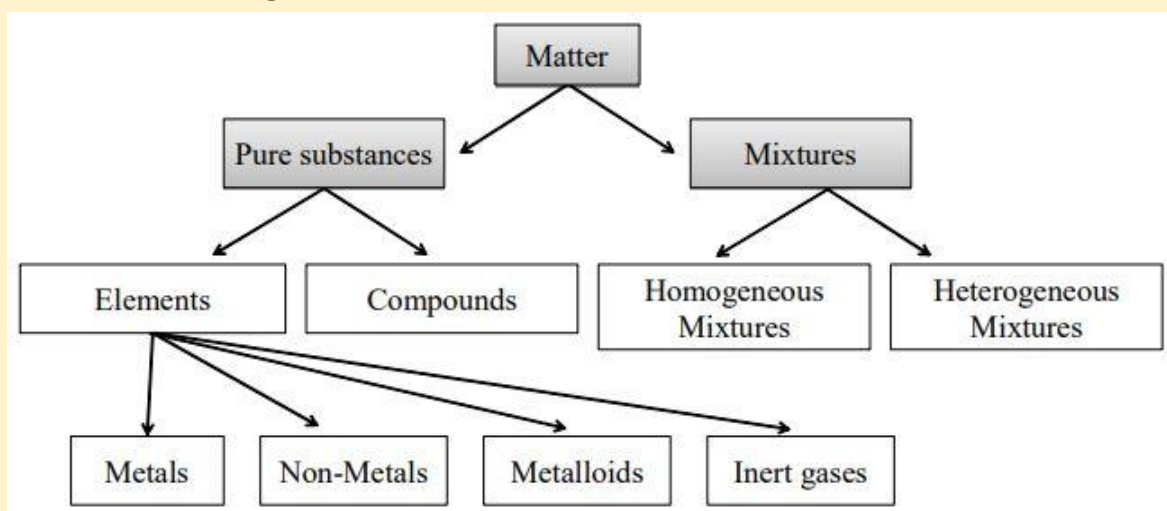


## Chapter-02 : Is matter around us pure

### Classification of matter :

- On the basis of the physical state, matter is classified into three main types. They are solids, liquids and gases.
- On the basis of chemical composition matter is classified into two main types. They are pure substances and mixtures.
  - Pure substances are of two types. They are elements and compounds.
  - Mixtures are of two types. They are homogeneous mixtures and heterogeneous mixtures.
  - Pure substance is a substance which consists of a single type of substance (element or compound). E.g.- iron, copper, hydrogen, oxygen, water, sugar, common salt etc.
  - Mixture is a substance which consists of two or more pure substances. E.g.- sea water, minerals, soil, air, sand in salt, sugar in water, salt in water etc.

