiment to avoid interference.

(iii) Why does the carrot in plain water stay stiff and crunchy, but the carrot in concentrated salt solution become rubbery and limp?

Answer:

Carrot in plain water (**Beaker A**): Plain water is a hypotonic solution (lower solute concentration than inside carrot cells). Water moves into the carrot cells by osmosis. The cells become turgid (swollen with water), pressing against the rigid cell wall. This pressure (turgor pressure) keeps the carrot stiff and crunchy.

Carrot in concentrated salt solution (**Beaker B**): The salt solution is a hypertonic solution (higher solute concentration than inside carrot cells). Water moves out of the carrot cells by osmosis (plasmolysis). The cells lose water and become flaccid (limp).

The inner content shrinks away from the cell wall, making the carrot rubbery and soft.

9. Indicate the presence or absence of following structures in bacterial and animal cells:

Structures in a cell	Bacterial cell	Animal cell
Chromosome		
Nucleus		
Mitochondria		
Golgi complex		
Chromoplasts		

Answer:

Structures in a cell	Bacterial cell	Animal cell
Chromosome	Present (single, circular-called nucleoid, without membrane)	Present (multiple, linear enclosed in nucleus)
Nucleus	Absent (has nucleoid instead)	Present (well-defined, membrane-bound)
Mitochondria	Absent	Present
Golgi complex	Absent	Present
Chromoplasts	Absent	Present

10. Carry out the following experiment:

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. Place each of the potato cups in a beaker

containing water (Fig. 2.22).

Now, set up the experiment as follows:

(a) Keep Cup A empty.

(b) Add one teaspoon sugar in Cup B.

(c) Add one teaspoon salt in Cup C.

(d) Add one teaspoon sugar in the boiled potato in Cup D.

Observe the four potato cups at least two hours and answer the following questions:

(i) Explain why water gathers in the hollowed portion of Cup B and Cup C.

(ii) Why is Cup A necessary for this experiment?

(iii) Explain why water does not gather in the hollowed portions of Cups A and D.

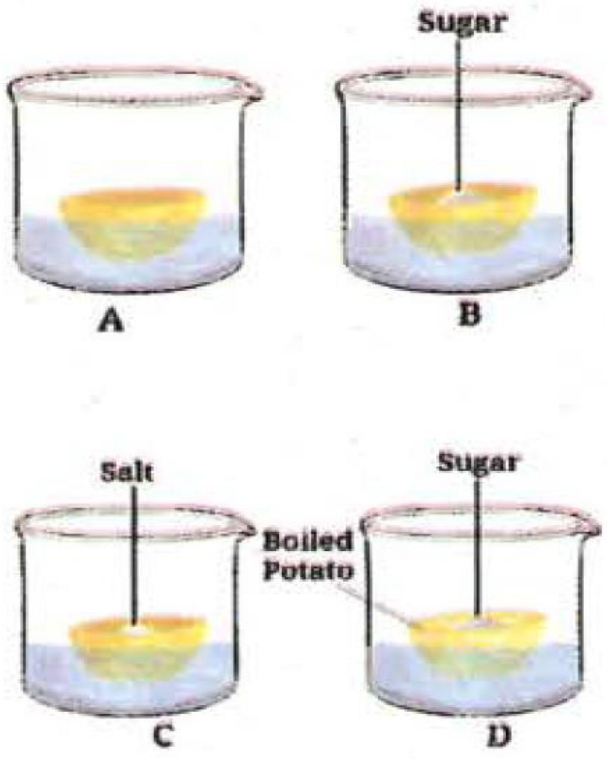


Fig. 2.22: Experimental set-up

Answer:

(i) Cups B and C contain sugar and salt respectively inside the hollowed potato. These create a hypertonic solution (high solute concentration) inside the cup. The surrounding water in the beaker is hypotonic (low solute concentration). Therefore, water moves into the potato cups by osmosis — from the region of high water concentration (outside) to low water concentration (inside the cup). This water accumulates visibly inside the cup.

(ii) Cup A is the control of the experiment. It has nothing added inside — just an empty potato cup. This helps us compare and confirm that any water collection in other cups is due to the solutes (sugar/salt) added and NOT due to any natural property of the potato itself.

(iii) • **Cup A (empty)**: No solute is added. The concentration inside and outside is equal or the inside is not concentrated enough to draw significant water. There is no concentration gradient to drive osmosis. So no water collects.

