

Class 9 Science - Free Sample Pack

Selected Chemistry, Physics and Biology pages from the Topper Formula Series

- Chemistry: concept clarity, observation, activities and scientific classification.
- Physics: reasoning before formula use, worked numericals and mistake alerts.
- Biology: structure-function learning, diagrams and memory support.

Selected preview - read, evaluate, then choose the complete book

CHAPTER 1

EXPLORING MIXTURES AND THEIR SEPARATION

A complete, activity-rich study of mixtures, solutions and separation

CHAPTER MYSTERY

Clear salt water looks like one substance, milk looks uniform, muddy water settles, and brass shines like a metal. Are all of them pure? Their particles—and the way we separate them—reveal the answer.

Learning outcomes

- Use scientific—not everyday—meaning of pure substance.
- Classify matter as elements, compounds, homogeneous mixtures or heterogeneous mixtures.
- Explain solutions, colloids and suspensions using particles and observable tests.
- Calculate concentration and reason about saturation and solubility.
- Select and justify separation methods from differences in physical properties.
- Distinguish physical and chemical changes using evidence.
- Interpret activities, apparatus, data, case studies and assertion–reason questions.

1.1 The Scientific Meaning of “Pure”

In ordinary speech, pure milk may mean unadulterated milk and pure air may mean clean air. In chemistry, a pure substance contains only one kind of constituent particle and has a fixed composition and characteristic properties. Distilled water is a pure compound; air, milk and tap water are mixtures even when clean and safe. Purity is therefore a statement about composition, not colour, cleanliness, natural origin or usefulness.

Sample	Everyday description	Chemical classification	Why
Distilled water	Clean/pure	Pure compound	Only H ₂ O particles under ideal school-level description.
Tap water	Clean	Mixture	Water plus dissolved salts and gases.
Milk	Pure/unadulterated	Colloid; mixture	Fat/protein-rich droplets dispersed in water.
24-carat gold	Pure gold	Element	Only gold atoms, apart from unavoidable trace impurities.
Air	Clean or polluted	Homogeneous mixture of gases	Composition can vary; components retain identity.
Brass	A metal object	Homogeneous solid mixture	Mainly copper and zinc in variable proportions.

HOW TO REMEMBER

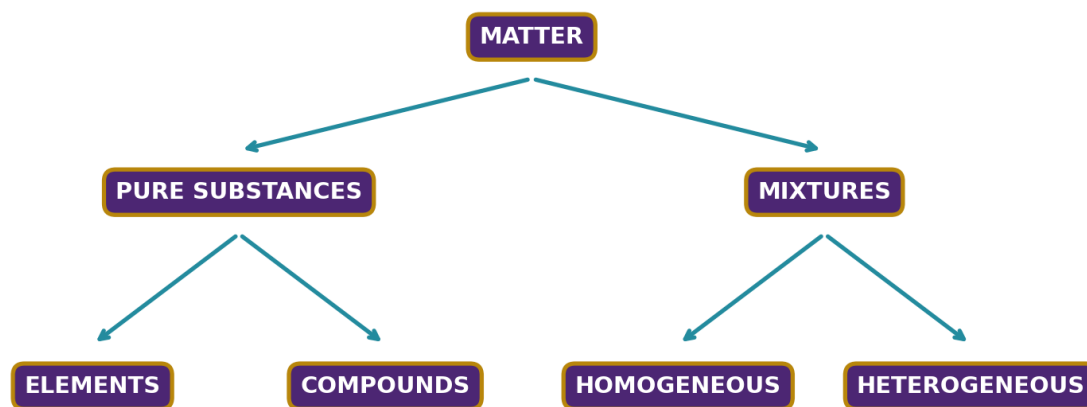
PURE = Particular Uniform Ratio Everywhere. A mixture may look uniform, but its composition can vary.

Activity 2.1: Classifying familiar samples

QUESTION

Can appearance alone establish purity?

