

CLASS 9 SCIENCE — CHAPTER 2

NCERT SOLUTIONS

Cell: The Building Block of Life

New NCERT *Exploration* Textbook | 2026–27

These are the **textbook's own questions** from “**Revise, Reflect, Refine**”, “**Pause and Ponder**”, **activities and chapter tasks**. The chapter covers cell structure, microscopy, osmosis, prokaryotic/eukaryotic cells, organelles, cell division and cell theory.

1. PAUSE AND PONDER — CELL WALL

Question 1

What argument would you give for the necessity of a cell wall in plants usually fixed in one place versus in animals usually moving from one place to the other?

Answer:

 **Plants** are generally fixed in one place. They need strong structural support to:

- Maintain their shape
- Stand upright
- Resist mechanical stresses
- Prevent excessive swelling when water enters the cell

Therefore, a **rigid cell wall** is particularly important for plant cells.

 **Animals**, on the other hand, generally move from one place to another. Their cells need greater flexibility and cannot have a rigid outer wall like plant cells.

Conclusion:

Plant cells need a rigid cell wall for support and protection, whereas animal cells require flexibility for movement and functioning of tissues.



Question 2

What consequences would you predict for a plant cell if its cell wall were to become as flexible as a cell membrane?



Answer:

If the plant cell wall became as flexible as the cell membrane:



The cell would lose much of its structural support.



It could swell excessively when water enters.



It would become more vulnerable to bursting or deformation.



Plant tissues would also lose rigidity.



Therefore:

A flexible cell wall would make plant cells less capable of maintaining their fixed shape and providing mechanical support to the plant.



Question 3

Why is it important to cut the two potato pieces in roughly equal size and measure their initial weight before placing them in different liquids?



Answer:

The two potato pieces should be approximately equal in size and their initial masses should be measured so that the experiment is a **fair comparison**.

If the pieces have different initial sizes or masses:



The final change in mass may be due partly to their different starting sizes rather than the liquids.

With similar starting conditions:

✓ Any difference in mass can be more confidently attributed to the movement of water through the cell membranes.

★ Conclusion:

Keeping the initial conditions similar helps make the experiment reliable and meaningful.



2. ACTIVITY 2.1 — ESTIMATE THE SIZE OF A CELL

The textbook asks students to use a transparent ruler and microscope to estimate the size of an onion-peel cell.

📖 Given:

Suppose diameter of the microscope's visible field:

5 mm

Since:

1 mm = 1000 μ m

Therefore:

5 mm = 5 $\times$ 1000 μ m

= 5000 μ m

The estimated size of one cell is calculated as:

Estimated cell size = Diameter of visible field / Number of cells along the diameter

For example, if 20 cells fit across the diameter:

Cell size = 5000 / 20

= 250 μ m

★ Important formula:

Cell size = Diameter of visible field ÷ Number of cells

3. ACTIVITY 2.2 — OSMOSIS

The textbook asks students to place one potato piece in plain water and another in a **20% salt or sugar solution** and observe the changes.

What happens?

Potato in plain water

Water enters the potato cells by **osmosis**.

- Cells gain water
- Potato becomes firmer

Potato in concentrated salt/sugar solution

Water moves out of the cells.

- Cells lose water
- Potato becomes softer/shrunken

★ Conclusion:

Osmosis is the movement of water through a selectively permeable membrane from a region of higher water concentration to a region of lower water concentration.

4. ACTIVITY 2.3 — PLANT AND ANIMAL CELLS

The textbook asks students to prepare temporary slides of onion/Rhoeo leaf peel and cheek cells and observe them under a microscope.

Onion/plant cells:

- Box-shaped
- Regularly arranged
- Have a cell wall
- Have a cell membrane
- Have cytoplasm
- Have a nucleus
- Plant cells may contain plastids

Cheek/animal cells:

- Irregular or roughly rounded in shape
- No cell wall
- Have a cell membrane
- Have cytoplasm
- Have a nucleus

Main difference:

Plant cells have a cell wall, whereas animal cells do not.



5. ACTIVITY 2.4 — BACTERIAL, PLANT AND ANIMAL CELLS

The textbook asks students to study the diagrams of bacterial, plant and animal cells and record their observations.