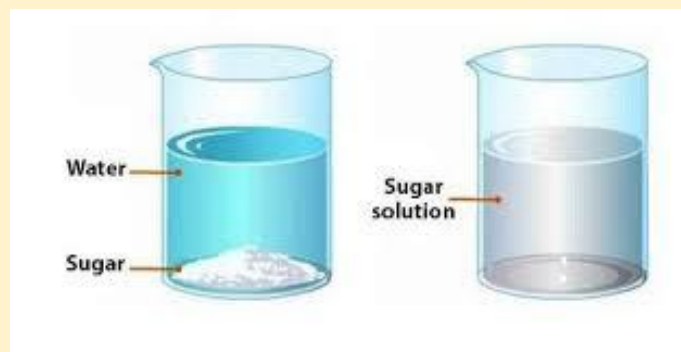


**Homogeneous mixture :** It is a mixture which has a uniform composition.

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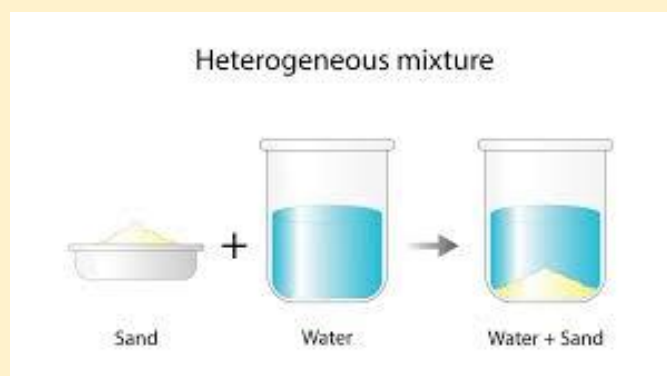
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- The particles of the mixture are not visible by the naked eye.
- The particles cannot be separated by filtration.
- The mixture is stable (the particles do not settle down).
- The path of a beam of light is not visible in the mixture.
- E.g.- mixture of sugar in water, mixture of salt in water, mixture of copper sulphate in water etc.



**Heterogeneous mixture :** It is a mixture which has a non-uniform composition.

- The particles are visible by the naked eye.
- The particles can be separated by filtration.
- The mixture is unstable (the particles settle down).
- The path of a beam of light is visible in the mixture.
- E.g.- mixture of salt and sand, mixture of sulphur and iron filings, mixture of oil and water.

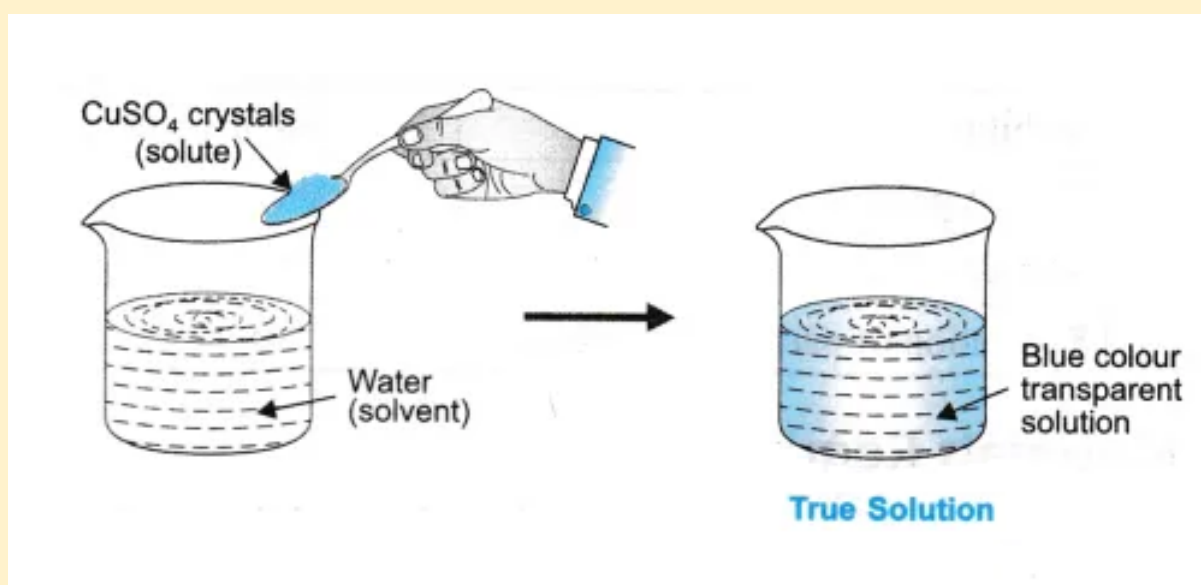


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**True solution** : A true solution is a homogeneous mixture of two or more substances.

- A solution has a solvent and solute as its components.
- The component in the larger amount is the solvent and the component in the lesser amount is the solute.
- E.g.- solution of salt in water, solution of sugar in water, iodine in water (tincture iodine), soda water etc.