Part	Details
Materials/apparatus	Labelled samples/images: salt, sugar, soil, air, milk, brass, distilled and tap water.
Procedure	For each, record appearance, expected components, fixed/variable composition and classification. Defend each choice with evidence.
Expected observation	Clear samples can be mixtures; cloudy samples can be colloids or suspensions.
Scientific inference	Classification requires composition and particle behaviour, not a quick glance.
Safety/quality note	Never taste unknown samples; use teacher-provided labels.



Classification depends on composition and particle distribution—not appearance alone.

1.2 Mixtures: components together without new fixed identity

A mixture contains two or more substances physically combined. Each component largely retains its properties; proportions may vary; and components can usually be separated by physical methods chosen from differences such as particle size, density, solubility, boiling point, magnetic behaviour or ability to sublime. “Physical method” may still require heating—it means no intended formation of a new substance.

Basis	Homogeneous mixture	Heterogeneous mixture
Distribution	Uniform at the scale considered	Non-uniform; distinct regions/phases
Boundary	No visible component boundary	Boundary or different regions may be observed
Examples	Air, salt solution, brass	Soil, oil–water, granite, muddy water
Sampling	Small samples usually have same composition	Different portions may have different composition
Important caution	Can still contain many substances	Some colloids appear uniform to the eye

Activity 2.2: Preparing four mixtures

QUESTION

How do salt, chalk/soil, starch and oil behave in water?

Part	Details
Materials/apparatus	Four beakers, water, salt, chalk/soil, starch, oil, rods, filter paper.
Procedure	Add equal small quantities separately; stir equally. Observe immediately, after standing and after filtration. Shine a narrow beam where safe.

Expected observation	Salt remains clear; soil/chalk settles and filters; starch scatters light; oil forms a separate layer or emulsion temporarily.
Scientific inference	Mixtures differ in particle size, stability, miscibility and light scattering.
Safety/quality note	Do not look directly into a laser; use a torch or supervised low-power beam.

1.3 Solutions—Homogeneous Mixtures at Particle Scale

A solution is a homogeneous mixture of two or more substances. The component present in larger amount or determining the physical state is usually the solvent; the other component is the solute. The terms describe roles, not importance.

Solution type	Solute	Solvent	Example
Solid in liquid	Salt/sugar	Water	Brine/syrup
Liquid in liquid	Acetic acid	Water	Vinegar
Gas in liquid	Carbon dioxide	Water	Carbonated water under pressure
Gas in gas	Oxygen and others	Nitrogen mainly	Air
Solid in solid	Zinc	Copper	Brass
Gas in solid	Hydrogen	Palladium	Hydrogen in palladium (concept example)

An aqueous solution uses water as solvent; a non-aqueous solution uses another solvent. Soluble and insoluble are relative terms: amount, temperature and solvent matter. Salt dissolves in water but not appreciably in oil; grease may dissolve in an organic cleaning solvent but not in water. “Like dissolves like” is a useful later-level guide, not a substitute for experimental evidence.

PARTICLE PICTURE

Solution particles are molecular/ionic in scale, do not settle, pass through ordinary filter paper and are too small to scatter a visible beam strongly. Filtration cannot remove dissolved salt because both solvent and solute pass through the pores.

Activity 2.3: Can dissolved salt be filtered?

QUESTION

Does invisibility mean the solute has disappeared?

Part	Details
Materials/apparatus	Salt solution, funnel, filter paper, evaporating dish, heat source.
Procedure	Filter salt solution; collect filtrate. Evaporate a small portion carefully.

CHAPTER 1

DESCRIBING MOTION AROUND US

Complete 2026–27 CBSE/NCERT-aligned descriptive textbook chapter

CHAPTER MYSTERY

When you sit inside a moving train, the bag beside you seems at rest—but the same bag is racing past a person on the platform. Can one object be both at rest and in motion? Physics begins by asking: relative to whom?

