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CLASS IX SCIENCE

CELL: THE BUILDING BLOCK OF LIFE

(The Fundamental Unit of Life)

SMART NOTES | Understand → Connect → Remember → Apply → Revise → Score

SECTION A 1st Revision	SECTION B Revise after 3 days	SECTION C Revise after 7 days

How to use these notes Day 1: understand the flow and mark weak points. Day 3: revise comparisons + recall without looking. Day 7: use the one-page revision sheet and Smart Check. This is a spaced-revision aid, not a claim of guaranteed permanent retention.

SECTION A · 1st Revision · Understand the Cell

1) Chapter Roadmap

Cell as life's basic unit → How we study cells → Cell boundary (plasma membrane) → Movement of materials (diffusion + osmosis) → Cell wall → Plant vs animal cells → Prokaryotic vs eukaryotic cells → Nucleus & genetic material → Cell organelles → Biomolecules → Cell division (mitosis/meiosis) → Errors/cancer → Cell culture & future questions.

2) Learning Outcomes

- Explain why the cell is the structural and functional unit of life.
- Describe how microscopes made the study of cells possible and estimate cell size using field of view.
- Explain plasma membrane structure and selective permeability; differentiate diffusion and osmosis.
- Predict what happens to cells in isotonic, hypotonic and hypertonic solutions.
- Differentiate plant and animal cells, and prokaryotic and eukaryotic cells.
- Describe the structure and main functions of the nucleus, ER, mitochondria, chloroplasts, vacuoles and other important cell organelles.
- Connect proteins, lipids, carbohydrates and DNA with cell structure/function.
- Explain the purpose and outcomes of mitosis and meiosis and how errors in division may cause problems.
- Connect cell biology with cell culture, chromosome research and the question of synthetic cells.

Golden line A cell is the smallest level at which the basic organisation and functions of life are carried out. In multicellular organisms, cells work together to form tissues, organs and organ systems.

3) How do we study cells? — Discovery + Microscopy

- Robert Hooke first observed small box-like compartments in a thin cork slice in 1665 using a self-designed microscope and called them "cells".
- The unaided human eye has a limit of resolution of about 0.1 mm at a viewing distance of about 25 cm.
- Light microscopes use an eyepiece and objective lenses to magnify objects. Total magnification = eyepiece magnification × objective magnification.
- Cell-size activity: estimated cell size = field-of-view diameter (in µm) ÷ number of cells across the diameter.
- Electron microscopes use electrons instead of visible light and reveal much finer cell details at the nanometre scale.

SMART ALERT Do not confuse magnification with resolution. Magnification makes the image bigger; resolution decides how clearly two close points can be distinguished.

ADVANCED EDGE Total magnification = objective × eyepiece. Actual size = image size ÷ magnification. Resolution describes image detail; resolving power is the ability to distinguish two very close points. Light microscopes and electron microscopes differ greatly in resolving ability.

4) Plasma Membrane — the universal cell boundary

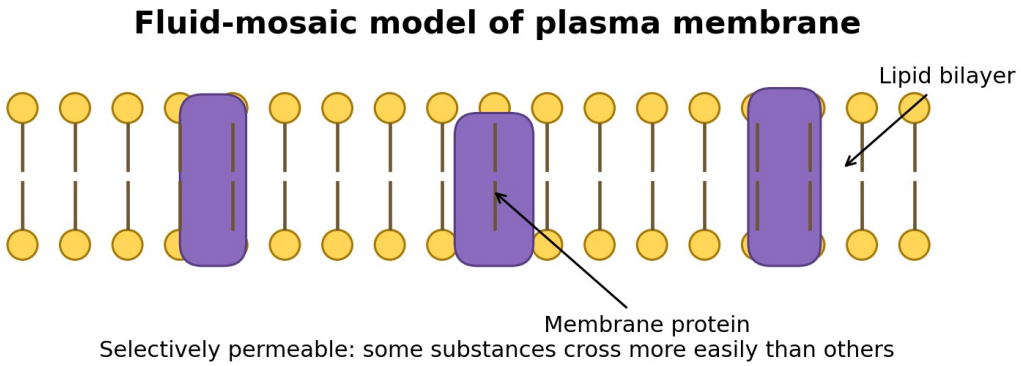


Diagram to practise: lipid bilayer + membrane proteins (Class IX schematic).