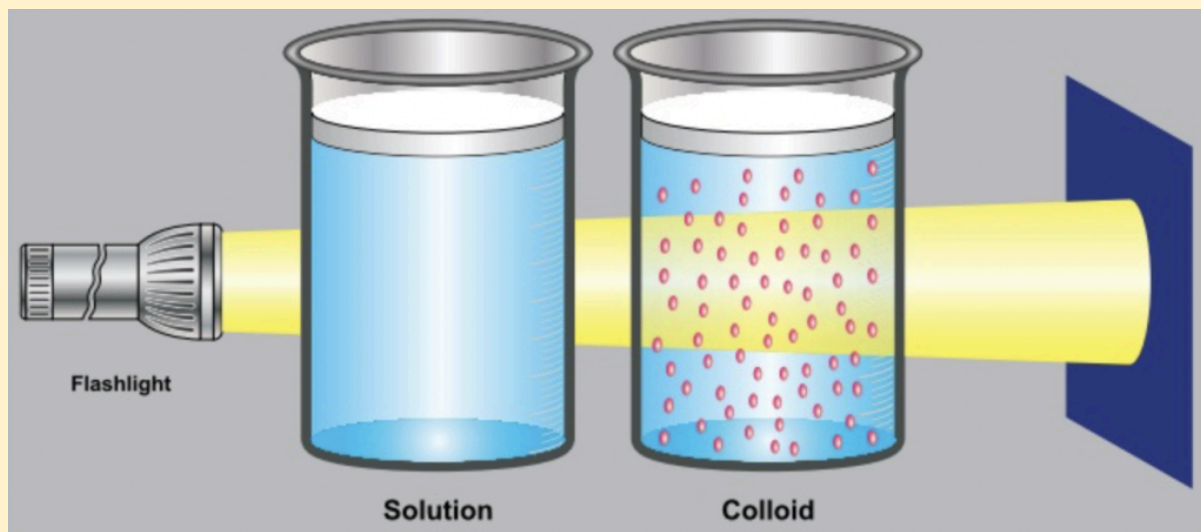
Properties of true solutions :

- True solution is a homogeneous mixture.
- The particles cannot be seen by the naked eye.
- The solute particles cannot be separated by filtration.
- The solute particles do not settle down and the solution is stable.
- The particles do not scatter a beam of light passing through it and the path of light is not visible in the solution.

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**Colloidal solution** : A colloidal solution is a heterogeneous mixture of two or more substances.

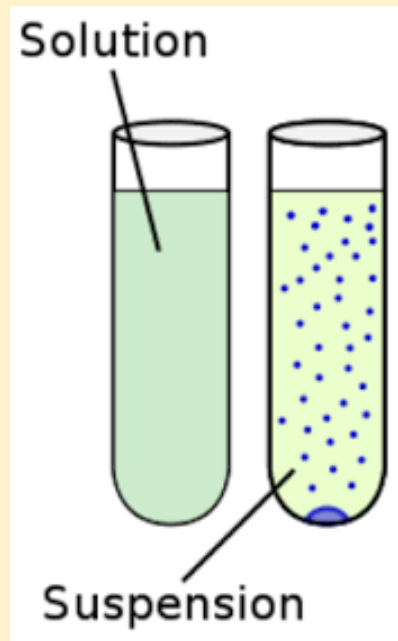


- E.g.- mixture of starch in water, mixture of egg albumin in water, milk, air containing dust and smoke etc.
- Properties of colloidal solution :
  1. Colloidal solution is a heterogeneous mixture.
  2. The particles cannot be seen by the naked eye.
  3. The solute particles cannot be separated by filtration.
  4. The solute particles do not settle down and the solution is stable.
  5. The particles scatter a beam of light passing through it and the path of light is visible in the solution.

**Suspension** : A suspension is a heterogeneous mixture of two or more substances.

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- E.g.- solution of sand in water, solution of chalk powder in water etc.
- Properties of suspension :
  1. Suspension is a heterogeneous mixture.
  2. The particles can be seen by the naked eye.
  3. The solute particles can be separated by filtration.
  4. The solute particles settle down and the solution is unstable.
  5. The particles scatter a beam of light passing through it and the path of light is visible in the solution.

