

Introduction

- Everything around us is made of matter. For example, wood, paper etc.
- All the matter around us is not pure. It can be pure or impure.

Elements

- An element is a substance which cannot be divided further into simpler substances by any chemical methods like applying heat, light or electric energy. For example, Carbon is an element and it cannot be split into simpler substances.
- An element is composed of only one kind of atoms. Therefore, cannot be further divided.
- There are 118 elements known till now, out of these 94 elements occur in nature while remaining 24 are synthesized artificially. Example Hydrogen, Carbon, Helium etc.
- Elements can occur in solid, liquid or gaseous form.
- All the material in the world is made of one or more elements.
- All the elements can be divided into 3 categories:
 - Metals- metal is an element that is lustrous, malleable, ductile and conducts heat and electricity.
 - For example- Silver, Gold, Iron, Copper etc.
 - Non- Metals- These are elements that are neither malleable nor ductile and do not conduct heat and electricity.
 - For example- Sulphur, Phosphorus etc.
 - Metalloids- These elements show some properties of metal and some of non- metals.
 - For example- Boron, Silicon, Germanium etc.

Compounds

- A compound is a substance composed of two or more elements, chemically combined with one another in a fixed proportion.
- For example, H₂O is a compound made of Hydrogen and Oxygen chemically combined in a fixed ratio 1:8 by mass.

Mixtures

- Mixture is a combination of two or more elements or compounds which are not chemically combined and may be present in any proportion.
- For example, air is a mixture of gases like Oxygen, Carbon Dioxide, Nitrogen, Argon and water vapour.

- **Types of Mixtures:**

- Homogenous Mixture- Those mixtures in which substances are completely mixed together and are indistinguishable from one another, are called Homogenous Mixture.
- For example- soft drinks, soda water, etc. all homogenous mixtures are solutions.
- Heterogenous Mixture- Those mixtures in which substances remain separate and one substance is spread throughout the other in the form of particles, bubbles or droplets are called Heterogenous Mixture.
- For example- mixture of salt and sand, mixture of oil and water.

Solution

- A solution is a homogeneous mixture containing two or more substances.
- Example- Lemonade, Soda water.

Properties of Solutions

- A solution is a homogenous mixture.
- A solution has two constituents' solute and solvent. The component that is getting dissolved is called the solute and the other component which is mostly present in larger quantity is called the solvent.
- The particles of a solution are less than 1 nm in diameter therefore cannot be seen by naked eye.
- They do not scatter a beam of light passing through the solution because of very small particle size.
- The solute particles cannot be separated from the mixture by filtration. The solute particles do not settle down when left undisturbed. That is, a solution is stable.

Types of Solution

Suspension

- A suspension is a heterogeneous mixture in which the solute particles do not dissolve but remain suspended throughout the bulk of the medium.
- Particles of a suspension are visible to the naked eye.

Properties of Suspension

- Suspension is a heterogenous mixture.
- The particles of a suspension can be seen with a naked eye.
- The particles of a suspension scatter a beam of light passing through it and make its path visible.

- The solute particles settle down and the suspension is left undisturbed, that is, a suspension is unstable. They can be separated from the mixture by the process of filtration.

Colloidal Solution

- Colloidal solution is a heterogenous solution in which due to relatively small size of particles as compared to suspension, the mixture appears to be homogenous.
- The particles of a colloid are uniformly spread throughout the solution.

Properties of Colloidal Solution

- The size of particles of a colloid is too small to be individually seen with a naked eye.
- They do not settle down when left undisturbed, that is, a colloid is quite stable.
- The colloidal particles cannot be seen with naked eye but can easily scatter a beam of light. This scattering is called Tyndall effect.
- The particles cannot be separated from the mixture by the process of filtration. But, a special process of separation known as centrifugation can be used to separate the colloidal particles.