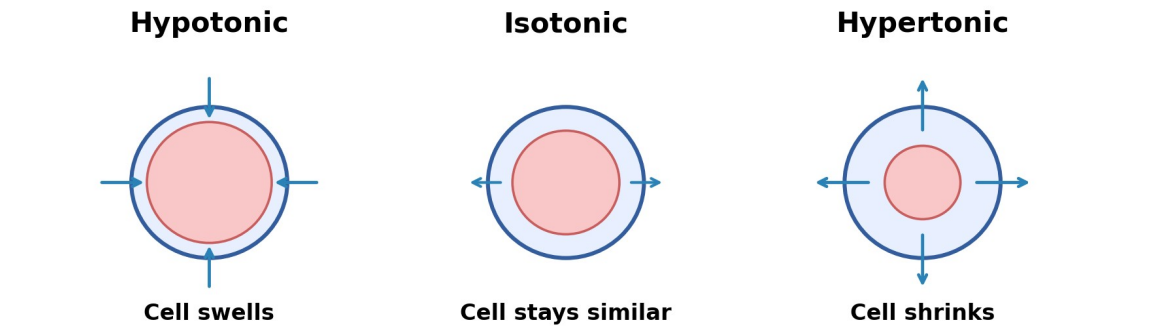
- Also called the cell membrane; it surrounds the cell, protects its contents and separates the cell from the surroundings.
- It is selectively permeable: it permits some substances to cross more easily than others.
- The plasma membrane is extremely thin (about 7–10 nm) and is made mainly of lipids and proteins.
- Fluid-mosaic idea: two lipid layers form a bilayer; proteins are embedded in it; membrane components can move within the layer, giving flexibility.
- Membrane proteins can act like gatekeepers for movement of substances.

EXAM WORDING Write: "The plasma membrane is selectively permeable because it allows some substances to pass while restricting others."

5) Diffusion vs Osmosis — movement across/around cells

Point	Diffusion	Osmosis
What moves?	Particles (solute/gas/etc.)	Water only
Direction	Net movement from higher particle concentration to lower concentration	Water moves from dilute side (more water/less solute) to concentrated side (less water/more solute)
Membrane essential?	No	Yes — selectively permeable membrane
Cell example	O_2 may diffuse into a cell; CO_2 may diffuse out	Water enters root cells / moves in or out of potato or living cells

Exam Alert Write "net movement" for diffusion and "across a selectively permeable membrane" for osmosis. These phrases carry the concept.



Osmosis = net movement of water across a selectively permeable membrane from dilute to concentrated solution

Diagram to practise: effect of hypotonic, isotonic and hypertonic solutions.

Solution around cell	Compared with inside	Net water movement	Expected effect
Hypotonic	Lower solute / more water outside	Into cell	Cell swells; plant cell becomes firm/turgid
Isotonic	Similar solute concentration	No net movement	No major size change
Hypertonic	Higher solute / less water outside	Out of cell	Cell shrinks; in plant cells, inner contents pull away from wall

COMMON MISTAKE Do not write only "water moves from higher concentration to lower concentration." Specify water concentration, or write: water moves from a dilute solution to a concentrated solution across a selectively permeable membrane.

Activity Connection · Potato Osmosis

Aim	Observation	Concept learned
Compare potato pieces in plain water and 20% salt/sugar solution	Plain-water piece gains water/swells; concentrated-solution piece loses water/shrinks	Water crosses living cell membranes by osmosis. Equal-sized pieces + initial masses make the comparison fair.

6) Cell Wall — support beyond the plasma membrane

- Plant cells have a rigid cell wall outside the plasma membrane; plant cell walls are mainly made of cellulose.
- The wall helps cells maintain shape, keeps leaves/flowers firm, and supports plants against physical stresses.
- The cell wall is permeable; water and some dissolved minerals can pass through it.
- Fungi and bacteria can also have cell walls that provide protection and structural support.
- In a concentrated sugar solution, a plant cell loses water. The rigid wall largely maintains the outer shape while the inner contents shrink and the membrane pulls away from the wall.
- Animal cells have no cell wall, so when they lose water in a concentrated solution, the whole cell can shrink.

Why do plants need a cell wall? Plants are generally fixed in place and need extra mechanical support; a rigid wall helps them withstand stresses and maintain firm shape.

VOCABULARY Plasmolysis is the shrinkage of the cell contents away from the cell wall when a plant cell loses water in a concentrated solution.

