PREMIUM STUDY NOTES

Exploring Mixtures and Their Separation

Class 9 Science • Chapter 5

Board	**CBSE**
Session	**2026–2027**
Book	**NCERT Exploration**
Category	**Coaching Institute Grade**

> *"Most substances around us are mixtures of two or more pure forms of matter. This chapter explores defining, classifying, and separating mixtures using physical property contrasts."*

Chapter Overview

Learning Objectives

- Understand the difference between pure substances and mixtures.
- Classify mixtures into homogeneous and heterogeneous categories.
- Distinguish solutions, suspensions, and colloids clearly.
- Master separation techniques based on physical properties.
- Solve concentration and solubility numericals accurately.

Importance in Exams & Real Life

High-weightage chapter frequently tested on Tyndall effect, separation flowcharts, and mass percentage calculations. Used extensively in municipal water treatment, dairy processing, and laboratory purification.

Complete Theory & Topic-Wise Breakdown

1. Mixtures

DEFINITION A mixture is a system formed by more than one kind of pure form of matter, mixed in any proportion without chemical combination.

Key Points: Components retain original properties; can be separated by physical methods; no fixed melting or boiling points.

Real-life Example: Air, Lemonade, Brass.

Exam Tip: Remember air is a mixture because composition varies slightly and components can be separated by fractional distillation of liquid air.

Common Mistake: Thinking mixtures must be liquid. They can exist in solid, liquid, or gaseous states.

2. Homogeneous & Heterogeneous Mixtures

⭐ BOARD IMPORTANT **Homogeneous:** Uniform composition throughout with no visible boundaries (e.g., salt water).
Heterogeneous: Non-uniform composition with distinct boundaries (e.g., oil and water).

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Matter
 ├── Pure Substances (Elements, Compounds)
 └── Mixtures
      ├── Homogeneous (Uniform, e.g., Alloys, Air)
      └── Heterogeneous (Non-uniform, e.g., Suspensions, Soil)
```

Feature	Homogeneous Mixture	Heterogeneous Mixture
Composition	Uniform throughout	Non-uniform throughout
Visible Boundaries	None	Present
Examples	Sugar solution, Brass	Iron filings + Sulphur, Chalk water

3. Solutions, Solute, and Solvent

DEFINITION A solution is a homogeneous mixture of two or more substances. The *solute* is dissolved in the *solvent*.

Key Points: Particle size is extremely small ($< 1 ext{ nm}$); does not scatter light (no Tyndall effect).

Real-life Example: Tincture of iodine, Carbonated drinks.

Exam Tip: Alloys like brass (30% Zn, 70% Cu) are solid solutions. Be ready to identify solute and solvent in alloys.

4. Concentration & Solubility

⭐⭐ VERY IMPORTANT Concentration measures the amount of solute dissolved in a given amount of solution/solvent.

$$\text{Mass \%} = \left(\frac{\text{Mass of Solute}}{\text{Mass of Solution}}\right) \times 100$$

Solved Numerical: A solution contains 40 g of common salt in 320 g of water. Calculate mass percentage.

Solution: Mass of solution = $40 + 320 = 360\text{ g}$. Concentration = $(40 / 360) \times 100 = 11.1\%$.

5. Solution vs Suspension vs Colloid

Property	True Solution	Colloid	Suspension
Nature	Homogeneous	Heterogeneous (Apparent)	Heterogeneous
Particle Size	$< 1\text{ nm}$	1 nm - 100 nm	$> 100\text{ nm}$
Tyndall Effect	Does not show	Shows clearly	May block/scatter
Stability	Highly stable	Stable	Unstable (settles down)

6. Separation Techniques

⭐ MOST EXPECTED Separation methods depend on physical property differences:

- **Crystallisation:** Solubility differences. Used to purify sea salt.
- **Distillation / Fractional Distillation:** Boiling point differences. Used for petroleum fractions and liquid air.
- **Paper Chromatography:** Adsorption/Solubility rates. Used for dye pigments.
- **Sublimation:** Sublimable components (e.g., Ammonium chloride + Salt).
- **Centrifugation:** Density differences under rotation (e.g., Cream from milk).

Quick Revision & Mnemonics

Mnemonic for Colloidal Systems: *S-F-E-A* (Sol, Foam, Emulsion, Aerosol) — Think of *Super Fast Electron Accelerator*.

Key Takeaways: Always verify mass of solution = solute + solvent before calculating percentage. Remember that milk is an emulsion, fog is an aerosol.