What you will master

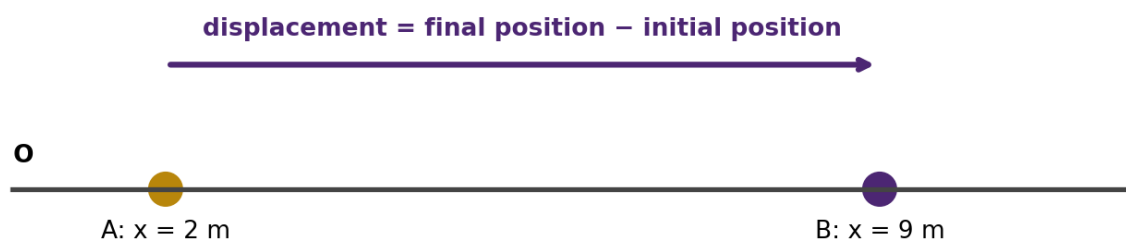
- Recognise motion as a change of position relative to a reference point.
- Distinguish distance from displacement and speed from velocity.
- Describe uniform and non-uniform motion and calculate averages correctly.
- Understand acceleration, retardation and sign conventions.
- Plot and interpret position–time and velocity–time graphs.
- Derive all three equations of uniformly accelerated motion graphically.
- Solve multi-step numerical problems with units and physical reasoning.
- Derive the speed of uniform circular motion and explain why it is accelerated motion.
- Plan and interpret the prescribed inclined-plane graph investigation.

1. Motion Begins with a Reference Point

Physics becomes easy when every word is tied to an observation. Motion does not mean “moving fast”; it means that position changes with time relative to a chosen reference.

Imagine a passenger sitting in a bus. Relative to the seat, the passenger’s position does not change, so the passenger is at rest. Relative to a tree outside, the passenger’s position changes continuously, so the passenger is in motion. Neither statement is wrong; each uses a different reference frame.

A reference point and positive direction give meaning to position



Term	Simple meaning	Example
Reference point	A chosen point from which position is measured	School gate, kilometre stone, origin O
Position	Location relative to the reference point	5 m east of O
Rest	Position does not change with time relative to reference	Student seated relative to classroom
Motion	Position changes with time relative to reference	Student walking relative to classroom

HOW TO REMEMBER

MOTION = position CHANGES with TIME relative to a REFERENCE. Always ask: “relative to what?”

Types of paths around us

- Rectilinear motion: movement along a straight path—an elevator or trolley on a straight track.
- Circular motion: movement along a circular path—a clock hand or stone tied to a string.
- Rotational motion: an object turns about its own axis—a fan or spinning top.
- Oscillatory motion: repeated to-and-fro movement about a mean position—a swing.
- Random motion: unpredictable changing direction—dust particles in air.

SCOPE NOTE

This chapter develops mathematical descriptions mainly for motion in a straight line in one direction, exactly as required in the 2026–27 syllabus.

2. Distance and Displacement — Path versus Change in Position

This pair causes confusion only when definitions are memorised without drawing the journey. Draw the path, mark the start and finish, then the difference becomes obvious.

Distance travelled

Distance is the total length of the actual path covered by an object. It is a scalar quantity: it has magnitude but no direction. Distance is never negative and normally increases as the journey continues. SI unit: metre (m).

Displacement

Displacement is the change in position from the initial point to the final point, measured along the shortest straight line and supplied with direction. In one dimension, displacement $\Delta x = x_2 - x_1$. It is a vector quantity. Its sign represents direction after a positive direction is chosen.

Feature	Distance	Displacement
Meaning	Actual path length	Straight-line change from initial to final position
Type	Scalar	Vector
Direction	Not required	Essential
Possible value	Positive or zero	Positive, negative or zero
Round trip	Non-zero if travelled	Zero if final position equals initial
Relation	Always $\geq$ magnitude of displacement	Magnitude always $\leq$ distance

Solved Example 2.1 — Foundation

QUESTION

Riya walks 60 m east and then 25 m west. Find distance and displacement.

1. Choose east as positive.
2. Distance = $60 + 25 = 85$ m.
3. Displacement = $+60 - 25 = +35$ m. Positive means east.

FINAL ANSWER

Distance = 85 m; displacement = 35 m east.