7) Plant Cell vs Animal Cell

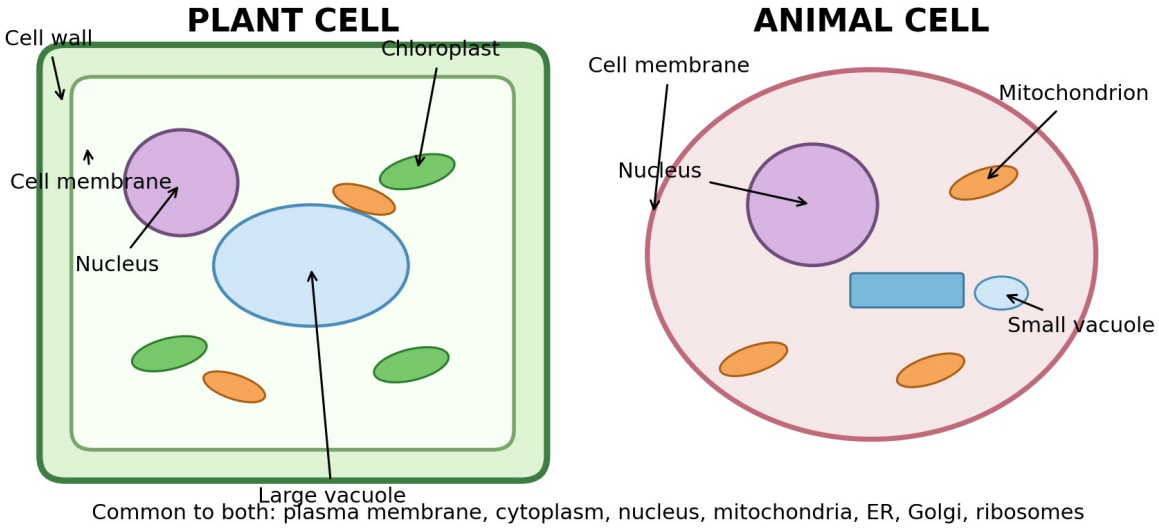


Diagram to practise: plant and animal cell. Essential labels are listed below.

Feature	Plant cell	Animal cell
Cell wall	Present	Absent
Cell membrane	Present	Present
Nucleus	Present in typical eukaryotic cells	Present in typical eukaryotic cells
Chloroplasts	Present in photosynthetic cells	Absent
Vacuole	Usually one large central vacuole in mature cell	May be present; usually smaller and temporary
Shape (typical classroom slide)	More regular/box-like due to wall	More flexible/irregular

Feature	Plant cell	Animal cell
Mitochondria, ER, Golgi, ribosomes	Present	Present

Diagram to practise for exam Plant: cell wall, cell membrane, cytoplasm, nucleus/nucleolus, large vacuole, chloroplast, mitochondrion, ER, Golgi. Animal: cell membrane, cytoplasm, nucleus/nucleolus, mitochondrion, ER, Golgi, ribosomes, small vacuole/lysosome.

Activity Connection · Plant and Cheek Cells

Aim	Observation	Concept learned
Prepare stained temporary mounts of plant and cheek cells	Plant cells appear regularly arranged and box-like; cheek cells are more irregular	Cell wall contributes to rigidity/shape; animal cells lack a wall.
Add concentrated sugar solution	Plant cell outer boundary remains while inner content shrinks; cheek cells shrink considerably	Osmosis + role of cell wall.

8) Prokaryotic vs Eukaryotic Cells

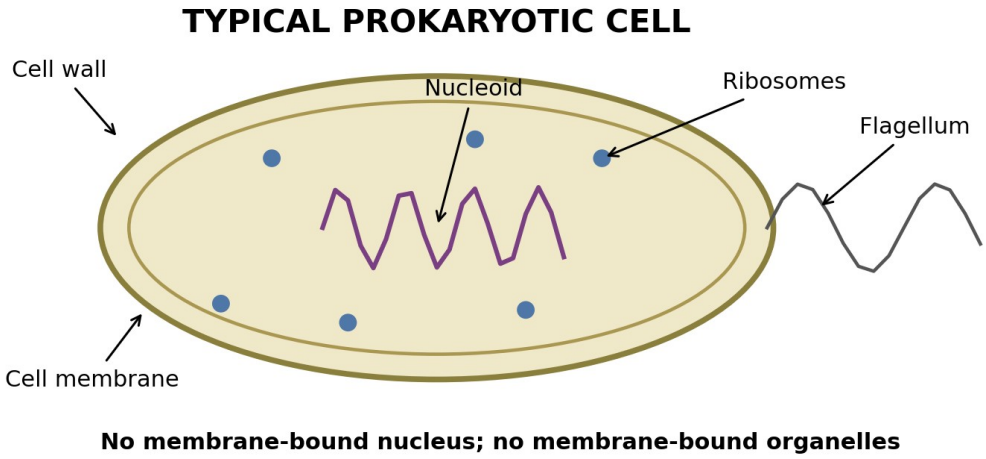


Diagram to practise: typical prokaryotic cell — wall, membrane, cytoplasm, nucleoid, ribosomes, flagellum (if shown).