**Tyndall effect** : When a beam of light is passed through a colloidal solution, the colloid particles scatter the beam of light and the path of light becomes visible in the solution. This effect is called the Tyndall effect.



- Tyndall effect can be seen when light enters a room through a small hole due to scattering of light by the dust and smoke particles.
- Tyndall effect can be seen in a dense forest due to scattering of light by water droplets in the mist.

### **Saturated and Unsaturated solution :**

- Saturated solution is a solution which cannot dissolve any more of a solute at a given temperature.
- Solubility of a substance is the amount of solute present in a saturated solution of the substance.
- Unsaturated solution is a solution which can dissolve some more of the solute at a given temperature.

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Preparation of a saturated solution : Take 50ml of water in two beakers. Add salt in one beaker with continuous stirring till no more salt dissolves in it. Similarly add sugar in the other beaker with continuous stirring till no more sugar dissolves in it. We get saturated solutions of salt and sugar respectively.



- If the mixtures are heated it dissolves some more of the solute.
- The solubility of different substances is different.
- The solubility of substances varies with temperature.

**Concentration of a solution :** The concentration of a solution is the amount of solute present in a given amount of the solvent or solution.

Concentration of a solution = Amount of solute / Amount of solvent  
or, Concentration of a solution = Amount of solute / Amount of solution

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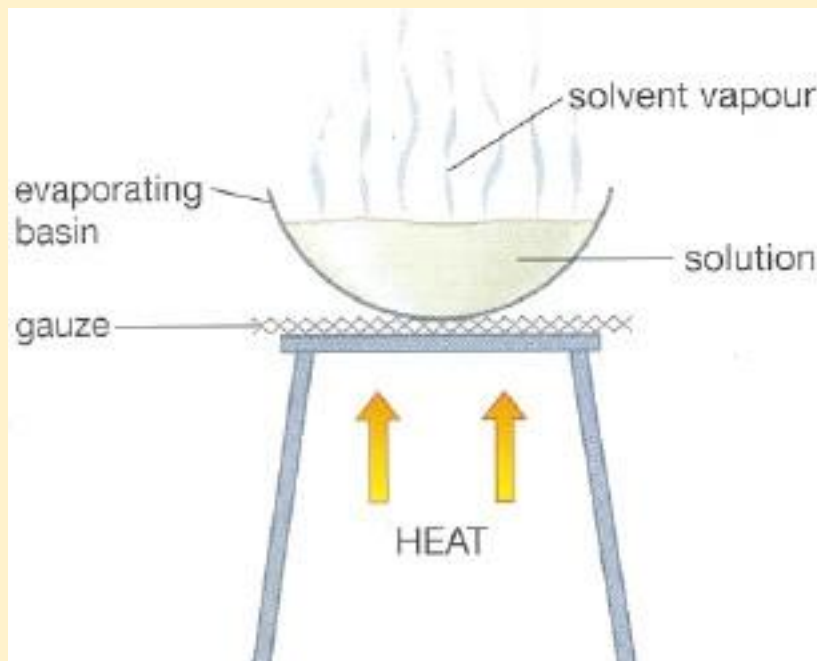


- The concentration of a solution can be expressed as mass by mass percentage or as mass by volume percentage.
  - Mass by mass percentage of a solution =  $\text{Mass of solute} \times 100 / \text{Mass of solution}$
  - Mass by volume percentage of a solution =  $\text{Mass of solute} \times 100 / \text{Volume of solution}$

Separating the components of a mixture : The components of a heterogeneous mixture can be separated by simple methods like hand picking, sieving, filtration etc. Sometimes special techniques are used to separate the components of mixtures like Evaporation, Centrifugation, Decantation (Using separating funnel), Sublimation, Centrifugation, Chromatography, Distillation and fractional distillation.