Solved Example 2.2 — Application

QUESTION

A runner completes one full lap of a circular track of radius 35 m. Find distance and displacement.

1. Distance = circumference = $2\pi r = 2 \times 22/7 \times 35 = 220$ m.
2. The runner finishes at the starting point. Initial and final positions are identical.

FINAL ANSWER

Distance = 220 m; displacement = 0 m.

Solved Example 2.3 — HOTS**QUESTION**

An ant moves 3 m east and then 4 m north. Find distance and magnitude of displacement.

1. Distance = $3 + 4 = 7$ m.
2. The straight-line displacement is the hypotenuse of a right triangle.
3. $|\text{displacement}| = \sqrt{(3^2 + 4^2)} = 5$ m.

FINAL ANSWER

Distance = 7 m; displacement magnitude = 5 m toward north-east.

MISTAKE ALERT

Displacement is not “distance with direction.” It ignores the route and compares only the final position with the initial position.

3. Speed — How Fast Is the Path Covered?

Speed tells how quickly distance is covered. Average speed is total distance divided by total time. It is not generally the arithmetic mean of two speeds because the time spent at each speed may differ.

FORMULA

Average speed = total distance travelled $\div$ total time taken. SI unit: m/s. Common unit: km/h.

Uniform and non-uniform speed

An object has uniform speed if it covers equal distances in equal intervals of time, however small those intervals may be. It has non-uniform speed if it covers unequal distances in equal time intervals or equal distances in unequal time intervals. A car's speedometer shows instantaneous speed—the speed at that moment.

Conversion	Rule	Reason
km/h $\rightarrow$ m/s	multiply by $5/18$	$1000 \text{ m} \div 3600 \text{ s} = 5/18$
m/s $\rightarrow$ km/h	multiply by $18/5$	inverse conversion

Solved Example 3.1 — Foundation**QUESTION**

A cyclist covers 1500 m in 5 minutes. Find average speed in m/s and km/h.

1. Convert time: $5 \text{ min} = 300 \text{ s}$.

CHAPTER 1

The Fundamental Unit of Life

Complete learning chapter

How to use this chapter

- Begin each topic with the real-life question.
- Study structure and function together: shape solves a job.
- Redraw diagrams with clean labels and explain every arrow.
- Perform activities through aim, apparatus, method, observation, inference and precaution.
- Use memory hooks only after understanding the mechanism.
- Finish with HOTS, cases, data and model-building tasks.

2026–27 SYLLABUS COMPASS Discovery; plant, animal, prokaryotic and eukaryotic cells; cell as structural and functional unit; organelles; membrane permeability; diffusion and osmosis; mitosis, meiosis and cancer; biomolecules; recent advances; mitochondrial dysfunction; Indian contribution; artificial-cell inquiry.

1. A hidden world inside a leaf

Every visible organism is built from microscopic living units.

A leaf feels like one object, yet it contains millions of cells arranged into tissues. Each cell manages a boundary, obtains matter, transforms energy, follows genetic instructions, removes wastes and may reproduce. The cell is the smallest unit capable of performing the essential activities of life.

ENGAGEMENT CHALLENGE If cells are microscopic, how can a tree become taller than a building? Growth occurs mainly by cell division followed by enlargement and specialisation.

2. Discovery of the cell

A new instrument created a new science.

Cell discovery: knowledge grew with better microscopes

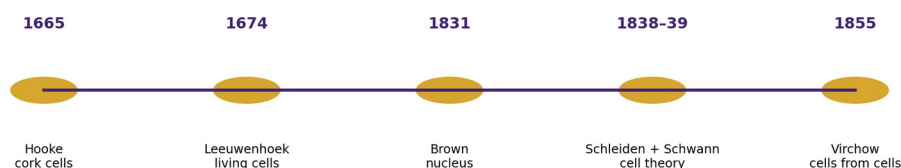


Figure 1. Milestones in cell discovery.