Characteristic	Prokaryotic cell	Eukaryotic cell
Nucleus	No membrane-bound nucleus; genetic material lies in nucleoid	Well-defined, membrane-bound nucleus
Membrane-bound organelles	Absent	Present
Typical diameter	1–10 µm	10–100 µm
Number of cells	Usually unicellular	Can be unicellular or multicellular
Example	Bacterial cell	Plant and animal cells

EXAM ALERT Cell dimensions are commonly expressed in micrometres (µm), not millimetres (mm).

EXPLORE MORE Cytoskeleton helps support cell shape, movement and internal transport. Cell inclusions are stored materials such as starch grains or crystals.

9) Nucleus — house of coded instructions

Genetic information is carried in DNA; genes are functional segments of DNA

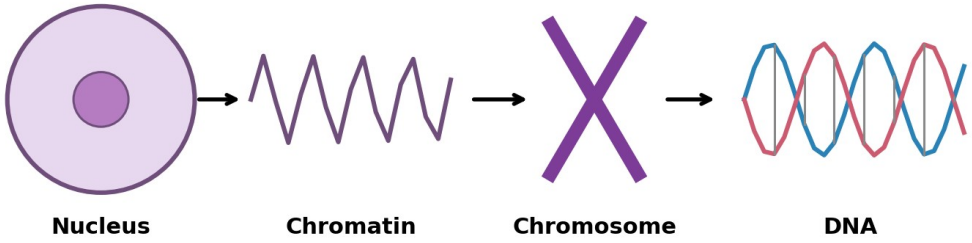


Diagram to practise: nucleus → chromatin → chromosome → DNA. Essential labels: nuclear membrane, pores, nucleolus, chromatin.

- Nuclear membrane: double-layered covering with pores that allow transfer of material between nucleus and cytoplasm.
- Nucleolus: dense rounded region where ribosomal subunits are formed.
- Chromatin: thread-like DNA-containing material in a non-dividing cell.
- Chromosomes: organised structures visible when the cell is about to divide; composed of DNA and specific proteins.
- DNA stores genetic information; a gene is a functional segment of DNA.
- Prokaryotes lack a well-defined nucleus; their genetic material lies in a nucleoid region.

SMART ALERT Chromatin and chromosomes are related forms of the same DNA-containing material. Chromatin condenses/organises into chromosomes when the cell prepares to divide.

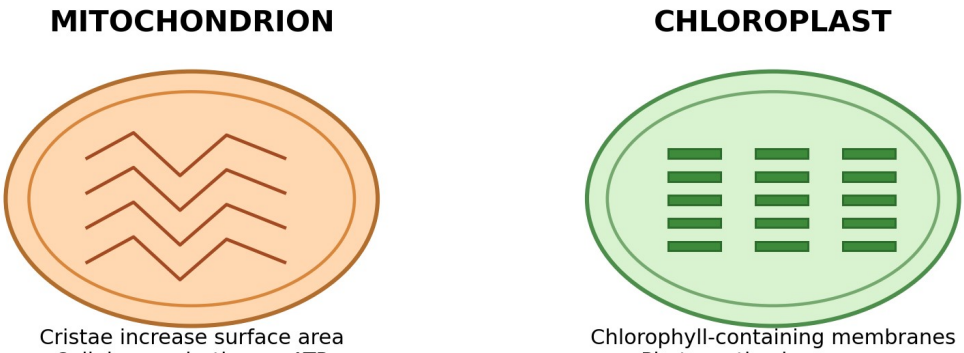
INTERESTING EXAMPLE Mature human RBCs lack a nucleus, creating more space for haemoglobin. Because they cannot repair or divide themselves, their lifespan is limited.

10) Cell Organelles — a coordinated working system

Organelle	Structure / feature	Main function	Plant/Animal	Smart memory clue
Ribosome	Tiny; free in cytoplasm or on RER	Protein synthesis	Both; also in prokaryotes	Protein factory
Rough ER	Membrane network with ribosomes	Protein synthesis, secretion and transport	Both eukaryotic	Rough = ribosomes
Smooth ER	Membrane network without ribosomes	Synthesis/storage of fats and some hormones	Both eukaryotic	Smooth = lipids
Golgi apparatus	Stacks of flattened sacs + vesicles	Modifies, sorts, packages proteins/lipids; transport/secretion; lysosome formation	Both eukaryotic	Post office
Lysosome	Single-membrane enzyme-filled sacs	Break down wastes, unwanted molecules and damaged parts; products may be reused	Commonly shown in animal cells	Clean-up system
Mitochondrion	Double membrane; inner folds = cristae	Cellular respiration; energy stored as ATP	Both	Powerhouse / ATP
Chloroplast	Double membrane; stroma + chlorophyll-containing membranes	Photosynthesis; sugars made/stored	Photosynthetic plant cells	Solar food factory
Chromoplast	Pigmented plastid	Yellow/orange/red colours in flowers/fruits	Plant	Colour plastid
Leucoplast	Colourless plastid	Stores starch/oils/proteins	Plant	Storage plastid
Vacuole	Single selectively permeable membrane; cell sap in plants	Stores water, minerals, sugars, wastes; supports firmness	Large central in mature plant; smaller/temporary in animals	Storage + support

