

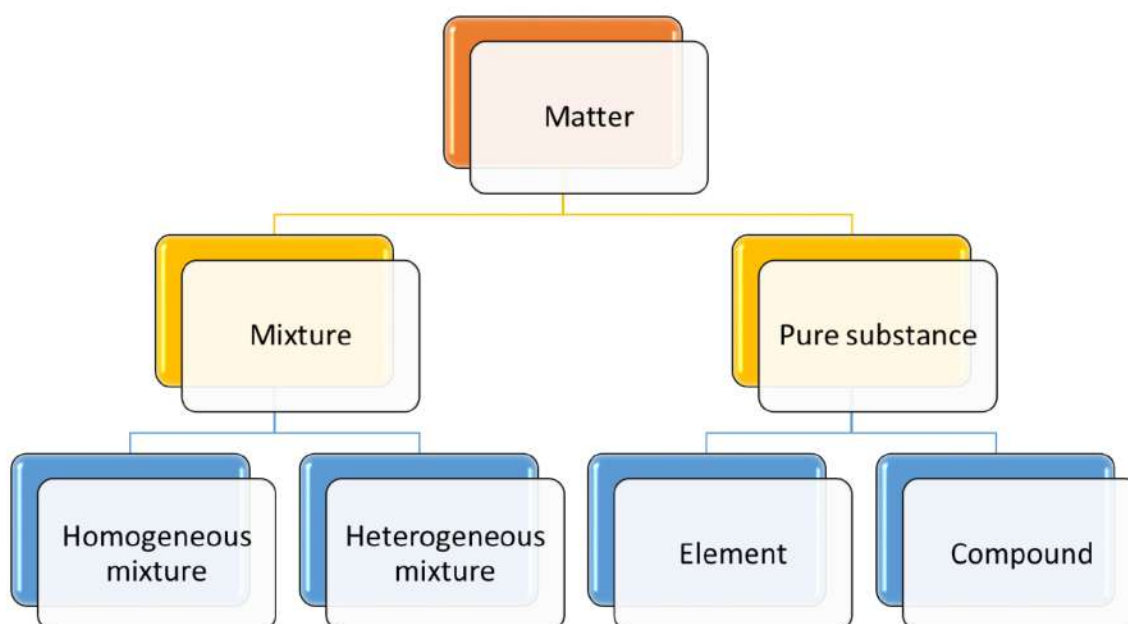
Chapter – 2

Is Matter around us Pure

Introduction to Matter

♦ Matter:

The substance which has mass and occupies a certain space is called matter. The matter can be divided into two types:



What is a Mixture?

⇒ The mixture is formed by combining two or more substances in which each substance retains its characteristics.

⇒ There are two types of mixture, homogeneous and heterogeneous.

(a) Homogeneous Mixture:

The mixture which has the same proportions of its components throughout the mixture is called a homogeneous mixture. For example, the air is a homogeneous mixture because it contains mixtures of different gases like nitrogen gas, oxygen gas, and so on.

(b) Heterogeneous Mixture:

The mixture which has the varied proportions of its components throughout the mixture is called a heterogeneous mixture. For example, the soil is a heterogeneous mixture that consists of pebbles, sand, and plant matter which remain separate in the mixture.

Homogeneous Mixture	Heterogeneous Mixture
The constituents are mixed uniformly.	The constituents are not mixed uniformly.
The components cannot be easily seen.	The components can be easily seen.
The components cannot be separated by filtration.	The components cannot be separated by filtration.
For example, sugar solution, soda water	For example, Milk, blood

What is Solution?

⇒ The solution is defined as the substance in which two or more substances are completely dissolved into each other and cannot be filtered out.

⇒ The solution is a special type of homogenous mixture in which only one type of phase is present. For example, lemonade is a solution.

⇒ The properties of a solution are shown below:

- It is a homogeneous mixture.
- The particles of solution are smaller than 1nm in diameter, so they cannot be seen through naked eyes.
- It does not show the Tyndall effect.
- It cannot be filtered.

⇒ The concentration of a solution is the amount of solute present in a given amount (mass or volume) of the solution or the amount of solute dissolved in a given mass or volume of solvent.

⇒ It is expressed as:

$$\text{Concentration} = \frac{\text{Amount of solute}}{\text{Amount of solution}}$$

⇒ The concentration can be expressed in two ways:

$$\text{Mass by mass percentage} = \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$$

$$\text{Mass by volume percentage} = \frac{\text{Mass of solute}}{\text{Volume of solution}} \times 100$$

Question. What is the concentration of salt solution which is prepared by dissolving 50 g of salt in 200 g of water?

$$\text{Answer: Concentration} = \frac{\text{Amount of solute}}{\text{Amount of solution}}$$

The mass of solute is 50g and mass of solution = 50g + 200g = 250 g

$$\text{Concentration} = \frac{50}{250} = 0.2$$

◆ What is Suspension solution?