Separation of Mixtures

- Different methods of separation are used to get individual components from a mixture.
- Heterogeneous mixtures can be separated into their respective components by simple physical methods like sieving, handpicking, filtration.
- Other physical processes which are used to separate the constituents of a mixture are-
 - Sublimation
 - Centrifugation
 - Evaporation
 - Crystallization
 - Chromatography
 - Distillation
 - Fractional distillation
 - Separating funnel

Separation of mixture of two solids

- Following methods are used:
 - By using a suitable solvent
 - By the process of Sublimation

- By using a magnet

By using a suitable solvent

- A mixture of sugar and sand can be separated by using water as a solvent.
- Sugar is soluble in water while sand is insoluble, this difference in their solubilities can be used to separate the two.

By Sublimation

- Conversion of a solid directly into vapours and vapours into solid on cooling is called Sublimation.
- The solid that undergoes sublimation is called sublime.
- This process is used to segregate such mixtures that contain a sublimable volatile component from a non- sublimable impurity.
- The solid substance obtained by cooling the vapours is called as sublimate.
- For example- solids like ammonium chloride, naphthalene and anthracene sublime on heating and can be recovered in the form of a sublimate by cooling into vapours.

Separation by magnet

- If a mixture contains iron as one of the constituents, it can be separated by using a magnet.
- For example- a mixture of sulphur powder and Iron fillings can be separated by using a magnet. The iron filling will be attracted by the magnet and sulphur won't.

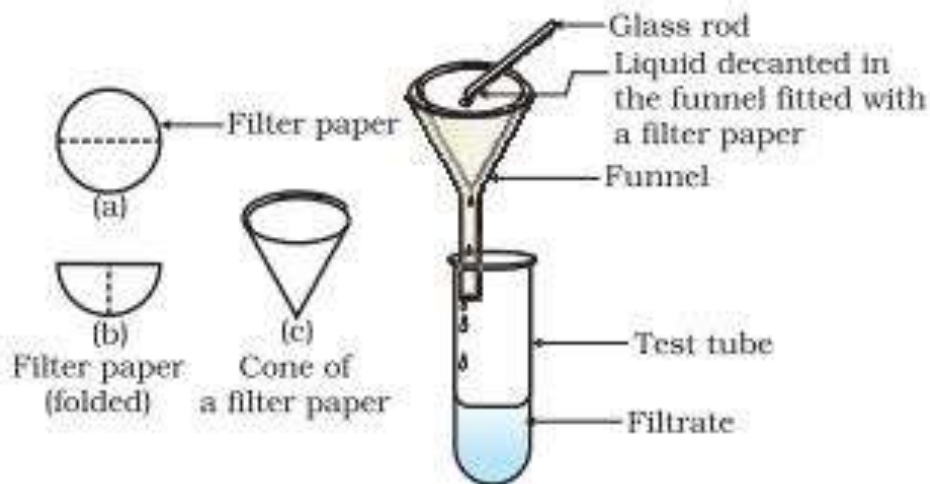
Separation of mixture of a Solid and a Liquid

- Mixtures containing a solid and a liquid are separated by following processes:
 - Filtration
 - Evaporation
 - Centrifugation
 - Chromatography
 - Distillation
 - Crystallization

Filtration

- Filtration is carried out using a Filter paper which is a round piece of special paper containing millions of pores in it.
- The liquids can pass through the tiny pores of a filter paper but solid particles are left behind.
- The solid that remains behind on the filter paper is called the residue.

- The liquid that passes through the filter paper is called the filtrate.
- A mixture of sand and water can be separated by filtration.
- Filtration cannot remove any solid substances which are dissolved in a liquid.



Evaporation

- The conversion of a liquid into vapours (or gas) is called evaporation.
- This process is used to separate a solid substance that has dissolved in water (or any other liquid).
- The use of this process for separating a mixture is based on the fact that the liquids vaporise easily whereas solids do not vaporise easily.
- For example: - The common salt dissolved in water can be separated by the process of evaporation.
- This process is used on a large scale to obtain common salt from sea-water.
- Evaporation is also used in recovering dissolved solid substances from liquid mixtures (or solutions) but the liquid itself cannot be recovered by this method. The liquid vaporises and is lost in the air.

Centrifugation

It is a method for separating the suspended particle of a substance from a liquid in which the mixture is rotated at a high speed in centrifuge and forces the denser particles to the bottom and lighter remain floating on above layer.