SMART NOTE Define lysosomes by their function: they contain digestive enzymes and act as the cell's clean-up and recycling system. "Suicidal bags" is only an informal nickname, not a complete definition.

Mitochondria and Chloroplasts — similarities + differences



Both contain their own DNA and ribosomes; their major functions are different.

Feature	Mitochondrion	Chloroplast
Main role	Releases usable energy during cellular respiration; ATP production	Captures light energy for photosynthesis; sugar formation
Occurrence	Plant + animal cells	Photosynthetic plant cells
Membranes	Double membrane; inner membrane folded into cristae	Double membrane; internal chlorophyll-containing membranes in stroma
Own DNA/ribosomes	Yes	Yes

Why cristae? Folds increase the inner-membrane surface area available for energy-producing chemical reactions.

11) Biomolecules in the Cell — Structure + Function

Biomolecule / group	Role in the cell	Example / connection
Lipids	Major part of plasma membrane; SER synthesises/stores fats	Fluid-mosaic membrane; ER
Proteins	Membrane proteins help transport; ribosomes make proteins; chromosomes include specific proteins	Plasma membrane; ribosome; nucleus
Carbohydrates	Cellulose forms plant cell wall; glucose provides energy during respiration; starch/sugars are stored in plant cells	Cell wall; mitochondria; plastids/vacuole
Nucleic acid (DNA)	Stores genetic information; genes are functional segments of DNA	Nucleus/chromosomes; mitochondria/chloroplasts also contain DNA

SMART LINK Proteins, lipids, carbohydrates and DNA each contribute to cell structure or function. Focus on these simple connections rather than detailed biochemistry.

12) Cell Division — new cells from pre-existing cells

Cell division is the process by which new cells form from pre-existing cells. It supports growth, repair, maintenance and reproduction.

Point	Mitosis	Meiosis
Where / purpose	Common in body growth, repair, maintenance; also asexual reproduction	Occurs in cells of reproductive organs; produces gametes for sexual reproduction
Number of divisions	One	Two successive divisions
Daughter cells produced	Two	Four
Chromosome number	Same as parent cell	Half of parent cell
Genetic similarity	Two genetically identical daughter cells	Four daughter cells; genetic variation/diversity is promoted
Importance	Maintains tissues and body growth	Maintains chromosome number across sexual reproduction after fertilisation and promotes variation

CLASS IX SCOPE Focus on the purpose and outcomes of mitosis and meiosis. Detailed stages of cell division are studied later.

Cancer link Errors in mitosis can cause uncontrolled cell division, which may lead to tumours. Errors in meiosis may cause

chromosome-related genetic problems, pregnancy loss or reduced fertility. Keep the Class IX answer at this concept level.

Activity Connection · Onion Root Tip

Aim	Observation	Concept learned
Observe growing onion root-tip cells	Cells show different structures because they are at different stages of division	Growing tissues contain actively dividing cells; cell division forms new cells.

13) Current Cell Biology Connections

- Cell culture: scientists can grow plant and animal cells outside the body in a nutrient-rich medium under controlled, sterile conditions. It helps study cells and can support production of useful biochemicals, food products, medicines and vaccines.
- Arun Kumar Sharma: an Indian cytogeneticist known for important work on chromosomes and laboratory methods used to study plant chromosomes.
- Think beyond: Can an artificial cell ever behave exactly like a natural living cell? This connects cell structure with current research and ethical questions.
- Leigh syndrome / mitochondrial dysfunction: use this as a case-study connection to understand why cells depend on healthy mitochondria for energy. Focus on the cellular concept rather than medical treatment details.

CASE-STUDY CONNECTION If mitochondria cannot release cellular energy effectively, tissues with high energy demand are affected strongly. Use this core idea while discussing mitochondrial disorders such as Leigh syndrome.

ADVANCED EDGE Microscopy extension: distinguish magnification from resolution, calculate total magnification, and compare light and electron microscopes.