Robert Hooke examined a thin slice of cork in 1665 and saw box-like empty compartments, which he called cells. Cork cells were dead; he mainly saw their walls. Antonie van Leeuwenhoek later observed living

microorganisms. Robert Brown described the nucleus. Schleiden and Schwann proposed that plants and animals are made of cells, and Virchow emphasised that new cells arise from pre-existing cells.

3. Cell theory—and its modern meaning

Three statements unite enormous biological diversity.

1. All living organisms are composed of one or more cells.
2. The cell is the basic structural and functional unit of life.
3. All new cells arise from pre-existing cells.

Modern cell theory adds that hereditary information passes during division, energy flow occurs within cells and cells share a broadly similar chemical basis. The first cell's origin is studied through origin-of-life science; “cells come from cells” describes present biological continuity.

4. Seeing cells with a microscope

Magnification enlarges; resolution separates detail.

Compound light microscope (schematic)

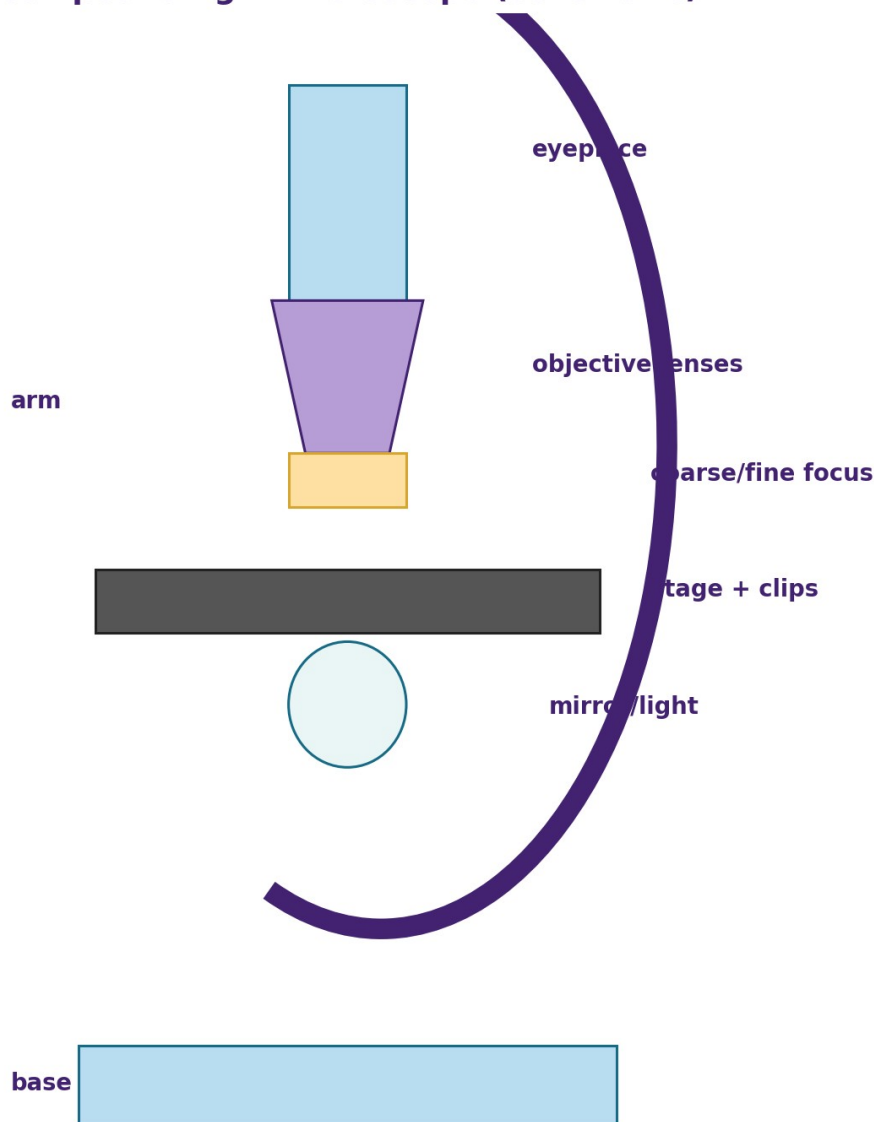


Figure 2. Main parts of a compound microscope.