Bacterial cell

- Cell membrane ✓
- Cell wall ✓
- Cytoplasm ✓
- Nucleoid ✓
- Well-defined nucleus ✗
- Membrane-bound organelles ✗

Plant cell

- Cell membrane ✓

- Cell wall ✓
- Cytoplasm ✓
- Well-defined nucleus ✓
- Membrane-bound organelles ✓
- Plastids ✓
- Large vacuole ✓

Animal cell

- Cell membrane ✓
- Cell wall ✗
- Cytoplasm ✓
- Well-defined nucleus ✓
- Membrane-bound organelles ✓
- Plastids ✗

★ **Key distinction:**

Bacteria → Prokaryotic

Plant/animal → Eukaryotic

The textbook explains that bacterial cells lack a well-defined nucleus and membrane-bound organelles.

6. REVISE, REFLECT, REFINE — Q1

Differentiate between the following pairs based on the clues given.

(i) Cell membrane and cell wall — permeability

Cell membrane 

Selectively permeable

Controls movement of substances

Cell wall 

Freely permeable to many substances

Provides support and protection

Present in all cells

Present in plants, fungi and bacteria

(ii) RER and SER — structure

RER	SER
Ribosomes present on its surface	Ribosomes absent
Appears rough	Appears smooth
Important in protein synthesis	Important in lipid synthesis

(iii) Chloroplasts and chromoplasts — pigments

Chloroplast 	Chromoplast 
Contains chlorophyll	Contains coloured pigments other than chlorophyll
Green	Usually yellow, orange or red
Performs photosynthesis	Gives colour to plant parts

These are the exact comparison prompts in the textbook's **Revise, Reflect, Refine** section.



7. REVISE, REFLECT, REFINE — Q2



Question:

Two similar animal cells are placed in two different solutions:

- **Cell X → Pure water**
- **Cell Y → Concentrated salt solution**

After some time, Cell X swells and Cell Y shrinks.

Which statement correctly explains the observations?

Options:

- (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 X 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:**

Cell X 💧

Pure water has a higher water concentration than the cell.

➡ Water enters the cell

➡ Cell swells

Cell Y 🧂

Concentrated salt solution has a lower water concentration than the cell.

➡ Water leaves the cell

➡ Cell shrinks

This movement of water through the selectively permeable cell membrane is called:

Osmosis



8. REVISE, REFLECT, REFINE — Q3

📖 **Question:**

Look at **Fig. 2.20** and identify the parts labelled (a) to (g) and match them with their functions.

The functions are:

1. Controlling all activities of a cell
2. Site of cellular respiration
3. Storage organelle that also provides rigidity
4. Separates cell contents from surroundings
5. Provides structural rigidity
6. Packs and stores materials received from ER
7. Helps in manufacturing food

✓ **Answers:**

Function	Organelle
(i) Controlling cell activities	 Nucleus
(ii) Cellular respiration	 Mitochondria
(iii) Storage + rigidity	 Vacuole
(iv) Separates cell contents	 Cell membrane
(v) Structural rigidity	 Cell wall
(vi) Packs/stores ER materials	 Golgi apparatus
(vii) Manufacturing food	 Chloroplast

9. REVISE, REFLECT, REFINE — Q4

 Question:

Which option correctly places organelles under the categories **present in plant cells** and **absent in animal cells**?

Options:

- (i) Leucoplast — Cell wall
- (ii) Mitochondria — Ribosome
- (iii) Cell wall — Golgi apparatus
- (iv) Lysosome — Endoplasmic reticulum

✓ **Answer:**

(i) Leucoplast — Cell wall

🧠 **Explanation:**

🌱 Leucoplasts are plastids found in plant cells.

🧱 Cell walls are present in plant cells but absent in animal cells.

Therefore, option (i) is correct.

10. REVISE, REFLECT, REFINE — Q5

📖 **Question:**

Renu says all parts of plants, even roots, contain plastids. Rohit says plastids are absent in plant roots because roots are underground and do not need photosynthesis.

Who is correct? Justify your answer.

✓ **Answer:**

Renu is correct. 🌱

Plastids are not restricted to green parts of plants.

Different plastids perform different functions.

Chloroplasts

Contain chlorophyll and perform photosynthesis.

Leucoplasts

Store substances such as starch, oils and proteins.

They can be present in underground parts such as roots.

Chromoplasts

Contain coloured pigments and give colour to various plant parts.

★ **Therefore:**

Although roots generally do not perform photosynthesis, they can contain **leucoplasts**, which are plastids.

11. REVISE, REFLECT, REFINE — Q6

Question:

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:

Similarities

Both have:

-  Double membranes
-  Their own DNA
-  Ribosomes
-  Internal membrane systems
-  Some ability to make proteins

Differences

Mitochondria

Site of cellular respiration

Releases usable energy from food

Present in plant and animal cells

Does not contain chlorophyll

Chloroplast

Site of photosynthesis

Captures light energy

Found in photosynthetic plant cells

Contains chlorophyll

★ In short:

Mitochondria → Energy release

Chloroplast → Food manufacture



12. REVISE, REFLECT, REFINE — Q7

📖 Question:

Which pair of cell organelles contains DNA?