14) Important Definitions — revision table

Term	Student-friendly definition	Key exam word
Cell	Basic structural and functional unit of living organisms	structural + functional
Plasma membrane	Thin selectively permeable boundary around the cell	selectively permeable
Diffusion	Net movement of particles from higher to lower concentration	net movement
Osmosis	Diffusion/net movement of water across a selectively permeable membrane from dilute to concentrated solution	water + membrane
Cell wall	Rigid outer layer outside plasma membrane in plant cells; mainly cellulose in plants	support + permeable
Cytoplasm	Semi-fluid jelly-like material inside the membrane containing organelles	cell interior
Prokaryotic cell	Cell without a membrane-bound nucleus and membrane-bound organelles	nucleoid
Eukaryotic cell	Cell with a well-defined membrane-bound nucleus and membrane-bound organelles	true nucleus
Chromatin	Thread-like DNA-containing material in a non-dividing nucleus	DNA threads
Chromosome	Organised DNA-protein structure visible when a cell is preparing to divide	inheritance
Gene	Functional segment of DNA	DNA segment
Organelle	Specialised sub-cellular structure with a particular function	specialised part
Mitosis	Cell division producing two genetically identical daughter cells	two + identical
Meiosis	Two-step division producing four cells with half chromosome number; forms gametes	four + half

SECTION B · Revise after 3 days · Stronger Retention

15) Five high-value comparison tables

A. Cell wall vs Plasma membrane

Point	Cell wall	Plasma membrane
Position	Outside plasma membrane in plant cells	Boundary of all living cells
Nature	Rigid; plant wall mainly cellulose	Flexible lipid-protein membrane

Point	Cell wall	Plasma membrane
Permeability	Permeable to water and some dissolved minerals	Selectively permeable
Main role	Support, firmness, shape, protection	Controls interaction and material movement

B. Rough ER vs Smooth ER

Point	RER	SER
Ribosomes	Present on surface	Absent
Major role	Protein synthesis/secretion	Fat and some hormone synthesis/storage
Look	Rough under electron microscope	Smooth

C. Chromatin vs Chromosome

Chromatin	Chromosome
Thread-like / entangled DNA-containing material in non-dividing cell	Condensed/organised DNA-protein structure visible when cell prepares to divide
Same genetic material in less condensed form	Same material in compact form

D. Plant vs Animal cell + E. Prokaryote vs Eukaryote

On Day 3, redraw the Plant vs Animal and Prokaryote vs Eukaryote tables from memory before checking.

16) Why? — concise model answers

Question	Model answer
Why is the plasma membrane called selectively permeable?	Because it allows some substances to cross while restricting others, so it controls exchange with the environment.
Why do plant cells need a cell wall?	The rigid wall gives support and shape and helps cells withstand physical stress and osmotic water gain/loss.
Why are mitochondria called powerhouses?	They carry out cellular respiration and store released energy in ATP, which cells use for activities.
Why do cristae help mitochondria?	They increase inner-membrane surface area for energy-producing reactions.
Why are chloroplasts important?	Chlorophyll absorbs light energy used to synthesise food by photosynthesis.
Why do mature plant cells have a large vacuole?	It stores water/solutes/wastes and helps maintain internal pressure, keeping cells firm.
Why is meiosis essential for sexual reproduction?	It makes gametes with half the chromosome number; fertilisation restores the original number and variation arises.
Why is lysosome called a clean-up system?	Its enzymes break down wastes, unwanted molecules and damaged cell parts; useful products may be recycled.
Should “suicidal bag” be your main lysosome definition?	No. It is only an informal nickname. A better definition is: lysosomes are membrane-bound sacs containing digestive enzymes that break down wastes and damaged cell material.

17) Don’t Confuse

Confusion	Correct distinction
Cell wall ≠ cell membrane	Wall is rigid extra support in plant cells; membrane is the selectively permeable boundary of all living cells.
Cytoplasm ≠ protoplasm	Cytoplasm is the jelly-like material inside the cell; “protoplasm” is not needed as a core term here.
Diffusion ≠ osmosis	Diffusion can involve many particles and needs no membrane; osmosis is water movement across a selectively permeable membrane.
Chromatin ≠ chromosome	Different packing states of the same DNA-containing material.
Chloroplast ≠ chromoplast	Both are plastids. Chloroplasts contain chlorophyll and perform photosynthesis; chromoplasts contain other coloured pigments.
Prokaryotic ≠ “no DNA”	Prokaryotes have DNA; it is not enclosed within a membrane-bound nucleus.
Magnification ≠ resolution	Big image is not automatically a sharp/detail-rich image.
Cell wall “only in plants”	Plant cells have walls, but fungi and bacteria may also have walls.

