

# Elements, Compounds and Mixtures

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.

- **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 |

- **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

- **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 fractions 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)