**Evaporation** : This method is used for separating a volatile component (solvent) from a non-volatile component (solute) by heating the mixture. E.g.- Ink is a mixture of a dye and water. If some ink is heated in a dish, the water evaporates and the dye is left in the dish. Similarly we can separate a mixture of salt and water or sugar and water by evaporation.





**Centrifugation** : The method of separating denser particles and lighter particles from a mixture by using a centrifuging machine is called centrifugation. E.g.- If we take some milk in a centrifuging machine and spin it rapidly, the cream separates from the milk because cream is less dense than milk.

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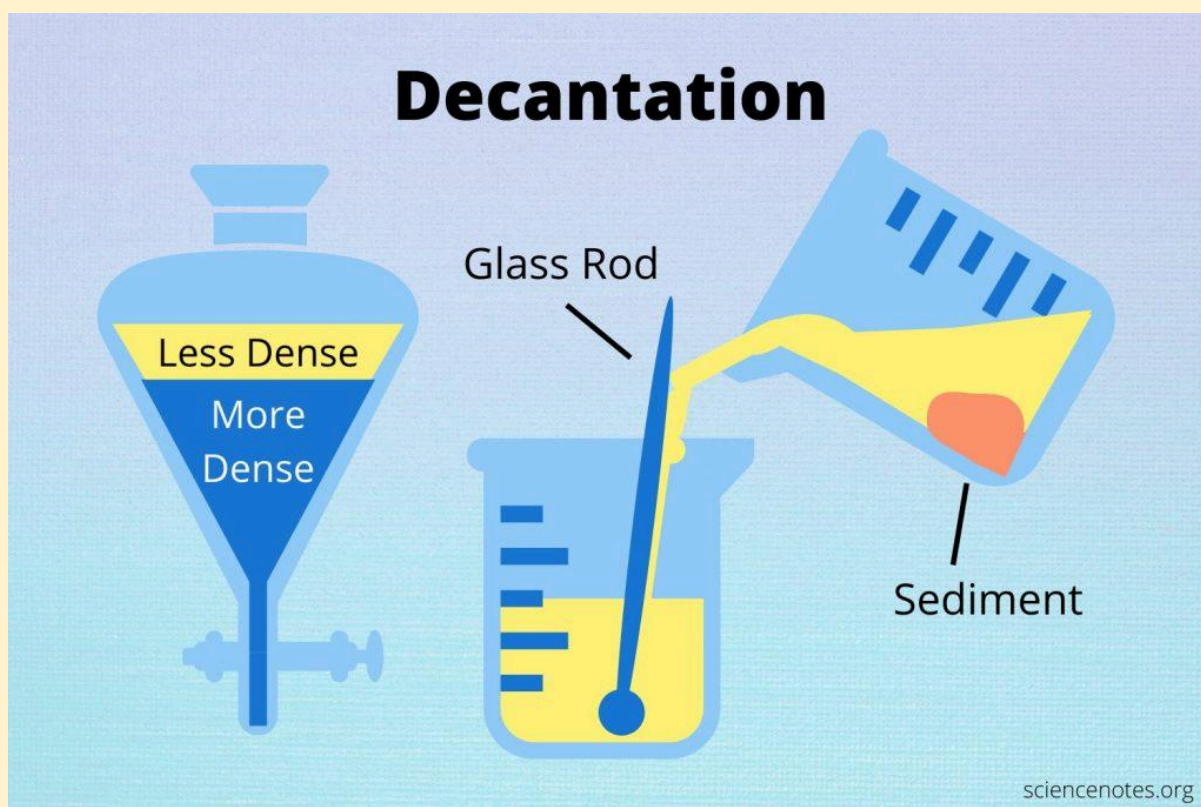
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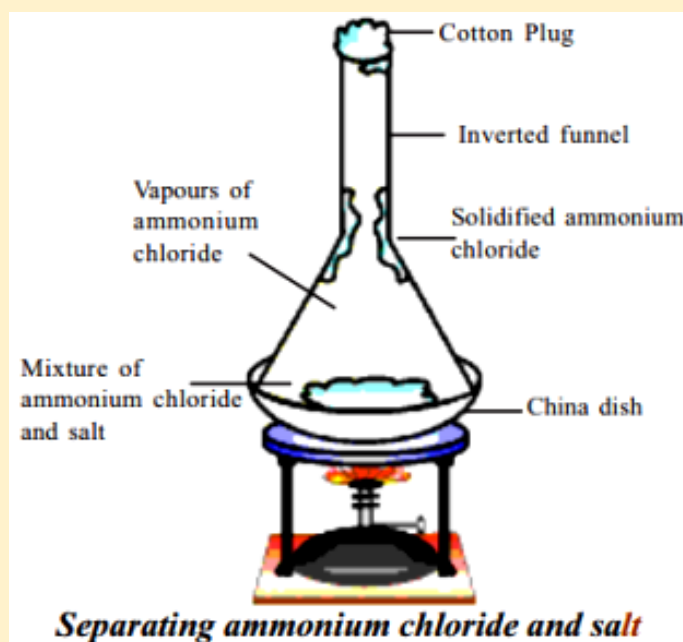
**Decantation using separating funnel :** This method is used for separating a mixture of immiscible liquids. Liquids separate into different layers depending on their densities. E.g.- If we take a mixture of kerosene oil and water in a separating funnel, it forms separate layers of oil and water. The water can be separated by opening the stop cock. After the water flows out the stop clock can be closed.

