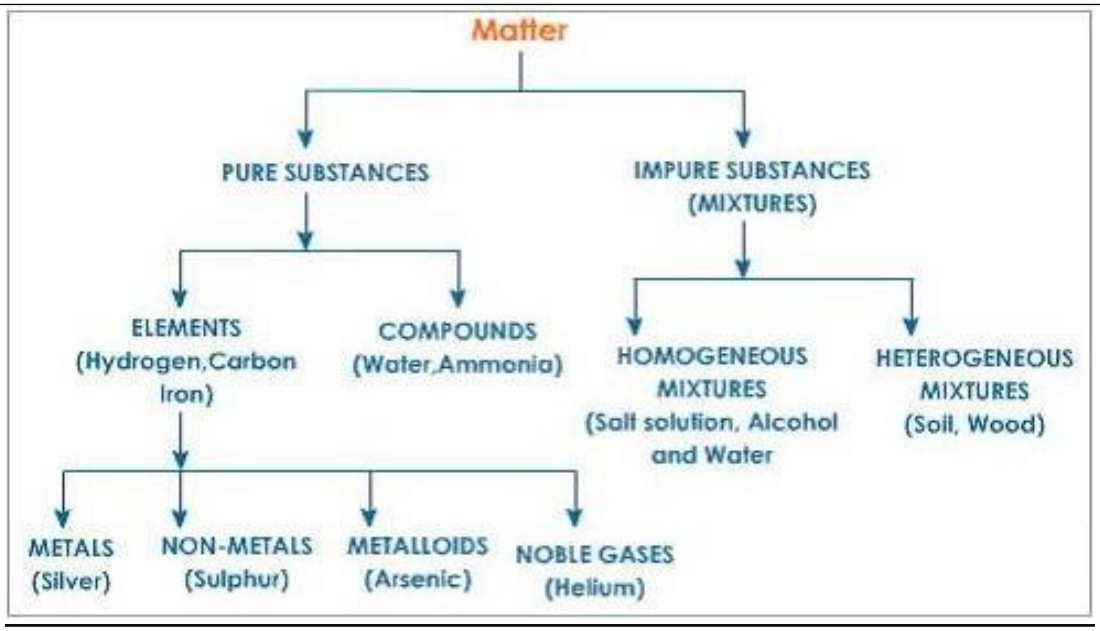
Is matter around us Pure?



Pure Substances: A pure substance means a single substance f(or matter) which cannot be separated into other kind of matter by any physical process.

- A pure substance is composed of the same kind of particles e.g. hydrogen, oxygen, water, sodium chloride, etc.
- A pure substance is homogeneous, irrespective of its origin or method of preparation.
- A pure substance has definite properties, characteristic of itself.
- A pure substance has the same composition throughout. For example, different samples of water, prepared by different methods, by different people at different places always consist of hydrogen and oxygen in the ratio 1:8 by mass and 2:1 by volume. If any sample has a different ratio of these elements, then it certainly is not water.

Types of Pure Substances **1. elements and 2. compounds.**

1. Elements

- The word element was introduced for the first time by Lavoisier, a French chemist.
- According to him. An element is the simplest or basic form of a pure substance which cannot be broken into anything simpler than it by physical or chemical methods.
- The later studies by Dalton have shown that the simplest form of matter is atom. In the light of this, the definition of an element has been modified. It may now be defined as :

  The pure substance which is made up of one kind of atoms only.

- The earth's crust is made mainly from two elements i.e., oxygen (46.6%) and silicon (27.7%) the rest of the elements are present in lesser proportions.
- All living things, both plants and animals are made from a few elements only. These are oxygen

(65%). Carbon(18%), hydrogen (10%), nitrogen (3%), calcium (2%) along with some other elements.

- Nearly 118 elements are known the universe is made mainly from the two. Out of the known elements, only about 92 have been found to be present in nature, the rest have been synthesized by the scientists in the laboratory. The man made elements are also known as synthetic elements.

Noble gases: nobel gases are a group of six elements that do not combine with other elements and tend to exist by themselves. They are characterized by extreme chemical inactivity.. Example: Neon, helium, argon etc

Types of Elements: 1. Metal 2. Non metal 3. Metalloid

A. Metals

In the metals, the atoms are very closely packed together and have special types of bonds known as ***metallic bonds***. Because of very tight or close packing the metals are quite hard.

1. ***State***: Metals are solids at room temperature.

   Exception: mercury is a liquid at room temperature.