18) Memory links that are actually useful

- RER = Ribosomes → proteins. SER = Smooth/no ribosomes → fats.
- Golgi = “Go-label-dispatch”: modify → sort → package → ship.
- Mitochondria = ATP; chloroplast = light → sugar; vacuole = store + support.
- Mitosis: 1 division → 2 similar cells. Meiosis: 2 divisions → 4 half-number cells.
- Hypertonic outside = more solute outside → water exits cell.

19) Exam-Oriented Questions by Major Topic

Try each question orally first, then write the answer in short, precise points.

Type	Question / prompt	Model answer point
1 mark	What did Robert Hooke observe in cork in 1665?	Small box-like compartments that he called cells.
1 mark	State one structural difference between a prokaryotic and eukaryotic cell.	Prokaryote lacks a membrane-bound nucleus; eukaryote has one.
1 mark	Which organelle is the site of protein synthesis?	Ribosome.
2 marks	Differentiate diffusion and osmosis.	Mention particles vs water; membrane not essential vs selectively permeable membrane required.
2 marks	Why does a plant cell retain outer shape in concentrated sugar solution while its inner content shrinks?	Water leaves by osmosis; rigid cell wall maintains outer shape while membrane/inner contents pull inward.
2 marks	Give two differences between mitosis and meiosis.	2 identical cells/same chromosome number vs 4 gamete cells/half chromosome number; one vs two divisions.
3 marks	Explain fluid-mosaic model at Class IX level.	Lipid bilayer + embedded proteins; components move within membrane = fluid; mosaic arrangement; proteins help transport.
3 marks	Explain nucleus → chromosome → DNA → gene relationship.	Nucleus contains chromatin/chromosomes; chromosomes contain DNA + proteins; DNA stores genetic info; genes are functional DNA segments.
3 marks	Compare mitochondria and chloroplasts.	Both double membrane + own DNA/ribosomes; respiration/ATP vs photosynthesis/sugar; occurrence differences.
Case based	A potato piece gains mass in water but loses mass in concentrated salt solution. Explain.	Hypotonic water causes net water entry; hypertonic salt solution causes net water exit via osmosis.
Diagram based	Draw and label a plant cell.	Labels: wall, membrane, cytoplasm, nucleus, vacuole, chloroplast, mitochondrion, ER, Golgi.
Assertion–Reason	A: Cell membrane is selectively permeable. R: All substances pass through it freely.	A true, R false.

20) HOTS / Advanced Thinking

1. If a plant cell wall became as flexible as a plasma membrane, what would happen to plant support and response to water gain?
2. Why would one giant mitochondrion be less useful than many smaller mitochondria? Think about surface area and distribution of energy demand.
3. If skin cells underwent meiosis instead of mitosis, would normal wound repair occur? Explain using chromosome number and daughter-cell purpose.
4. Why can higher magnification still produce a poor image if resolution is low?
5. Predict what happens to a soaked mung bean placed in a concentrated solution and justify using osmosis.

ADVANCED EDGE · THINKING RULE **Focus on cause → effect: surface area, chromosome number, membrane transport and measurement quality.**

21) Chapter Practice — model answer points

Prompt	Answer points
Why must potato pieces be roughly equal before the osmosis experiment?	To control size/surface-area differences so change in mass can be attributed mainly to the surrounding solution.
Why are cells in onion root tip structurally different from one another?	They are actively dividing and therefore are observed at different stages of cell division.
What would happen if gametes formed by mitosis?	They would not have half the chromosome number; fertilisation would disturb normal chromosome-number maintenance across generations.
A white flower lacks green colour. Does it necessarily lack plastids?	No. It may contain non-green plastids; pigment type determines colour. Leucoplasts can be colourless.
Which organelles help build plasma membrane material?	RER/ribosomes provide proteins and SER provides lipids; Golgi can modify, package and route products in vesicles to the membrane.

1-PAGE SMART REVISION SHEET

10–15 minute revision order Boundary → transport → cell types → nucleus → organelles → division. Speak each line before reading the next.

Core term	Lock-in line
Cell	Structural + functional unit of life.
Membrane	Lipid-protein; selectively permeable.
Diffusion	Particles: high → low concentration; membrane not essential.