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**Sublimation** : This method is used to separate a mixture of a sublimely component from a non-sublimely component by heating the mixture. E.g.- If a mixture of ammonium chloride and common salt is heated, the ammonium chloride sublimes and can be cooled and solidified and collected and salt is left behind.



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**Chromatography** : This method is used for separating coloured components from a liquid by using a filter paper or blotting paper. E.g.- Put a drop of ink near one end of a strip of filter paper and dip the end of the paper in a test tube containing water. Ink is a mixture of two or more coloured components. The component which is more soluble in water rises faster and gets separated.

**Distillation** : This method is used for separating a mixture of miscible liquids by boiling the mixture and cooling and condensing the vapours.



- Simple distillation is used for separating a mixture of two miscible liquids having sufficient difference in their boiling points. E.g.- If a mixture of acetone and water is heated in a

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distillation apparatus, the acetone which has a lower boiling point than water first boils and cools and condenses and is separated from the water.

- Fractional distillation is used for separating a mixture of two or more miscible liquids whose difference in boiling points is less than 25K.
- The apparatus used for fractional distillation is similar to that used for simple distillation except that a fractionating column is fitted between the distillation flask and condenser. The fractionating column has glass beads which increases the surface for the vapours to cool and condense.
- Fractional distillation is used for separating the components of petroleum, separating the different gases from air etc.

**Separation of components of air** : Air is a mixture of gases. The components of air can be separated by fractional distillation.

- Air is compressed by increasing the pressure and cooled by decreasing the temperature to get liquid air. The liquid air is then allowed to warm up slowly in a fractional distillation column. Then the different components separate at different heights depending on their different boiling points.