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

✅ Answer:

(ii) Mitochondria, Nucleus

🧠 Explanation:

The **nucleus** contains the cell's main genetic material.

Mitochondria also contain their own DNA.

Therefore:

Nucleus + Mitochondria → DNA



13. REVISE, REFLECT, REFINE — Q8

A researcher takes two carrots of similar size.

 One is placed in plain water.

 The other is placed in concentrated salt solution.

After 24 hours, observations are recorded.

(i) What hypothesis does she want to test?

 **Answer:**

She wants to test whether the concentration of the surrounding solution affects the movement of water into or out of plant cells through **osmosis**.

(ii) What improvement would you suggest?

 **Answer:**

The experiment could be improved by:

- Using carrots of exactly or nearly equal mass.
 - Measuring their initial masses.
 - Using equal volumes of solutions.
 - Keeping the temperature and time the same.
 - Repeating the experiment for reliability.
 - Measuring the final mass.
-

(iii) Why does the carrot in plain water remain stiff and crunchy while the carrot in concentrated salt solution becomes rubbery and limp?

 **Answer:**

 **Plain water:**

Water enters the carrot cells by osmosis.

 Cells become turgid.

 Carrot remains **stiff and crunchy**.

 **Concentrated salt solution:**

Water moves out of the cells.

→ Cells lose turgidity.

→ Carrot becomes **rubbery and limp**.

14. REVISE, REFLECT, REFINE — Q10

Four potato cups are placed in water:

Cup A:

Empty

Cup B:

 One teaspoon sugar

Cup C:

 One teaspoon salt

Cup D:

 One teaspoon sugar in a **boiled potato**

The textbook asks three questions.

(i) Why does water gather in Cups B and C?

 **Answer:**

Sugar and salt make the solution inside the potato cup more concentrated.

Water from outside moves through the potato's selectively permeable cell membranes towards the more concentrated solution.

This movement is:

Osmosis

Therefore, water accumulates in Cups B and C.

(ii) Why is Cup A necessary?

✓ **Answer:**

Cup A acts as a:

Control experiment

It contains no sugar or salt.

Therefore, any water collected in Cups B and C can be compared with Cup A to determine whether the dissolved substances caused the observed effect.

(iii) Why does water not gather in Cups A and D?

Cup A:

There is no sugar or salt creating a concentrated solution inside the cup.

Therefore, there is no significant osmotic movement causing water to collect there.

Cup D:

The potato has been **boiled**.

Boiling damages the cell membranes, so they lose their normal selective permeability.

Therefore, normal osmosis does not occur effectively.

★ **Key idea:**

Osmosis requires a selectively permeable membrane.



15. REVISE, REFLECT, REFINE — Q11

Question:

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:

SER is mainly involved in:

 Lipid synthesis

It is **not** responsible for cellulose synthesis.

Therefore, pair **(ii)** is incorrect.



16. REVISE, REFLECT, REFINE — Q12

Question:

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

Answer:

Mitochondria are the major sites of cellular respiration and provide much of the energy required by the cell.

If all mitochondria were removed:

 Cellular energy production would drastically decrease.



Important cellular processes would be affected.



The cell would eventually lose its ability to function normally.

★ **Therefore:**

Removal of all mitochondria would severely impair the functioning and survival of a eukaryotic cell.



17. REVISE, REFLECT, REFINE — Q13

 **Question:**

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



Answer:

The phenomenon is:

Contact inhibition

In many normal animal cells, cell division stops when cells come into contact with neighbouring cells.

This helps prevent uncontrolled growth.



Cancer cells:

Cancer cells can lose contact inhibition.



They continue dividing uncontrollably.



This can lead to tumour formation.



Can plants develop tumours?

Yes.

Plants can also develop abnormal growths or tumours.

However, plant cells have rigid cell walls and do not show contact inhibition in the same way as animal cells. The textbook specifically explains this difference.



18. REVISE, REFLECT, REFINE — Q14

Question:

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:

The main organelles involved are:

Smooth Endoplasmic Reticulum (SER)

Helps in synthesis of:

Lipids

Ribosomes on Rough ER

Help in synthesis of:

Proteins

The proteins and lipids are then transported to the:

Golgi apparatus

The Golgi apparatus modifies, sorts and packages them.