Osmosis	Water across selectively permeable membrane: dilute → concentrated solution.
Cell wall	Rigid support; plant wall mainly cellulose; permeable.
Prokaryote	Nucleoid; no membrane-bound organelles; 1–10 µm.
Eukaryote	True nucleus + membrane-bound organelles; 10–100 µm.
Nucleus	DNA instructions; chromatin condenses into chromosomes; genes are DNA segments.
Mitosis	1 division → 2 genetically identical cells, same chromosome number.
Meiosis	2 divisions → 4 gamete cells, half chromosome number.
Organelle	**One-line function**
Ribosome	Protein synthesis
RER	Protein synthesis/secretion/transport
SER	Fats + some hormones
Golgi	Modify-sort-package-ship
Lysosome	Clean-up / breakdown / recycle
Mitochondrion	Respiration → ATP
Chloroplast	Photosynthesis
Chromoplast	Colour pigments
Leucoplast	Food storage
Vacuole	Storage + firmness
Must remember	**Statement**
1	Plasma membrane = selectively permeable.
2	Hypotonic: water enters; hypertonic: water leaves.
3	Plant wall maintains outer shape during water loss.
4	Chloroplast, chromoplast and leucoplast are plastids.
5	Mitochondria + chloroplasts have own DNA and ribosomes.
6	Prokaryotes have DNA — just no membrane-bound nucleus.
7	Lysosome = clean-up and recycling system.
8	Errors in mitosis can lead to uncontrolled division/tumours.
9	Cell culture = growing cells outside body under controlled conditions.
10	Detailed mitotic stages are studied at higher levels; focus here on the purpose and outcome of cell division.

Diagrams to practise Plant cell • Animal cell • Prokaryotic cell • Plasma membrane • Nucleus/chromosome/DNA link • Mitochondrion • Chloroplast • Osmosis (hypo/iso/hypertonic).

LAKSHYA SMART CHECK

Part 1 · 5 MCQs

- 1. The main reason a cell membrane is called selectively permeable is that it: (A) is rigid (B) lets every substance pass freely (C) allows some substances while restricting others (D) is made only of proteins.
- 2. In a hypertonic solution, a typical animal cell will: (A) gain water (B) lose water (C) show no net water movement (D) form a cell wall.
- 3. Which structure is absent as a membrane-bound organelle in prokaryotes? (A) ribosome (B) nucleoid (C) nucleus (D) cell membrane.
- 4. Which pair both contain their own DNA? (A) nucleus and lysosome (B) mitochondrion and chloroplast (C) Golgi and ribosome (D) vacuole and lysosome.
- 5. Meiosis produces: (A) two identical cells (B) four cells with half chromosome number (C) one cell with double chromosome number (D) two gametes with double chromosome number.

Part 2 · 5 Very Short Answers

6. Define diffusion.
7. Define osmosis.
8. Name the fluid inside a mature plant vacuole.
9. What is a nucleoid?
10. What is a gene?

Part 3 · 5 Conceptual Questions

11. Why does an onion/Rhoeo cell keep its outer shape in concentrated sugar solution while cheek cells shrink?
12. Why is chloroplast absent from animal cells?
13. Why can a prokaryotic cell still carry out life activities even though it lacks membrane-bound organelles?
14. How are chromatin and chromosomes related?

15. Why is mitosis important in wound healing?

Part 4 · 2 Diagram Questions

16. Draw a plant cell and label: cell wall, plasma membrane, nucleus, cytoplasm, chloroplast, vacuole, mitochondrion, ER and Golgi apparatus.
17. Draw three cells placed in hypotonic, isotonic and hypertonic solutions and show the direction of net water movement.

Part 5 · 2 Application / HOTS Questions

18. A microscope uses a 10× eyepiece and a 40× objective. Calculate total magnification. Why can the image still be unclear even at this magnification?
19. A student says, “Prokaryotes have no nucleus, so they have no DNA.” Evaluate this statement and justify your answer.

SMART CHECK · ANSWER KEY

MCQs

1-C | 2-B | 3-C | 4-B | 5-B

Very Short Answers

Q	Answer
1	Net movement of particles from higher concentration to lower concentration.
2	Net movement/diffusion of water across a selectively permeable membrane from a dilute solution to a more concentrated solution.
3	Cell sap.
4	The region in a prokaryotic cell containing genetic material that is not enclosed by a nuclear membrane.
5	A functional segment of DNA.

Conceptual Answers

Q	Key points
1	Plant cell wall remains rigid; water loss shrinks inner contents. Animal cells lack wall, so whole cell shrinks.
2	Animals do not perform photosynthesis; chloroplasts are specialised plastids for light capture/food synthesis in photosynthetic cells.
3	Most cellular activities can occur directly in prokaryotic cytoplasm; ribosomes and genetic material are present even though membrane-bound organelles are absent.
4	Chromatin is the less-condensed thread-like form; it organises/condenses into chromosomes during cell division.
5	Mitosis increases cell number and produces genetically identical replacement cells with the same chromosome number.

HOTS Answers

Q	Answer
1	10×40 = 400×. Clarity also depends on resolution; greater magnification without sufficient resolution can give a larger but blurry image.
2	Incorrect. Prokaryotes have DNA; it lies in the nucleoid and is not enclosed by a nuclear membrane.