⇒ A suspension is a heterogeneous mixture in which the solute particles do not dissolve but remain suspended throughout the bulk of the medium.

⇒ The properties of a suspension solution are as follows:

- It is a heterogeneous mixture.
- The size of particles of suspension is greater than 1000nm.
- It shows the Tyndall effect.
- It can be filtered.

◆ What is Colloidal solution?

⇒ The colloidal solution is the solution in which the particles of a colloid are uniformly spread throughout the solution.

⇒ The properties of a colloidal solution are as follows:

- It is a heterogeneous mixture.
- The size of particles of colloid is between 1nm to 1000nm, so it is not visible to naked eyes.
- It shows the Tyndall effect.
- It cannot be filtered.

⇒ Types of colloidal solution:

S.No	Type of colloids	Dispersed phase	Dispersed medium
1	Aerosol	Liquid	Gas
		Solid	Gas
2	Foam	Gas	Liquid
		Gas	Solid
3	Emulsion	Liquid	Liquid
4	Sol	Solid	Liquid
5	Gel	Liquid	Solid
6	Solid sol	Solid	Solid

Question. Identify the type of colloid for the following solution.

1) Rubber 2) Milk

Answer:

1. The rubber is a type of foam in which the gas is dispersed in solid.
2. Milk is a colloidal solution that consists of protein, fats, and water. So, it is a type of emulsion.

Separating the Components of a Mixture

Method to separate components from mixture:

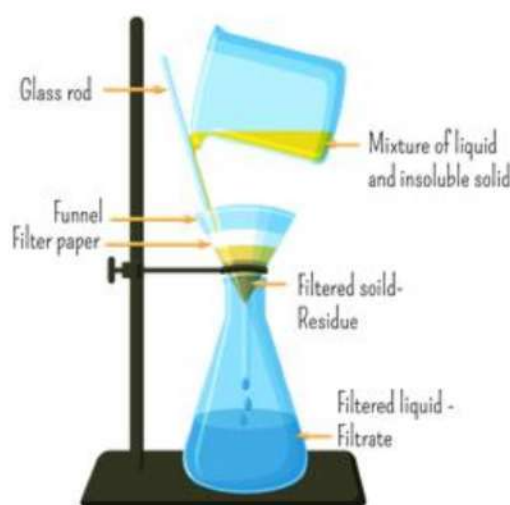
1. Evaporation:

The salt is separated from seawater by using the process called evaporation. Evaporation is the process in which the liquid changes its state to a gas at any temperature below its boiling point.

2. Filtration:

The process which is used to separate a solid substance from a liquid by allowing the liquid substance to pass through the filtering medium is called filtration. In the process of filtration, the liquid is allowed to pass through the filter paper attached to a funnel. The liquid will pass through the paper while the solid will remain on the filter paper.

FILTRATION



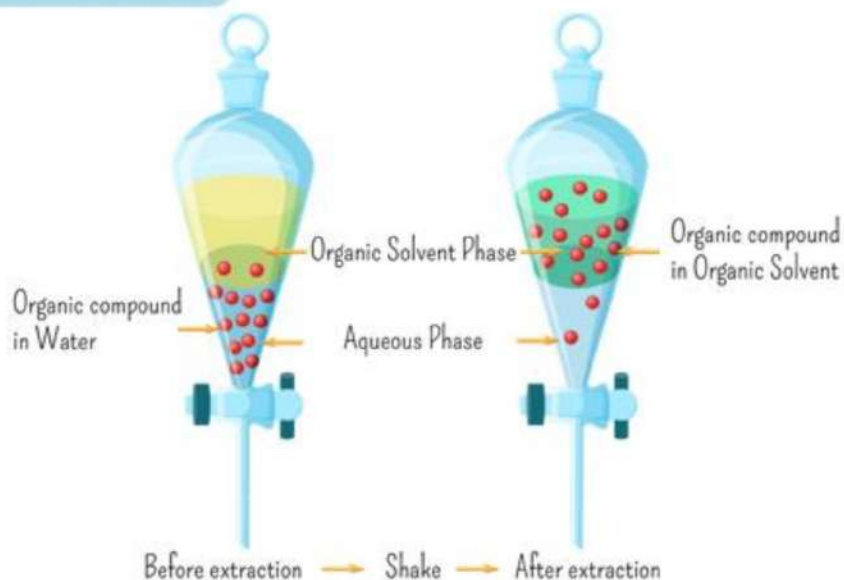
3. Centrifugation:

Centrifugation is the technique in which the mixture is separated through spinning and the denser particles are forced to the bottom while the lighter particles stay at the top when spun rapidly.