   Gallium and Cesium become liquid at a temperature slightly above room temperature (303K)

2. ***Lustrous***: Metals have shining surface they have generally silver-grey or golden-yellow surfaces. And this property is known as l**uster.**
3. ***Conductivity:*** Metals are good conductors of heat and electricity.
4. ***Hardness:*** Metals are generally quite hard.

   Exception : metals like sodium and potassium are soft and can be cut easily with knife.

5. ***Malleable***: Metals are **malleable** in nature means they can be converted into thin sheet.
6. Ductility: Metals are **ductile** in nature as they can be converted in to thin wire.
7. Metals are **sonorous(ringing sound)**
8. ***Melting and boiling point***: Metals have generally high melting and boiling points.

Example: copper (Cu), silver (Ag), gold(Au), aluminum(Al), iron(Fe), sodium(Na), potassium(K), calcium(Ca), magnesium(Mg), mercury (Hg), zinc(Zn), Lead(Pb), Iron(Fe)

B. Non-Metals

1. ***State:*** Non-Metals are either gases or solids at room temperature.

   Exception bromine is a liquid at room temperature.

2. ***Not lustrous:*** Non-Metals vary in colour. Solids have generally **dull surfaces**.

   Exception crystals of iodine have bright iustre.

3. ***Conductivity:*** Non-Metals are mostly poor conductors of heat and electricity.

   Exception graphite is a good conductors of electricity.

4. ***Density:*** Most of the non-metals are quite soft and have smaller densities than metals.

   Exception diamond is very hard. It is probably the hardest substance known.

5. **Malleability and ductility** : Non-metals are non-malleable and non-ductile in nature.

6. ***Non sonorous:*** Non-metals are also not sonorous in nature.

7. ***Melting and boiling points:*** As compared to metals, the non-metals have very low melting and boiling points.

Example : carbon (C)(coke, diamond graphite, coal, charcoal) nitrogen(N), oxygen(O), chlorine(Cl), bromine(Br), iodine(I), phosphorus(P), sulphur(S) etc

C. Metalloids

There are few elements which possess the characteristics of both the metals and non-metals***. Example:*** Arsenic, antimony, bismuth.

Metals and non-metals differ in most of their properties. This is an account of the difference in the structures of atoms belonging to these.

2. Compounds (Chemical Compounds)

A pure substance containing two or more elements which are combined together in a fixed proportion by mass is known as compound.

Types of Compounds: 1. Inorganic compound 2. Organic compound

A. **Inorganic compounds** these compounds have been mostly obtained from non-living sources such as rocks and minerals.

Example: common salt(NaCl), marble($CaCO_3$).

B. **Organic compounds** The word 'organ' relates to different organs of living beings.

Organic compounds are the compounds which are obtained from living beings i.e., plants and animals. It has been found that all the organic compounds contain carbon as their essential constituents. Therefore, the organic compounds are quite often known as **'carbon compounds'**.

Examples: methane(CH_4), Alcohol(C_2H_5OH), ethane(C_2H_6).

Characteristics of Compounds

1. A pure compound is composed of the same elements
2. A pure compound is homogeneous in nature.

3. A chemical compound is formed as a result of chemical reaction between the constituent elements.
4. Properties of a compound differ entirely from those of its constituent elements.
5. Constituents of a chemical compound cannot be separated mechanically.
6. Formation of compounds involves energy changes.
7. The constituent elements in a compound are in a fixed proportion by mass.
8. A compound has a fixed melting point and boiling point. For example, ice melts at $0^{o}C$

Purity of compounds can be tested by determining their melting points. For example, m.p. of pure sodium chloride is 1073 k. if a given sample of the salt melts at this temperature, it will represent a pure sample. In case, the m.p. is different, the sample will be impure.

Impure Substances (Mixtures)

The combination of two or more substances (elements or compounds) which are not chemically combined with each other and may also be present in any proportion is known as mixture.

Mixtures are not pure substances in terms of science.

Properties of mixtures

- A mixture may be homogenous or heterogeneous.
- The constituents of a mixture can be separated by physical means like filtration, evaporation, sublimation and magnetic separation.
- In the preparation of a mixture, energy is neither evolved nor absorbed.
- A mixture has no definite melting and boiling point.
- The constituents of a mixture retain their original set of properties. For example, magnet attracts iron filings in a mixture of sand and iron powder.

Types of Mixtures 1. Homogeneous 2. Heterogeneous

1. Homogeneous mixture:

A mixture is said to be homogeneous if the different constituents or substances present in it are uniformly mixed without any clear boundary of separation.