They are then transported in vesicles to the:

Cell membrane

Pathway:

SER + Ribosomes



Proteins + Lipids



Endoplasmic Reticulum



Golgi apparatus



Transport vesicles



Cell membrane



19. REVISE, REFLECT, REFINE — Q15



Question:

What would happen if gametes are formed by mitotic divisions?



Answer:

Gametes normally form through **meiosis**, which reduces the chromosome number by half.

If gametes were produced by mitosis:



The chromosome number would not be reduced.

Each gamete would retain the same chromosome number as the parent cell.

During fertilisation:

Gamete + Gamete



The chromosome number would become **twice the normal number**.

If this continued generation after generation, chromosome number would keep increasing.

★ **Therefore:**

Meiosis is necessary for producing gametes with half the chromosome number and maintaining a stable chromosome number across generations.

20. REVISE, REFLECT, REFINE — Q16

 **Question:**

Deepa has excess amla and lemons. She uses salt, sugar or jaggery to prepare pickles, murabbas and sharbat to prevent wastage. Answer the following.

(i) Which scientific concept has the farmer applied?

✓ **Answer:**

The scientific concept is:

Osmosis

High concentrations of salt or sugar create conditions in which water moves out of microbial cells.

(ii) How do high concentrations of salt and sugar prevent spoilage?

✓ **Answer:**

A concentrated salt or sugar solution has lower water availability.

When bacteria and fungi come into contact with such an environment:

 High salt/sugar concentration



 Water moves out of microbial cells by osmosis



 Cells lose water



 Their growth and metabolic activities are inhibited.

Therefore, the food is preserved for a longer period.

(iii) Suggest a healthy recipe of this kind for food preservation.

 **Answer:**

Lemon pickle

Ingredients:

-  Fresh lemons
-  Appropriate amount of salt
-  Suitable spices
-  Clean, dry glass jar

The lemons can be cut and mixed with salt and suitable spices and stored properly in a clean, dry container.

(iv) What scientific values are addressed in this case?

 **Answer:**

The example demonstrates:

 **Waste reduction**

 Sustainable use of resources

 Application of scientific knowledge

 Food preservation

 Income generation

 Food security

★ It shows how scientific knowledge can be applied to solve a real-life agricultural and economic problem.



CHAPTER 2 — QUICK ANSWER KEY

Q	Answer
Pause & Ponder 1	Cell wall provides plant cells rigidity/support
Pause & Ponder 2	Flexible wall would reduce support and increase risk of deformation
Pause & Ponder 3	Equal starting conditions make the experiment fair
Revise Q1(i)	Cell membrane vs cell wall
Revise Q1(ii)	RER vs SER
Revise Q1(iii)	Chloroplast vs chromoplast
Revise Q2	(iii)
Revise Q3	Nucleus, mitochondria, vacuole, membrane, wall, Golgi, chloroplast
Revise Q4	(i)
Revise Q5	Rohit is incorrect; Renu is correct
Revise Q6	Mitochondria vs chloroplast
Revise Q7	(ii)
Revise Q8	Osmosis experiment

Revise Q10	Osmosis + control + damaged membrane
Revise Q11	(ii)
Revise Q12	Severe reduction in energy production
Revise Q13	Contact inhibition
Revise Q14	SER + RER/ribosomes → Golgi → membrane
Revise Q15	Chromosome number would increase after fertilisation
Revise Q16	Osmosis-based food preservation

The textbook's own answer key confirms several of these Chapter 2 selections, including **Q2 = (iii)**, **Q4 = (i)**, **Q7 = (ii)** and the osmosis explanation.

CHAPTER 2 — MOST IMPORTANT CONCEPTS

-  **Cell = basic structural and functional unit of life**
-  **Microscope = helps observe cells**
-  **Prokaryotic cell = no well-defined nucleus**
-  **Eukaryotic cell = well-defined nucleus + membrane-bound organelles**
-  **Cell wall = rigidity and protection**
-  **Cell membrane = selectively permeable**
-  **Osmosis = movement of water through a selectively permeable membrane**
-  **Mitochondria = cellular respiration**
-  **Chloroplast = photosynthesis**
-  **Golgi apparatus = modifies, sorts and packages materials**
-  **Nucleus = contains genetic material and controls cell activities**
-  **Ribosomes = protein synthesis**

 **SER = lipid synthesis**

 **RER = protein synthesis**

 **Lysosomes = digestion/breakdown**

 **Mitosis = two daughter cells**

 **Meiosis = four daughter cells with half chromosome number**

 **Contact inhibition = helps control cell division in many animal cells**

 **Cancer = uncontrolled cell division**