

## 14. Elements, Compounds and Mixtures

- **Characteristics of matter particles**

- Atoms are the smallest possible units of the matter which combine to form molecule.
- There are spaces between matter particles.
- Matter particles move continuously – movement increases with rising temperature.
- Matter particles attract each other – attraction force is highest in solids > liquids > gases.

- **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.

**Chemical Symbols**



- Jöns Jacob Berzelius suggested that letters of the alphabet can be used as symbols to represent the elements.
  - The International Union of Pure and Applied Chemistry (IUPAC) approves the names and symbols for the elements.
  - Rules are followed while writing the symbol of elements.
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- A mixture is formed when two substances are mixed in any proportion. For example, a mixture is obtained when sugar and water are mixed together.
  - Separation of different components of a mixture is done to separate harmful components or sometimes useful components from a mixture.
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- **Different methods of separation of mixtures:**
    - In the mixture of sand and water, the heavier sand particles settle at the bottom by the process of **sedimentation**.
    - Water is then removed (from the mixture of sand and water after sedimentation) by the process of **decantation**.
    - **Filtration:** It is used to separate the components of a mixture of an insoluble solid and a liquid.
    - **Evaporation:** It is the process of conversion of liquid into its vapour. It can be used to separate a solid dissolved in water. Salt can be separated from sea water by the process of evaporation.
    - **Condensation:** It is the process of conversion of water vapour into its liquid form.
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- **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)