• **Cup D (boiled potato with sugar)**: The potato is boiled, which kills the cells and destroys the cell membranes. Dead cells cannot carry out osmosis because osmosis requires a living, selectively permeable membrane. Even though sugar is present, water cannot be drawn in through osmosis. Hence, no water collects.

11. Identify the pair that incorrectly matches the cell organelle with its function.

(i) Ribosome – Protein synthesis
(ii) SER – Lipid and cellulose synthesis
(iii) Lysosome – Digestion of foreign agents

Answer:
(ii) SER – Lipid and cellulose synthesis
Explanation:

- Correct Ribosome → Protein synthesis. Ribosomes are indeed the sites of protein synthesis.
- Incorrect SER → Lipid and cellulose synthesis. SER (Smooth Endoplasmic Reticulum) is involved in synthesis and storage of lipids and hormones, NOT cellulose. Cellulose is a component of the cell wall and is synthesised by the Golgi apparatus.
- Correct Lysosome → Digestion of foreign agents. Lysosomes contain digestive enzymes and break down foreign particles, worn-out organelles, etc.

12. What outcome do you expect if all the mitochondria are removed from a eukaryotic cell?

Answer:
If all mitochondria are removed from a eukaryotic cell, the following outcomes would occur:

• No ATP production: Mitochondria are the "powerhouses" of the cell — they carry out cellular respiration and produce ATP (Adenosine Triphosphate), which is the energy currency of the cell.
• Cell activities stop: All energy-dependent activities — active transport across membranes, muscle contraction, protein synthesis, cell division — would stop because there is no energy ATP available
• Cell death: Without energy, the cell cannot maintain its structure, repair itself or carry out metabolism. The cell would quickly die.
• Only anaerobic respiration (in the cytoplasm) could still produce small amounts of energy temporarily, but this is highly inefficient and not enough to sustain cellular life for long.

13. Which phenomenon inhibits the formation of tumors in the human body? Can plants also develop tumors? Explain.

Answer:
The phenomenon is called contact inhibition. In many animal cells, cell division usually stops when cells come in contact with neighbouring cells. This prevents uncontrolled growth and thus inhibits the formation of tumors. However, cancer cells lose this control and keep dividing uncontrollably, which leads to the formation of tumors.

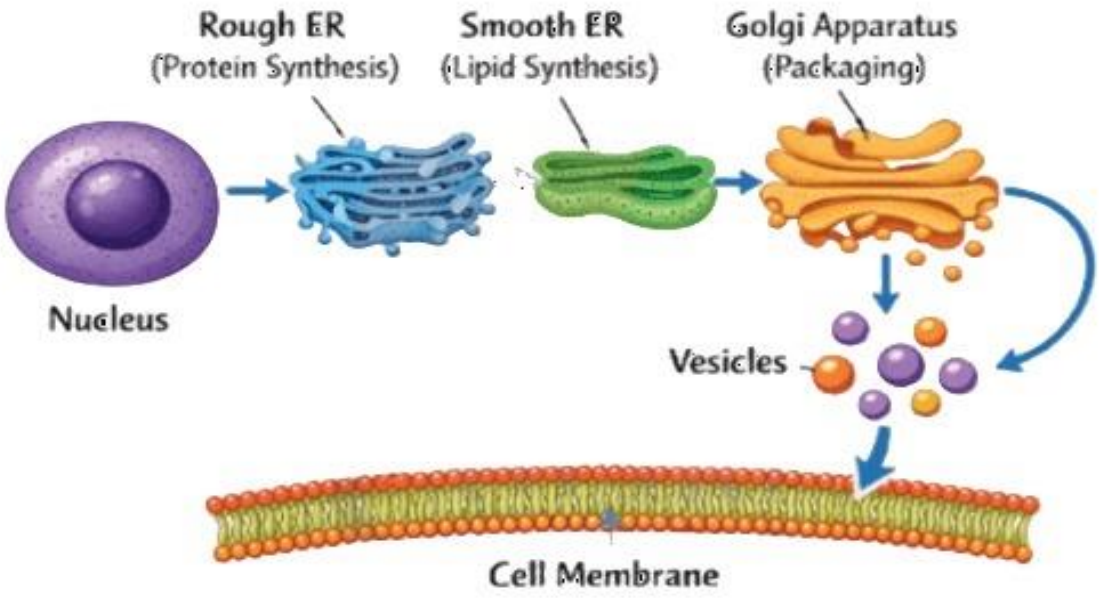
No, plants do not show contact inhibition and therefore follow a different pattern of growth. This is because plant cells have rigid cell walls — due to this rigidity, plant cells do not respond to contact with neighbouring cells the same way animal cells do. So while uncontrolled division can technically occur in plants too (and certain bacterial infections like crown gall disease can cause tumour-like growths), the chapter specifically states that plants do not show contact inhibition and grow differently from animal cells. The rigid cell wall is the key reason plants follow a different growth pattern altogether.