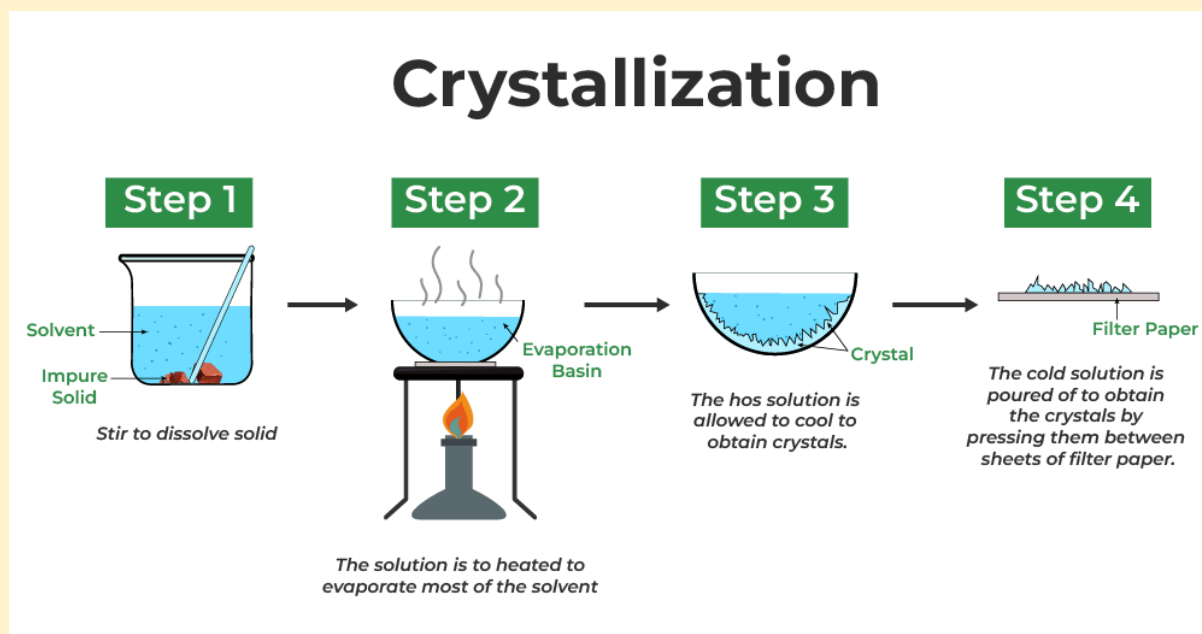
**Purification of solids by crystallization** : Crystallization is the process of obtaining a pure solid in the form of crystals from its solution. E.g.- By crystallization we can obtain pure copper sulphate from its solution.

- Dissolve about 5g of copper sulphate in a minimum amount of water. Filter the solution to remove the impurities. Evaporate

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the solution in a china dish to get a saturated solution. Cover the solution with a filter paper and allow it to cool. Pure copper sulphate crystals are formed.



**Element :** Element is a basic form of matter which cannot be broken down into simpler substances by chemical reactions.

- Elements are of three types. They are metals, nonmetals and metalloids.