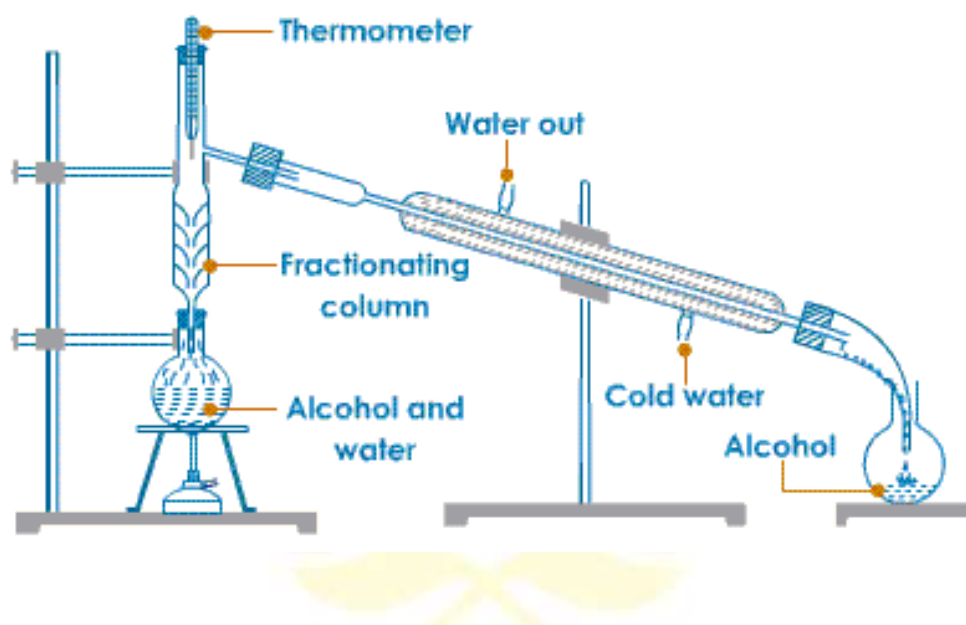
By the process of Chromatography

- The ink that we use has water as the solvent and the dye is soluble in it. As the water rises on the filter paper it takes along with it the dye particles. Usually, a dye is a mixture of two or more colours. The coloured constituents that is more soluble in water rises faster and in this way the colours get separated.
- The process of separation of components of a mixture is known as Chromatography. Kroma in Greek means colour. This technique was first used for separation of colours, so this name was given, Chromatography is

the technique used for separation of those solutes that dissolve in the same solvent.

Distillation

- It is a process of heating a liquid to form vapour and then cooling the vapour to get the liquid back.
- This process is used to get both salt as well as water from salt-water mixture.
- The liquid obtained by condensing the vapours is called the Distillate.
- In this process the homogenous mixture of solid and liquid is heated in a closed distillation flask, the liquid being volatile forms vapours.
- These vapours are allowed to pass through a condenser where they get cooled and condense to form pure liquid.
- This pure liquid is collected in a separate vessel.
- The solid being non- volatile, remains behind in the distillation flask.



Crystallization

- Crystallization is a process that separates a pure solid in the form of its crystals from a solution. This method is used to purify a solid, example the salt we get from sea water contains many impurities in it. To remove these impurities, the process of crystallization is used.
- Crystallization technique is better than simple evaporation technique as-
 - Some solids decompose or some, like sugar, may get charred during heating to dryness.
 - Some impurities may remain dissolved in the solution even after filtration. On evaporation these contaminate the solid.
- Following are the steps involved in obtaining pure solid substance from impure sample: -
 - The impure solid substance is dissolved in the minimum amount of water to form a solution.
 - The solution is filtered to remove insoluble impurities.

- The clear solution is heated gently on a water bath till a concentrated solution or saturated solution is obtained.
- The hot, saturated solution is allowed to cool slowly.
- Crystals of pure solid are formed leaving behind the Impurities dissolved in solution.
- The solution is filtered to separate the crystals of pure solid and is dried.
- For Example: -
Impure copper sulphate is purified by the method of crystallisation.