Exmaple: (1) When we dissolve a salt like sodium chloride or sugar in water, the solution formed is known as a homogenous mixture. The different constituents are so uniformly mixed that it may not be possible tot identify them. This means that there is no boundary of separation in them.

(2) Air is also a homogenous mixture of a number of gases like nitrogen, oxygen, carbon dioxide, water vapours, inert gases etc. all the gases present in air are uniformly mixed throughout. It is not possible to identify these gases present in air.

2. Heterogeneous Mixture

A mixture is said to be heterogeneous if it does not have a uniform composition and also has visible boundaries of separation between the constituents.

Example: A mixture of sand and common salt is regarded as a heterogeneous mixture. The particles of sand and common salt can be easily seen in the mixture.

Remember :

- The components hydrogen and oxygen cannot be separated by physical methods such as filtration or evaporation.
- Hydrogen and oxygen are present in a fixed proportion of 1: 8 by weight
- Energy changes accompany the formation of this compound i.e., heat and light are given out.
- Properties of water are entirely different from the constituents, hydrogen and oxygen.
- The boiling point of water is 100°C at 76 cm of Hg i.e., one atmospheric pressure

Mixtures can also be classified based on the composition and can be broadly divided into three groups, depending on whether the constituents are elements or compounds or both.

Element with an Element :	Compound with a Compound	Element with a Compound
a) Oxygen and nitrogen b) Alloys: 1. Copper and zinc, 2. Sodium and mercury (amalgam)	a) Water and salt b) Water and alcohol c) Salt and sugar.	a) Oxygen and water (air dissolved in water) b) Oxygen, nitrogen, carbon dioxide and water vapour (air).

Mixtures can also be grouped on the basis of their physical states.

Matter	MixtureType	Example
Solid	Solid mixture	Iron filings and sulphur
Solid	Liquid mixture	Common salt and water
Solid	Gas mixture	Air entrapped in soil
Liquid	Gas mixture	Oxygen dissolved in water
Gas	Gas mixture	Air containing hydrogen, oxygen, nitrogen, carbon dioxide etc.
Liquid	Liquid mixture	Water and alcohol

Property	True Solution	Colloidal Solutions	Suspension
Size of the particles	< 1nm	1– 1000nm	>1000nm
Nature	Homogeneous	Heterogeneous	Heterogeneous

Filterability(Diffusion through parchment paper)	Particles of true Solution diffuse rapidly through filter paper as well as parchment paper.	Colloidal particles pass through filter paper but not through parchment paper.	Suspension particles do not pass through filter paper and parchment paper.
Visibility	Particles of True Solution are not visible to naked eye.	Colloidal particles are not seen to naked eye but can be studied through ultra microscope.	Suspension particles are big enough to be seen by naked eye.
Tyndall effect	True Solution does not show Tyndall effect.	Colloids shows Tyndall effect.	Suspension may or may not show Tyndall effect.
Appearance	Transparent	Translucent	Opaque

Difference between Compounds and Mixtures

Compounds	Mixtures
1. In a compounds, two or more elements are combined chemically.	In a mixture, two or more elements or compounds are simply mixed and not combined chemically.
2. In a compound, the elements are present in the fixed ratio by mass. This ratio cannot change.	In a mixture, the constituents are not present in fixed ratio. It can vary.
3. Compounds are always homogeneous i.e., they have the same composition throughout.	Mixtures may be either homogeneous or heterogeneous in nature.
4. In a compound, the constituents lose their identities i.e., a compound does not show the characteristics of the constituting elements.	In a mixture, the constituents do not lose their identities i.e., a mixture shows the characteristics of all the constituents.
5. In the formation of a compound, energy in the form of heat, light or electricity is either absorbed or evolved.	No energy change is noticed in the formation of a mixture.
6. In a compound, the constituents cannot be separated by physical means.	The constituents from a mixture can be easily separated by physical means.

Humidity:

- The term Humidity is usually taken in daily language to refer to relative humidity.
- ***Relative Humidity:*** Relative humidity is defined as the amount of water vapor in a sample of air compared to the maximum amount of water vapor the air can hold at any specific temperature.
- High humidity makes people feel hotter outside in the summer because it reduces the effectiveness of sweating to cool the body by preventing the evaporation of perspiration from the skin.

Filtration:

- Filtration is a mechanical/physical operation which is used for the separation of solids from fluids (liquids or gases) by interposing a medium to fluid flow through which the fluid can pass, but the solids (or at least part of the solids) in the fluid are retained.