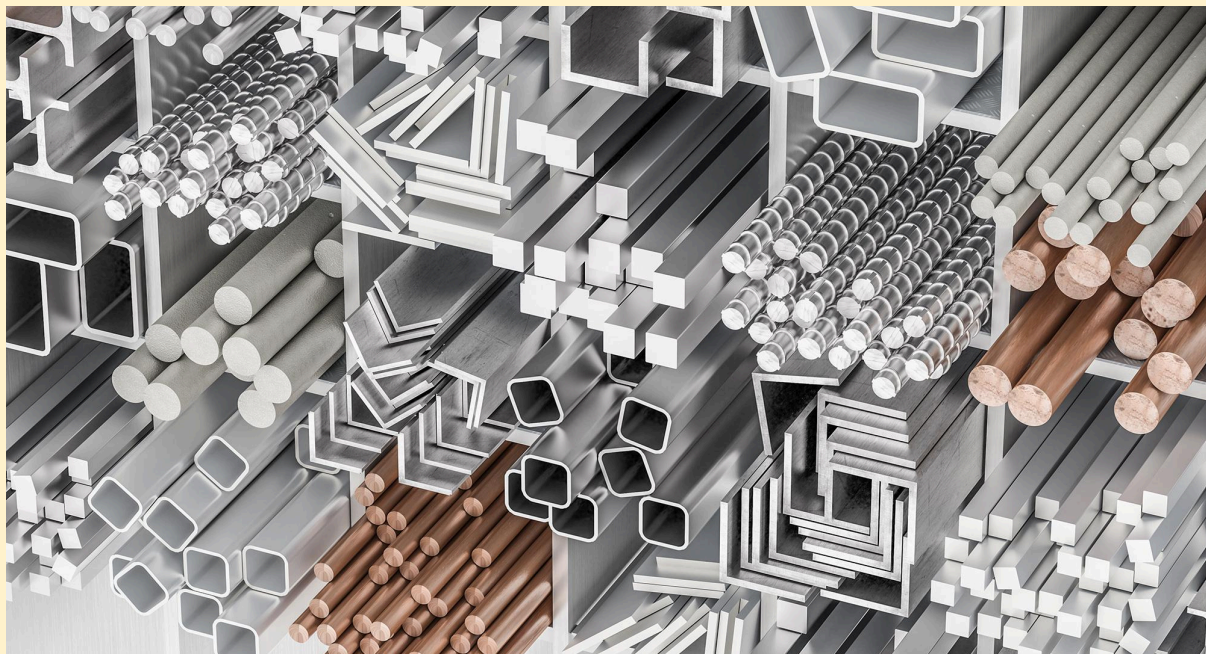
### **Properties of metals :**

- They have luster.
- They are malleable and ductile.
- They are good conductors of heat and electricity.

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- They are sonorous. E.g.- iron, aluminium, zinc, mercury, copper, silver, gold etc.



#### **Properties of non-metals :**

- They do not have luster.
- They are not malleable or ductile.
- They are poor conductors of heat and electricity.

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- They are not sonorous. E.g.- hydrogen, oxygen, nitrogen, iodine, carbon, sulphur, phosphorus etc.

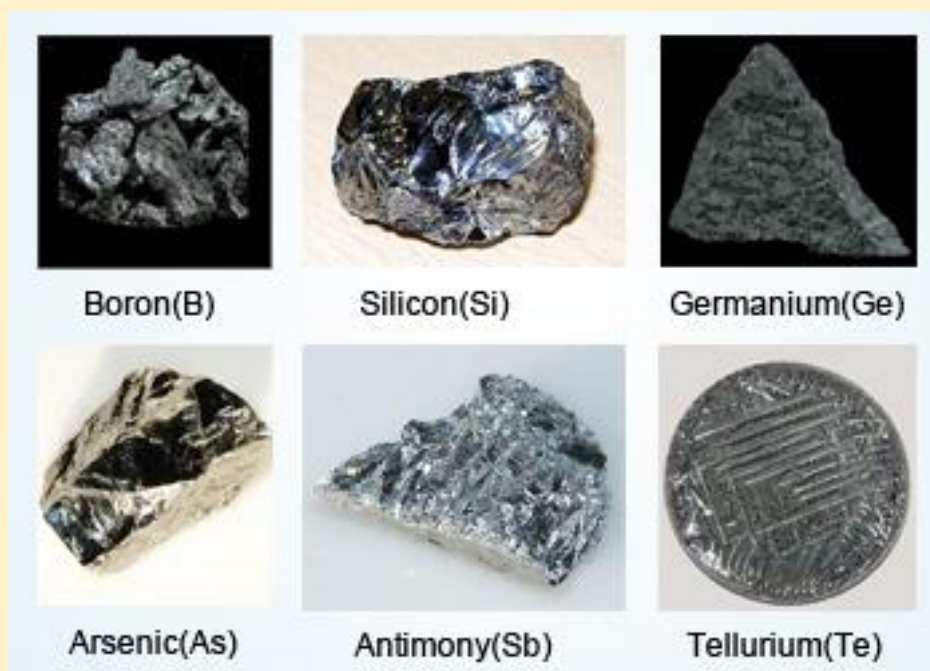


#### **Properties of metalloids :**

Metalloids are elements which show some properties of metals and some properties of non-metals. E.g.- boron, silicon, germanium etc.

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**Compound** : A compound is a substance composed of two or more elements chemically combined together in a fixed ratio. E.g.- water, carbon dioxide, sugar, salt, iron sulphide etc.

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