4. Separating funnel:

The immiscible liquids can be separated by using a separating funnel. The principle used in separating the funnel is based on the difference in densities of the two liquids. The denser liquid is settled at the bottom of the funnel, while the lighter liquid will remain at the top.

EXTRACTION



5. Sublimation:

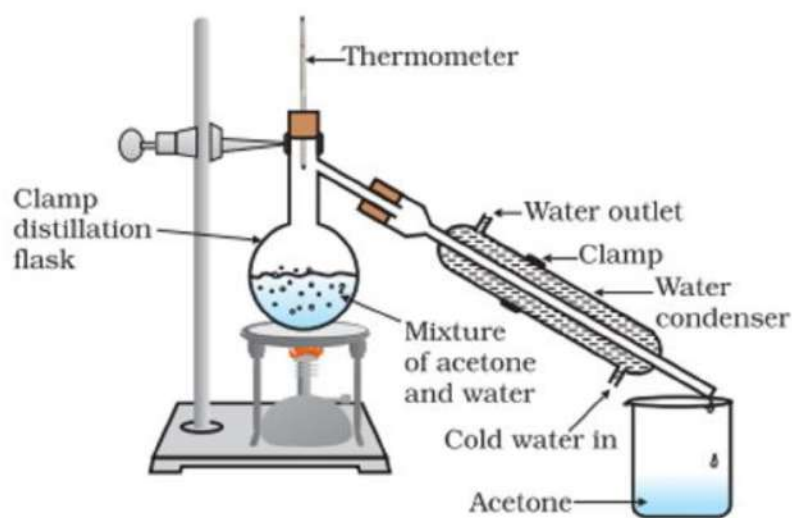
The process in which the solid-state changes its state directly to a gas without converting it into liquid is called sublimation. This process is generally used to separate sublimable volatile components from nonsublimable impurities.

Ammonium chloride, iodine, naphthalene, dry ice, arsenic, etc are examples of sublimable solid which changes their state from solid to gas without leaving any residue.

6. Chromatography:

Chromatography is the technique used for the separation of those solutes that dissolve in the same solvent. It works on the principle of interaction between the solute and solvent. The compound which is more soluble in the solvent can elute faster while the compound which has low solubility in the solvent will elute slower.

Distillation is the method for the separation of components of a mixture containing two miscible liquids that boil without decomposition and have sufficient differences in their boiling points. It is commonly used in water purification techniques.



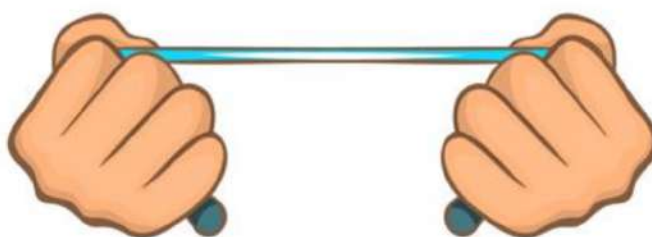
Fractional distillation is the type of distillation process in which the chemical mixture is separated into different fractions using the difference in their boiling points. It is useful for liquids whose difference in boiling point is less than 25K. The liquid which has a low boiling point separates first from a mixture while the liquid which has the highest boiling point will separate last.

8. Crystallisation:

The process in which the large crystal of pure substances formed from their solution is called crystallization. It is used to separate crystals of alum (phitkari) from impure samples.

Physical and Chemical Changes

⇒ A change in which the substance undergoes a process to change its physical properties is called a physical change. It is a reversible process that does not form a new product. For example, stretching of a rubber band.



⇒ A change in which the substance undergoes a process to change its chemical composition is called a chemical change. It is an irreversible process that forms a new product. For example, burning of magnesium ribbon.



Burning of magnesium ribbon

What are the Types of Pure Substances?

⇒ The substance which has a fixed structure and is made up of only one kind of particle is called a pure substance.

⇒ A pure substance is of two types: elements and compounds.

◆ Element:

⇒ Element is defined as a basic form of matter that cannot be broken down into simpler substances by chemical reactions.

⇒ The element is classified into metal, non-metals and metalloids.

⇒ The substance which conducts heat and electricity and is lustrous is called metal while the substance that is a non lustrous and bad conductor of electricity and heat is called non-metal.

⇒ The metalloid is a substance which certain properties of a metal and certain properties of a non-metal. For example, silicon is a metalloid.

◆ Compound:

⇒ The compound is the substance that is prepared by combining two or more elements in a fixed proportion. For example, water is a compound.

⇒ The difference between mixture and compound is shown below:

Mixture	Compound
Elements or compound form mixture by physical interactions.	Elements undergo chemical interactions to form compound.
It has variable composition.	It has fixed composition.
It show the properties of its constituents.	It will not show the properties of its constituents.
Constituents can be separated by physical methods.	Constituents can be separated by chemical reactions.