Concentration of a solution:

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

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

Or

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

There are various ways of expressing the concentration of a solution,Some are here:

Mass by mass percentage of a solution	Mass by volume percentage of a solution	Volum by volume percentage of a solution
$\frac{\text{mass of solute}}{\text{mass of solution}}\times 100$	$\frac{\text{mass of solute}}{\text{volume of solution}}\times 100$	$\frac{\text{volumof solute}}{\text{volume of solution}}\times 100$
$\frac{\text{mass of solute}}{\text{mass of solvent}}\times 100$	$\frac{\text{mass of solute}}{\text{volume of solvent}}\times 100$	$\frac{\text{volumof solute}}{\text{volume of solvent}}\times 100$

Saturated solution:

- Saturation is the point at which a solution of a substance can dissolve no more of that substance and additional amounts of that substance will appear as a precipitate.
- This point of maximum concentration, the saturation point, depends on the temperature of the liquid as well as the chemical nature of the substances involved.
- This can be used in the process of recrystallisation to purify a chemical:
    - It is dissolved to the point of saturation in hot solvent, then as the solvent cools and the solubility decreases, excess solute precipitates. Impurities, being present in much lower concentration, do not saturate the solvent and so remain dissolved in the liquid. If a change in conditions (e.g. cooling) means that the concentration is actually higher than the saturation point, the solution has become supersaturated.

Unsaturated solution :

If the amount of solute contained in a solution is less than the saturation level, it is called an unsaturated solution

Solubility:

- Solubility is a physical property referring to the ability for a given substance, the solute, to dissolve in a solvent.
- It is measured in terms of the maximum amount of solute dissolved in a solvent at equilibrium. The resulting solution is called a saturated solution.
- Certain liquids are soluble in all proportions with a given solvent, such as ethanol in water. This

property is known as miscibility.

- solubility can be exceeded under various conditions to give a so-called supersaturated solution.

Dilute and concentrated are comparative terms

Tyndall effect:

- The Tyndall effect is the effect of light scattering on particles in colloid systems, such as suspensions or emulsions.

Emulsion:

- An emulsion is a mixture of two immiscible substances. One substance (the dispersed phase) is dispersed in the other (the continuous phase).
- Examples : milk and cream : In milk and cream,

Emulsification is the process by which emulsions are prepared.

Miscible liquid:

- Miscibility refers to the property of liquids to mix in all proportions, forming a homogeneous solution. E***xample***, water and ethanol are miscible in all proportions.

Sublimation

Sublimation of an element or compound is a transition from the solid to gas phase with no intermediate liquid stage.

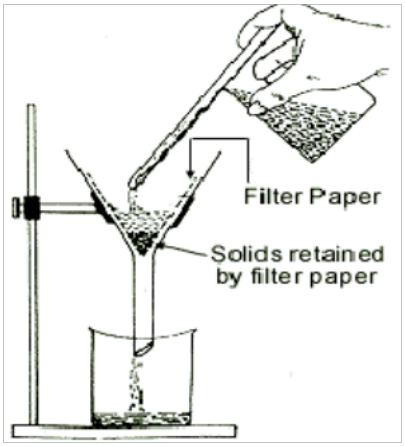
Separation of Mixtures Using Different Techniques

Various types of separation processes are:

- **Crystallization**
- **Filtration**
- **Decantation by using Separating funnel**
- **Sublimation**
- **Evaporation**
- **Simple distillation**
- **Fractional distillation**
- **Chromatography**
- **Centrifugation**

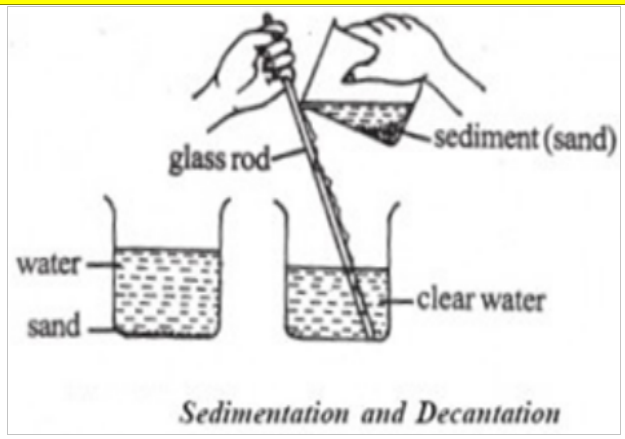
Filtration

- This method is used for separating insoluble solids from a liquid.
- When a mixture of chalk and water is poured through a filter paper in a funnel, chalk particles remains as *residue* in the filter paper, while the water gets collected in the beaker below as *filtrate*.



