Is Matter Around Us Pure

- **Mixture**

1. Mixtures refer to those substances which consist of two or more elements or compounds, mixed together in any ratio and do not give rise to new compound. For example: sea water, air, chocolate milk etc.

2. Mixture is composed of two or more substances mixed together in any ratio i.e. the composition is variable and do not possess properties like fixed melting or boiling point.

3. Mixture shows the properties similar to that of its constituents and they can be separated by using physical and chemical methods.

4. There are two types of mixtures:
   i. Homogeneous mixtures: Such mixtures have only one phase. They have the same composition throughout and there is no visible separation of line between the constituents. For example: sugar solution, vinegar etc.

   ii. **Heterogeneous mixture:** Mixtures which has more than one phase is known as heterogeneous mixture. There is a visible boundary of separation between the components and they do not have the same composition throughout.

5. Homogeneous mixtures are of three types: (i) Solid homogeneous mixture (alloys), (ii) Liquid homogeneous mixture (solution of alcohol in water) and (iii) Gaseous homogeneous mixture (air).

6. Heterogeneous mixtures are of three types: (i) Solid heterogeneous mixture (mixture of sand and sugar), (ii) Solid-liquid heterogeneous mixture (solution of chalk in water) and (iii) Gaseous heterogeneous mixture (smoke in air).

- **Substance** – Cannot be separated into its constituent particles by any physical process
- **Solution –** Homogeneous mixture of two or more substances
- **Alloys** – Homogeneous mixture of metals

Solution:

- The component of the solution that dissolves the other component in it is called solvent (present in larger amount).
- The component of the solution that is dissolved in the solvent is called solute (present in lesser quantity).

- **Properties of solution:**

- Homogeneous mixture
- Particles are extremely small, not visible to the naked eye
- Light path not visible
- Solute particles cannot be separated by filtration

- **Concentration of solution**= Solute amount / Solvent amount

- Mass by mass percentage = $\frac{\text{Solute mass}}{\text{Solution mass}} \times 100$
- Mass by volume percentage = $\frac{\text{Solution mass}}{\text{solution volume}} \times 100$

Expressing Concentration of Solutions

- Mass percentage (w/w)

  Mass % of a component = $\frac{\text{Mass of the component in the solution}}{\text{Total mass of the solution}} \times 100\%$
- Volume percentage (v/v)

  Volume % of a component = $\frac{\text{Volume of the component}}{\text{Total volume of solution}} \times 100\%$
- Mass by volume percentage (w/v)

  ss by volume % = $\frac{\text{Mass of the solute}}{\text{Total volume of solution}} \times 100\%$

- Parts per million (ppm)

  Parts per million

  $= \frac{\text{Number of parts of the component}}{\text{Total number of parts of all the components of the solution}} \times 10^6$

- Mole fraction (x)

  Mole fraction of a component

  $= \frac{\text{Number of moles of the component}}{\text{Total number of moles of all the components}}$

For solution containing *i* number of components,

$$x_i = \frac{n_i}{n_1 + n_2 + n_3 + ... + n_i} = \frac{n_i}{\sum n_i}$$

And, $x_1 + x_2 + x_3 + ... + x_i = 1$

- Molarity (M)

$$\text{Molarity} = \frac{\text{Moles of solute}}{\text{Volume of solution in litre}}$$

- Molality (*m*)

$$\text{Molality} = \frac{\text{Moles of solute}}{\text{Mass of solvent in kg}}$$

- **Suspension**

  - Heterogeneous mixture of solids and liquids
  - Solid particles suspend throughout the medium

- **Properties**

  - Heterogeneous mixture
  - Particles visible by the naked eye
  - Light path visible
  - Particles settle down
  - Solute particles can be separated by filtration

- **Example –** sand in water

- **Properties of a colloid**

  - Heterogeneous mixture
  - Particle size is small, not visible to the naked eye
  - Light path can be visible
  - Particles do not settle down
  - Substances cannot be separated by filtration

- Colloids are classified according to the states of the **dispersion medium** and the **dispersed phase**.

		Dispersed Phase		
		Solid	Liquid	Gas
	Solid	**Solid sol**	**Gel**	**Foam**

Dispersion Medium		Coloured gemstone, ruby glass	Cheese, jelly	Sponge, foam, rubber
	Liquid	**Sol** Mud, milk of magnesia	**Emulsion** Milk, cream	**Foam** Shaving cream
	Gas	**Aerosol** Smoke, automobile exhaust	**Aerosol** Fog, cloud	**None** All gases are soluble

Colloids can be classified on the nature of interaction between the dispersed phase and dispersion medium:
1. Hydrophilic colloids
2. Hydrophobic colloids

- **Tyndall effect –** Scattering of the light beam by suspended particles in the solution

- **Example** – milk

- **Separation process**

- **Evaporation –** For mixture of volatile solvents and non-volatile solutes
- **Centrifugation –** Cream from milk

- Uses

  - In diagnostic laboratories for blood and urine tests
  - In dairies and homes for separation of butter from milk
  - For drying wet clothes

- **Separating funnel –** Immiscible liquids are separated out in layers (oil and water, slag in iron extraction)

- **Sublimation process**

  - Sublime solids
  - Ammonium chloride
  - Camphor
  - Naphthalene
  - Anthracene

- **Chromatography –** To separate those solutes that dissolve in the same solvent
  - To separate
  - Colours in dye
  - Pigments from natural colour

- Drugs from blood

- **Distillation –** To separate two miscible liquids that boil without decomposition (acetone + water)

- **Fractional distillation**

- When the boiling temperature difference is less than 25 K
- (Different factions from petroleum products)
- Air components are separated by fractional distillation

- **Crystallization –** Process to separate pure solids from a solution by forming crystal (copper sulphate from an impure sample)

- Uses – Purification of salt
- Separation of alum from an impure sample

- **Solvent extraction** – Process to separate substances using an appropriate solvent based on the soluble nature of the components of mixture (salt + sand)

- **Physical Change**

- Changes which involve a change in the physical properties of a substance.
- Formation of a new substance does not take place during a physical change.
- Most physical changes can be reversed easily
- The chemical composition of the substance undergoing a physical change remains the same.

- **Chemical Change**

- Changes which involve a change in the chemical composition of a substance, undergoing the change
- Formation of one or more new substances takes place during a chemical change.
- Most chemical changes can not be reversed easily.
- The chemical composition of the substance undergoing a chemical change does not remain the same
- Chemical changes are always accompanied by a change in energy

Mixture	Compound
No new compound	New compound
Elements or compounds mix	Elements react
Properties of constituents remain unchanged	New substance has totally new properties

A constituent can be separated easily by physical methods	Can be separated by chemical methods or electrolysis

Pure substance can be classified as **elements** or **compounds**.
Element: The basic form of matter that cannot be broken down into simpler substances by chemical reactions'.

Elements can be further classified as metals, non-metals, metalloids and noble gases.
Compound: Compounds are formed when two or more elements combine chemically in a fixed proportion.