Part	Function
Eyepiece	magnifies the image formed by objective
Objective lenses	primary magnification and resolution
Stage/clips	support and hold slide
Diaphragm/condenser	control/focus illumination
Coarse focus	large movement; low power only
Fine focus	sharpens image, especially high power
Mirror/lamp	provides light

5. Microscope calculations and safe use

Total magnification = eyepiece × objective.

A 10× eyepiece with a 40× objective gives 400× total magnification. Begin with the lowest-power objective, centre the specimen, use coarse focus, then fine focus. On high power use fine focus only. The image appears inverted, so moving the slide left makes the image appear to move right.

MEMORY: L-C-F-H-F Low power → Centre → coarse Focus → Higher power → Fine focus.

6. Cell size, shape and function

There is no single “typical” cell shape.

Cell	Adaptation to function
Neuron	long processes transmit information over distance
Red blood cell	biconcave, flexible; large exchange surface
Root-hair cell	long projection increases absorption area
Muscle fibre	elongated, packed with contractile machinery
Sperm	streamlined head, energy-rich middle piece, motile tail
Guard cells	shape changes open/close stomatal pore

Most cells are microscopic because a high surface-area-to-volume ratio improves exchange and because information/control distances remain short. A large cell needs special adaptations, such as the huge food-filled ostrich egg or the long axon of a neuron.

7. Unicellular and multicellular organisation

One cell can do everything—or cells can divide the labour.

Unicellular	Multicellular
one cell performs all life functions	many specialised cells cooperate
Amoeba, bacteria, yeast	plants, animals, most fungi
growth mainly by cell enlargement/division	growth mainly by increasing cell number and size
damage to the cell threatens whole organism	loss of some cells may be repaired

LEVELS Cell → tissue → organ → organ system → organism.

8. Prokaryotic and eukaryotic cells

The major difference is internal compartmentalisation.

Prokaryotic cell: small, complete and highly organised

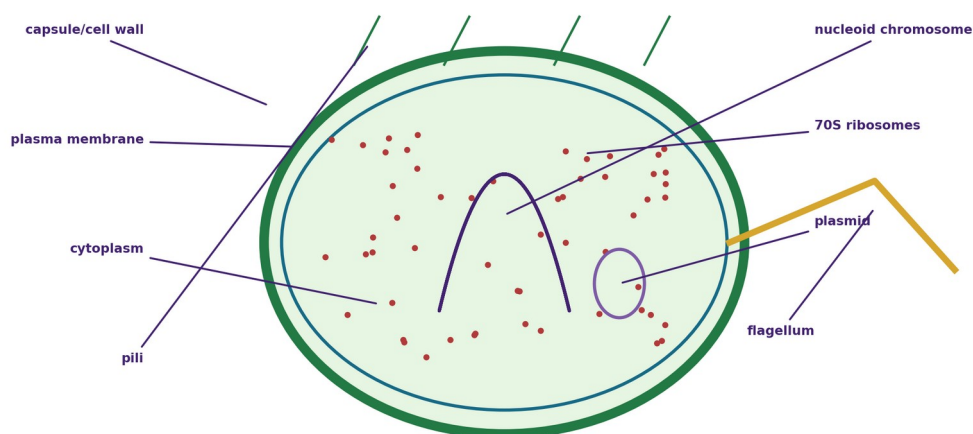


Figure 3. A bacterial prokaryotic cell.

Feature	Prokaryote	Eukaryote
Nucleus	no membrane-bound nucleus; nucleoid	true nucleus with envelope
DNA	usually circular main	linear chromosomes

Explore the complete Class 9 books

The full books include deeper theory, solved examples, MCQs, CBSE-style practice,

[View Science & Chemistry Books](#)

[Ask Class 9 Availability on WhatsApp](#)