14. The cell membrane of a cell is made up of proteins and lipids. Which cell organelles help in the synthesis of cell membrane?

Write the path of these compounds from their site of synthesis to the cell membrane and show this through a labelled diagram.

Answer:
Organelles involved:
• Ribosomes — synthesise proteins (on RER surface).
• SER (Smooth Endoplasmic Reticulum) — synthesises lipids.
• Golgi apparatus — receives proteins and lipids from ER, modifies, packages, and sends them to the cell membrane via vesicles.

Pathway: Ribosomes (on RER) → Proteins synthesised → transported through ER → Golgi apparatus → packaged into vesicles → vesicles fuse with Cell Membrane
Similarly: SER → Lipids synthesised → transported to Golgi apparatus → packaged → sent to Cell Membrane



15. What would happen if gametes are formed by mitotic divisions?

Answer:
Normally, gametes (sperm and egg) are formed by meiosis, which halves the chromosome number. If gametes were formed by mitosis instead, the following problems would arise:
• Double chromosome number: Mitosis produces cells with the SAME number of chromosomes as the parent cell. So gametes would have the full chromosome number (e.g., 46 in humans) instead of the halved number (23).

• Doubling every generation: When fertilisation occurs, two gametes combine. If each gamete already has 46 chromosomes, the fertilised egg (zygote) would have 92 chromosomes. The next generation would have 184 and so on. The chromosome number would double with every generation.
• No genetic diversity: Meiosis creates genetic variation through crossing over and random assortment. Mitosis does not. Gametes formed by mitosis would be genetically identical, eliminating the diversity seen in offspring.
• Species extinction: Eventually the genome would become unmanageable — organisms would not be able to survive with continuously increasing chromosome numbers. This would likely lead to the extinction of sexually reproducing species.

16. A farmer, Deepa, was very happy with the harvest of amla (Indian Gooseberry) and lemons on her farm.

However, she could sell only one-fourth of the produce in the local market. Recognising that a significant amount of produce may be lost post-harvest, she employed a traditional yet scientifically sound method to extend the shelf life of amla and lemons. She turned perishable produce into profitable products, such as pickles and sharbat. She used the excess produce to prepare pickles, murabbas, and sharbat by adding appropriate amounts of salt, sugar, or jaggery to small pieces of fruit and their juices. These were then stored in small glass bottles for sale, helping her prevent the wastage of post-harvest produce.

This shift from farming to agro-processing would strengthen food security and boost the local economy, creating a sustainable model that cuts waste while increasing her income. Based on the above passage answer the following questions:

(i) Which scientific concept has the farmer applied in the preservation of the farm produce?

(ii) How does the addition of high concentrations of salt and sugar create an environment that prevents the growth of spoilage-causing bacteria and fungi?

(iii) Suggest a healthy recipe of this kind for food preservation.
(iv) What are the scientific values addressed in this case?

Answer:
(i) Deepa is applying the concept of Osmosis. By adding high concentrations of salt or sugar, she creates a hypertonic environment around spoilage-causing microorganisms (bacteria and fungi).

(ii) When bacteria or fungi are placed in a highly concentrated salt or sugar solution (hypertonic), water moves out of their cells by osmosis. The microbial cells lose water, shrink (plasmolysis), and cannot carry out normal metabolic activities. This dehydration effect kills or prevents the growth of spoilage-causing microorganisms, thereby preserving the food.

(iii) Healthy recipe for food preservation

Amla–Ginger Murabba:

• Take fresh amla (Indian Gooseberry), wash and prick them with a fork.

• Boil in water briefly to soften. Drain and let cool.

• Prepare a sugar syrup using jaggery (healthier than refined sugar) with a pinch of cardamom and dry ginger powder.

• Add the amla pieces into the syrup. Store in clean, airtight glass jars.

• The high jaggery concentration preserves the amla through osmosis while retaining its Vitamin C content.

(iv) **Scientific values addressed**

• Application of science: Using osmosis to preserve food without artificial chemicals.

• Sustainability: Reducing post-harvest waste and promoting eco-friendly preservation methods.

• Entrepreneurship: Converting perishable farm produce into marketable products to improve livelihood.

• Food security: Making nutritious food available throughout the year by extending shelf life.