Sedimentation and Decantation

- **Sedimentation** is the process of separating an insoluble solid from a liquid in which it is suspended by allowing it to settle to the bottom of the container.
- If this also involves pouring off of the liquid leaving the solid behind, it is called **decantation**.
- **Decantation is a fast method for separating a mixture of a heavier solid and a liquid.**
- Example: For separating the mixture of water & sand, first, we should let the sand to settle on the bottom of the container (sedimentation). Then we pour off the water at the top into the other container.



Sedimentation and Decantation

Separating funnel

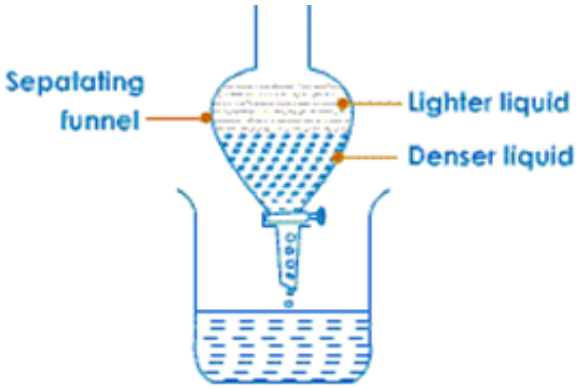
- Separating funnel is used to separate the components from a mixture of two immiscible liquids, such as mixture of oil and water.
- ***Principle***: This separation is based on the differences in the densities of the liquids. The liquid having more density forms the lower layer and the liquid having less density forms the upper layer.
- The lighter one can be decanted after settling of mixture, carefully in other container.
- In the process of decantation some of the heavier liquid also poured out with lighter one. Therefore, components from a mixture of two immiscible liquids; can be separated more easily and accurately using a separating funnel.
- A separating funnel is usually made of glass with a stop cork with drain pipe at bottom. The heavier liquid which is settled at bottom is drained out from the mixture of two immiscible liquids by opening of stop cork from a separating funnel

Activity: Separation of kerosene oil from water using a separating funnel.

1. Pour the mixture of kerosene oil and water in a separating funnel.
2. Let it stand undisturbed for sometime so that separate layers of oil and water are formed.
3. Open the stopcock of the

separating funnel and pour out the lower layer of water carefully.

4. Close the stopcock of the separating funnel as the oil reaches the stop-cock.



Separation of Immiscible Liquids

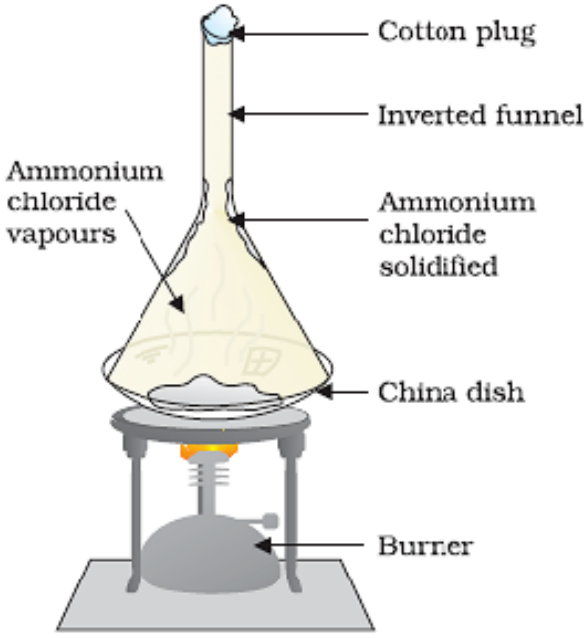
Applications:

- To separate a mixture of oil and water.
- To separate a mixture of kerosene oil and water.
- In the extraction of iron from its ore, the lighter slag is removed from the top by this method to leave the molten iron at the bottom in the furnace.

Sublimation

- There are many substances which are converted into gas from solid when heated, and converted from gas to solid when cooled without converting into liquid. Such substances are known as sublime or sublimating substances. for example – ***ammonium chloride, naphthalene balls, camphor,*** etc.
- Therefore, mixture of one sublime and other substance can be separated using the method of ***sublimation***.
- The mixture of ***ammonium chloride and common salt*** can be separated out using the process of sublimation.

o ***Procedure***: The mixture is heated in a China dish. The China dish is covered by an inverted funnel. Cotton is used for plugging the opening of the funnel. After heating, ammonium chloride is converted into vapour and gets deposited over the inner surface of funnel; due to cooling. This leaves the common salt in China dish. Ammonium chloride can be taken out by scratching from the inner wall of funnel.



Evaporation

This method can be used to separate the volatile component (solvent) from its non-volatile solute.

