Chapter 2 – Is Matter Around Us Pure? (Premium Detailed Notes)

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1. Introduction

Everything around us is made of matter, but not all matter is pure. Many substances we encounter in daily life, like water, air, and milk, are mixtures containing more than one component. This chapter helps us understand the difference between pure substances and mixtures and how matter is classified into elements, compounds, and mixtures.

We also learn about different types of mixtures, such as solutions, suspensions, and colloids, and their properties. The chapter introduces simple methods to separate mixtures, like filtration, evaporation, distillation, and chromatography, which are useful in everyday life and scientific experiments.

By studying this chapter, students gain a clear understanding of how matter is structured, classified, and purified, forming a strong foundation for learning chemistry.

Key Points:

- ***Pure substances vs. mixtures***
- ***Elements, compounds, and mixtures***
- ***Types of mixtures: solutions, suspensions, colloids***
- ***Separation techniques and their applications***

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2. Types of Substances

A. Pure Substances

A pure substance is made of only one type of particle and has a fixed composition. It cannot be separated into other substances by physical methods. Pure substances can be classified into elements and compounds.

Key Features of Pure Substances:

- ***Uniform Composition → Every sample has the same chemical composition.***
- ***Definite Properties → Melting point, boiling point, density, and other physical properties are fixed.***
- ***Cannot be Separated Physically → Requires chemical methods to break down compounds into simpler substances.***

Examples:

- ***Elements: Oxygen (O_2), Hydrogen (H_2), Gold (Au) – made of only one type of atom.***
- ***Compounds: Water (H_2O), Carbon dioxide (CO_2), Sodium chloride (NaCl) – made of two or more elements chemically combined.***

B. Impure Substances (Mixtures)

An impure substance contains two or more different types of particles mixed together, either uniformly or non-uniformly. Impure substances can be separated into their components using physical methods.

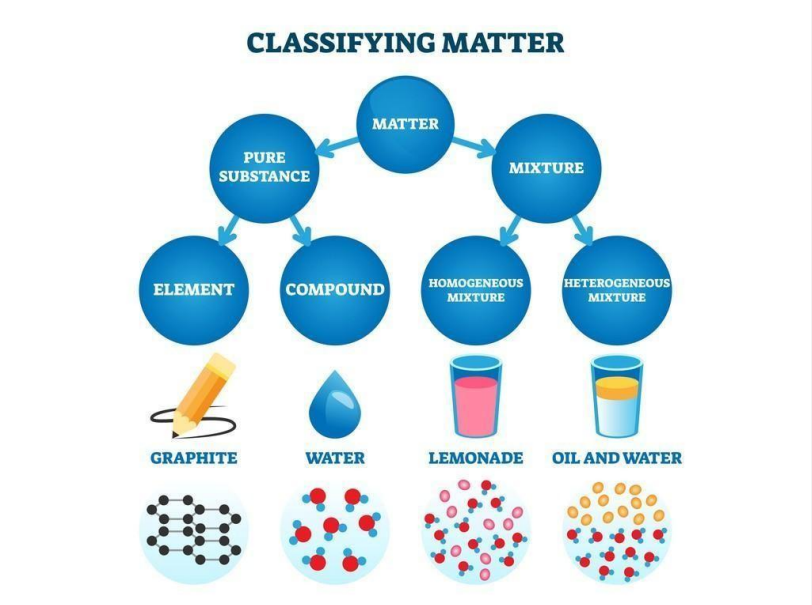
Key Features of Impure Substances:

- ***Variable Composition → The ratio of components can change.***
- ***Properties Vary → Physical properties like melting point or boiling point may not be fixed.***
- ***Can be Separated Physically → Methods include filtration, evaporation, distillation, etc.***

Examples:

- ***Homogeneous Mixtures (Uniform): Salt solution, sugar in water.***

- ***Heterogeneous Mixtures (Non-uniform): Sand in water, oil and water mixture.***



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2. Types of Mixtures

A.Homogeneous Mixtures

A homogeneous mixture has a uniform composition throughout. You cannot see the individual components because they are evenly mixed at the molecular level.

Key Features:

- ***Uniform composition in every part of the mixture.***
- ***Components are evenly distributed.***
- ***Cannot be separated by simple sight; physical methods like distillation or evaporation are needed.***

Examples:

- ***Salt dissolved in water***
- ***Sugar in water***

- *Air (mixture of gases like nitrogen, oxygen, etc.)*

B. Heterogeneous Mixtures

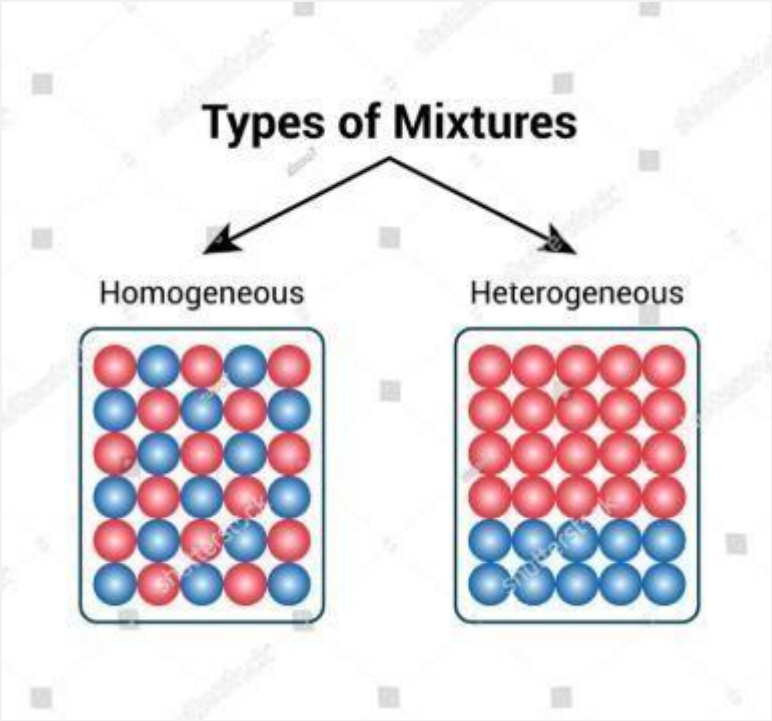
A heterogeneous mixture has a non-uniform composition. You can see the different components with the naked eye or under a microscope.

Key Features:

- ***Non-uniform composition; different parts have different properties.***
- ***Components are not evenly distributed.***
- ***Can be separated easily by simple physical methods like filtration or sedimentation.***

Examples:

- ***Sand in water***
- ***Oil and water mixture***
- ***Salad, soil, or cereals***



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4. Solutions

A solution is a type of homogeneous mixture in which one substance is completely dissolved in another. Solutions can exist in solid, liquid, or gaseous states, but the most common are liquid solutions.

Key Features of Solutions:

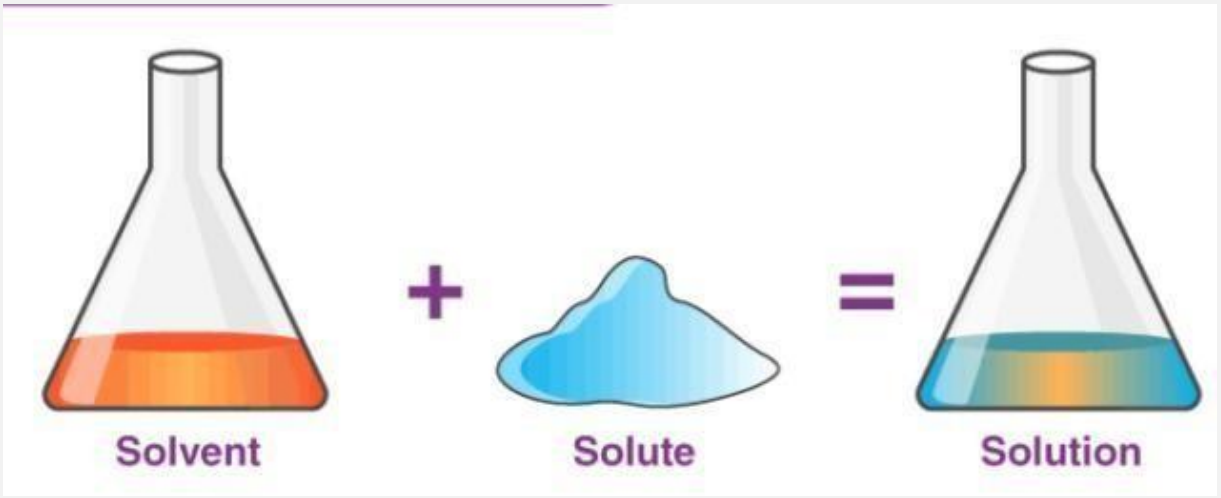
- ***Uniform Composition: The solute is evenly distributed throughout the solvent.***
- ***Clear Appearance: Usually transparent, although some solutions may be colored.***
- ***Cannot be Separated by Filtration: Since the solute is completely dissolved, simple filtration won't separate it.***
- ***Stable Mixture: The solute does not settle down on standing.***

Components of a Solution:

1. ***Solvent:*** ***The substance in which the solute is dissolved. Usually present in a larger amount.*** ○ ***Example: Water in sugar solution.***

2. ***Solute:*** ***The substance that is dissolved in the solvent. Usually present in a smaller amount.***

    ○ ***Example: Sugar in sugar solution.***



Types of Solutions:

- ***Solid in Liquid: Sugar in water, salt in water***

- *Liquid in Liquid: Alcohol in water, vinegar in water*
- *Gas in Liquid: Carbon dioxide in soda*
- *Gas in Gas: Air (mixture of oxygen, nitrogen, and other gases)*

Properties of Solutions:

- *Transparent and uniform*
- *Components cannot be separated by filtration*
- *Solute may change properties of solvent (like boiling point, freezing point)*

Examples in Daily Life:

- *Salt water – solid dissolved in liquid*
- *Tea or coffee – solid or liquid dissolved in hot water*
- *Soft drinks – gas dissolved in liquid*

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5. Concentration of a Solution

- *Mass by mass % = (Mass of solute / Mass of solution) × 100*
- *Mass by volume % = (Mass of solute / Volume of solution) × 100*

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6. Suspensions

Definition: Heterogeneous mixtures in which solid particles are dispersed in a liquid or gas.

Properties:

- ***Particles are visible.***
- ***Can be separated by filtration.***
- ***Scatter light (Tyndall effect present).***
- ***Unstable—particles settle on standing.***

Example: Chalk powder in water.

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7. Colloids

Definition: Heterogeneous mixture where particle size is between that of a solution and suspension.

Properties:

1. ***Components cannot be separated by filtration.***
2. ***Scatter light (Tyndall effect present).***
3. ***Stable—do not settle on standing.***
4. ***Appear homogeneous to naked eye, but heterogeneous under a microscope.***

Examples: Milk, Fog, Gel.

Types of Colloids (based on dispersed phase and medium):

Disperse Phase	Dispersion Medium	Type	Example
Gas	Liquid	Foam	Shaving Cream
Gas	Solid	Solid Foam	Foam rubber
Liquid	Gas	Aerosol	Fog, mist, clouds
Liquid	Liquid	Emulsion	Hair, cream, milk
Liquid	Solid	Solid Emulsion (gel)	Butter, Cheese
Solid	Gas	Smoke	Dust
Solid	Liquid	Sol	Ink, paint
Solid	Solid	Solid Sol	Alloys, ruby glass

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8. Separation of Mixtures

A. Physical Methods:

1. ***Filtration – Separate insoluble solids from liquids (sand from water).***
2. ***Evaporation – Separate dissolved solids from liquids (salt from water).***

3. ***Distillation – Separate liquids with different boiling points (water from alcohol).***

4. ***Fractional Distillation – Separate miscible liquids with close boiling points (petroleum refining).***

5. ***Centrifugation – Separate suspended particles from liquids using highspeed spinning (cream from milk).***

6. ***Chromatography – Separate different components from a mixture (pigments in ink).***

7. ***Magnetic Separation – Remove magnetic substances from non-magnetic ones (iron from sand).***

8. ***Sublimation – Separate substances that sublime (camphor, naphthalene).***

B. Purification of Drinking Water:

- ***Sedimentation → Filtration → Chlorination.***

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9. Pure Substances vs Mixtures

- ***Composition:***
  - ***Pure substances have a fixed composition.***
  - ***Mixtures have a variable composition.***
- ***Types:***
  - ***Pure substances include elements and compounds.***
  - ***Mixtures include homogeneous and heterogeneous mixtures.***
- ***Properties:***
  - ***Pure substances have constant physical and chemical properties.***
  - ***Mixtures' properties depend on the components and their proportions.***
- ***Separation:***

- ***Pure substances cannot be separated by physical methods.***
- ***Mixtures can be separated by physical methods like filtration, evaporation, or distillation.***

 Uniformity:

- ***Pure substances are uniform throughout.***
- ***Mixtures may be uniform (homogeneous) or non-uniform (heterogeneous).***

 Examples:

- ***Pure substances → Water (H_2O), Oxygen (O_2), Gold (Au)***
- ***Mixtures → Salt solution, sugar solution, sand in water, oil and water***

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10. Elements & Compounds

- ***Element: Substance made of only one type of atom (O_2, Fe).***
- ***Compound: Pure substance made of two or more elements chemically combined in fixed ratio (H_2O, CO_2).***

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11. Key Diagrams to Include

- ***Flow chart: Classification of matter → Pure substances & Mixtures.***
- ***Table: Differences between Solution, Suspension & Colloid.***
- ***Process diagram: Separation techniques (Filtration, Distillation, Chromatography).***

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12. Summary (Exam-Ready)

- ***Matter → Pure substances & Mixtures.***

- ***Pure substances → Elements & Compounds.***
- ***Mixtures → Homogeneous & Heterogeneous.***
- ***Solutions: No Tyndall effect, stable.***
- ***Colloids: Tyndall effect present, stable.***
- ***Suspensions: Tyndall effect present, unstable.***
- ***Separation techniques depend on physical properties like particle size, solubility, and boiling point.***