Activity :-

1. Fill half a beaker with water.
2. Put a watch glass on the mouth of the Beaker.
3. Put few drops of ink on the watch glass.
4. Now start heating the beaker. We do not heat the ink directly.
5. evaporation is taking place from the watch glass.
6. Continue heating as the evaporation goes on and stop heating when no further change on the watch glass.

Observation—Ink remains on the watch glass.

Q• What do you think has got evaporated from the watch glass?
Ans. Water (Solvent) has got evaporated from the watch glass.
Q• Is there a residue on the watch glass? Ans. Yes.
Q• What is your interpretation? Is ink a single substance (pure) or is it a mixture?
Ans. It is a mixture.

Conclusion-We find that ink is a mixture of a dye in water.

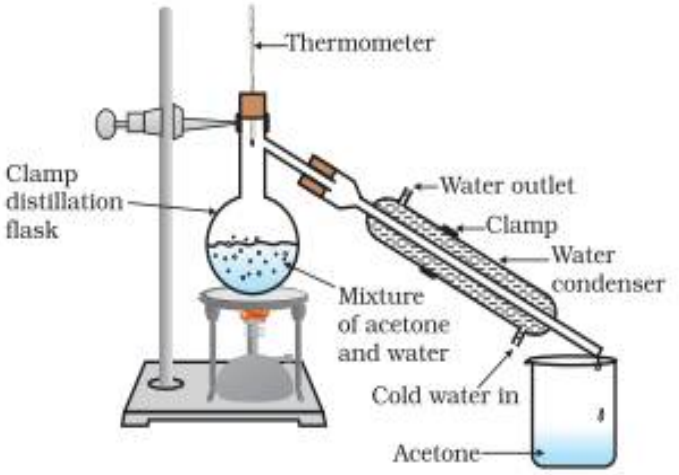
Centrifugation:

- Sometimes the solid particles in a liquid are very small and can pass through a filter paper. For such particles, the filtration technique cannot be used for separation.
- Such mixtures are separated by centrifugation.
- Centrifugation is the process of separation of insoluble materials from a liquid where normal filtration does not work well.
- The centrifugation is based on the size, shape, and density of the particles, viscosity of the medium, and the speed of rotation.
- The apparatus used for centrifugation is called a centrifuge. On rapid rotation of the rotor, the centrifuge tubes rotate horizontally and due to the centrifugal force, the denser insoluble particles separate from the liquid. When the rotation stops, the solid particles end up at the bottom of the centrifuge tube with liquid at the top.
- **Principle:** The principle is that the denser particles are forced to the bottom and the lighter particles stay at the top when spun rapidly. *The centrifugal method involves the principle of centrifugation (separation according to the size and density)according to which the denser components of a mixture goes away from the axis of rotation while the lighter particles move towards the axis of rotation of the centrifuge (a device that puts a substance in rotation around a fixed axis). It is carried out with the help of a separator.*
- When milk is introduced in this device, it is spun around an axis. Cream, being lighter than milk collects in the middle while milk, which is heavier is pulled outwards. Both these components are then collected through separate outlets

Applications: → *Used in diagnostic laboratories for blood and urine tests.*
→ *Used in dairies and home to separate butter from cream.*
→ *Used in washing machines to squeeze water from wet clothes*

Simple distillation

- Simple distillation is a method used for the separation of components of a mixture containing two ***miscible liquids*** that boil without decomposition and have sufficient difference in their boiling points.
- The distillation process involves heating a liquid to its boiling points, and transferring the vapors into the cold portion of the apparatus, then condensing the vapors and collecting the condensed liquid in a container.
- **Applications:** → Separation of acetone and water.
  → Distillation of alcohol

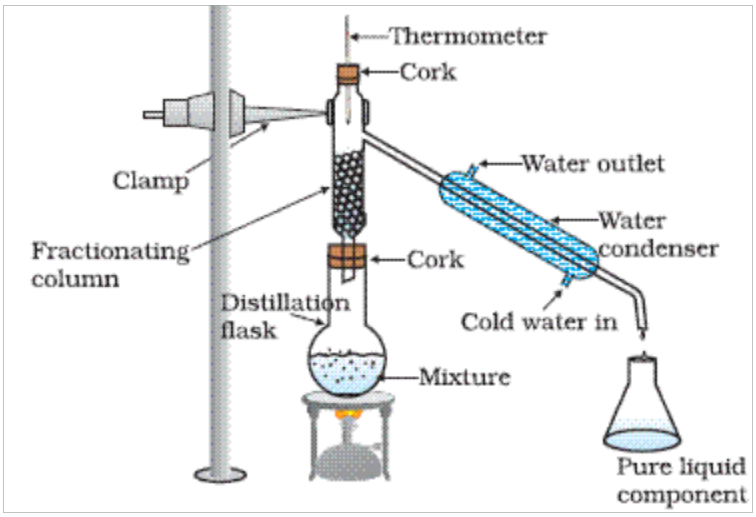


Fractional distillation:

- Fractional distillation is used for the sseparation of a mixture of two or more miscible liquids for which the difference in boiling points is less than 25K.
- The apparatus for fractional distillation is similar to that of simple distillation, except that a fractionating column is fitted in between the distillation flask and the condenser.

receiver flask.

- A simple fractionating column is a tube packed with glass beads. The beads provide surface for the vapors to cool and condense repeatedly. When vapors of a mixture are passed through the fractionating column, because of the repeated condensation and evaporation, the vapors of the liquid with the lower boiling point first pass out of the fractionating column, condense and are collected in the receiver flask. The other liquid, with a slightly higher boiling point, can be collected in similar fashion in another



Example – Ethanol and water are separated from their mixture using fractional distillation. The boiling point of water is 100ºC while the boiling point of ethanol is 78.4ºC. Since the difference of their boiling point is less than 25ºC, thus they are separated using fractional distillation.

Applications : → In petroleum refineries, petrochemical and chemical plants, natural gas processing and cryogenic air separation plants.

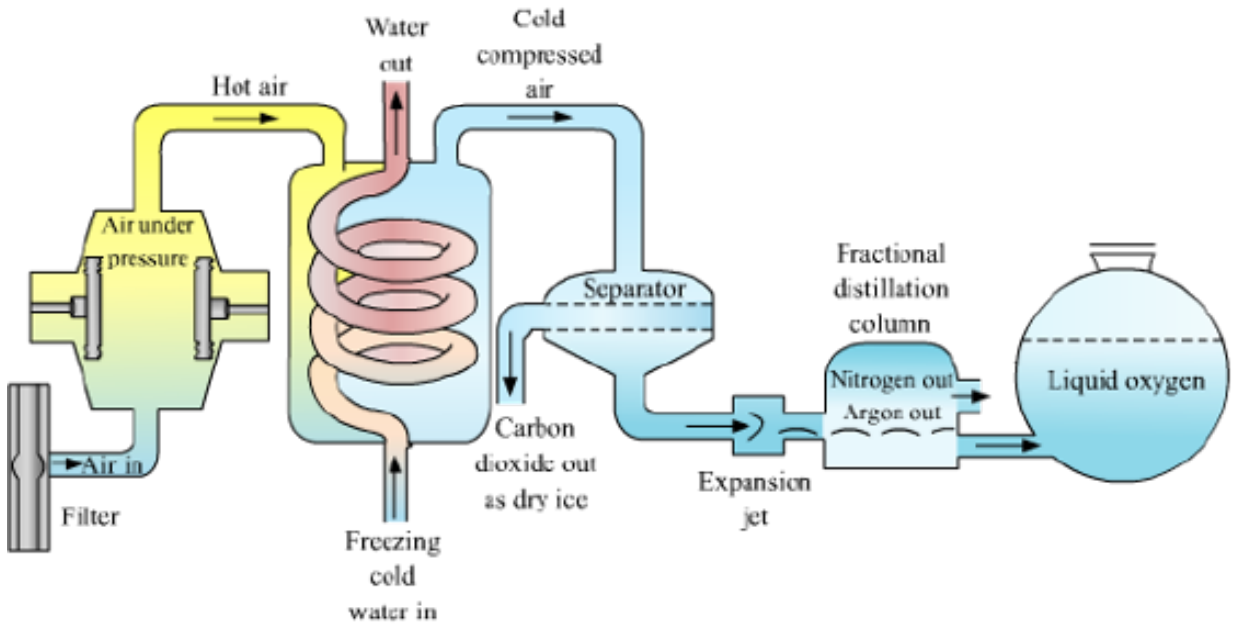
- ➔ In oil refineries to separate crude oil into useful substances (or fractions).
- ➔ In the process of organic juice.
- ➔ In the separation of oxygen, liquid nitrogen and argon from air.

Separation of different gases from air

Air comprises of nitrogen, oxygen, carbon dioxide and argon as major components. Since air is the cheapest source of these gases, thus these are extracted from air at large scale

Stages involved in separation of the components of air:

- Air is first filtered to remove dust particles. Then, it is compressed under high pressure.
- This compressed air is then passed through a water condenser to decrease its temperature.
- The cold compressed air is now passed through a separator. Here, carbon dioxide separates as **dry ice**. Due to repeated compression, air becomes cold and turns into liquid.
- The liquid air coming out of the separator is passed through an expansion jet into the distillation column. Here, it is warmed slowly. Liquid nitrogen, having the boiling point of 196C, boils first to form liquid nitrogen gas. This gas is collected from the upper part of the column. Argon, having a boiling point of 186C, is collected next. Oxygen, having a boiling point of 183C, is collected last.
- this process is called fractional distillatio



Chromatography

Chromatography is a separation technique used to separate the different components in a liquid mixture.

- It was introduced by a Russian Scientist ***Michael Tswett.***
- Chromatography involves the sample being dissolved in a particular solvent called mobile phase. The mobile phase may be a gas or liquid. The mobile phase is then passed through another phase called stationary phase. The stationary phase may be a a piece of chromatography paper.
- The various components of the mixture travel at different speeds, causing them to separate.
- There are different types of chromatographic techniques such as:

a. **Column chromatography,**
b. **Paper chromatography, and**
c. **Gas chromatography.**

Paper chromatography : It is one of the important chromatographic methods. Paper chromatography uses paper (cellulose filter paper) as the stationary phase and a liquid solvent as the mobile phase. In paper chromatography, the sample is placed on a spot on the paper and the paper is carefully dipped into a solvent. The solvent rises up the paper due to capillary action and the components of the mixture rise up at different rates and thus are separated from one another.

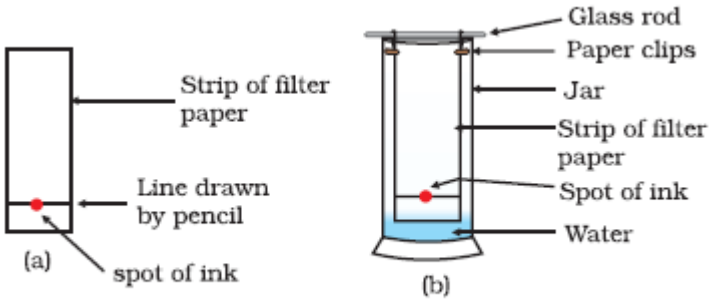
Principle: Chromatography is the technique used for separation of those solutes that dissolve in the same solvent.

Applications: → To separate colors in a dye.
→ To separate pigments from natural colors.
→ To separate drugs from blood.

Activity : Different compounds of a dye can be separated by chromatography method:

⇨ Take a thin strip of filter paper.
⇨ Draw a line on it using a pencil, approximately 3 cm above the lower edge.
⇨ Put a small drop of ink (water soluble, that is, from a sketch pen or fountain pen) at the centre of the line. Let it dry.
⇨ Lower the filter paper into a jar/glass/ beaker/test tube containing water so that the drop of ink on the paper is just above the water level. and leave it undisturbed.
⇨ Watch carefully, as the water rises up on the filter paper.

Observation-- Different components (red and green ink) of ink get separated This process of separation of components of a mixture is known as chromatography.



Physical and Chemical Changes

Physical properties: The properties that can be observed and specified like colour, hardness, rigidity, fluidity, density, melting point, boiling point etc. are the physical properites.

Physical change: **A physical change** brings changes in the physical properties of the matter. It may or may not be reversible.

Example: Melting of ice into water

Chemical change: **A chemical change** brings change in the chemical properties of matter and we get new substances. A chemical change is also called a chemical reaction.

Example: Formation of milk of milk

- *During burning of a candle, both physical and chemical changes take place.*

- *Melting and evaporation of wax are the physical changes and*
- *burning of the wax is a chemical change.*

Activity: Make two groups . Give 50 g of iron filings and 3 g of sulphur powder in a china dish to both the groups. **Group I** • Mix and crush iron filings and sulphur powder. **Group II** • Mix and crush iron filings and sulphur powder. Heat this mixture strongly till red hot. Remove from flame and let the mixture cool.

Groups I and II (Observation)

1. Check for magnetism	Content with gr. I show magnetism.
	Content with gr. II does not show magnetism.
2. Colour	Gr. I – Yellow with black spots.
	Gr. II – Black
• Add carbon disulphide to one part of the material obtained. Stir well and filter.	Gr.-I Yellow solution of S in CS_2 and iron filings get separated.
	Gr. II- Material does not dissolve in CS_2.
• Add dilute sulphuric acid or dilute hydrochloric acid to the other part of the material obtained	Gr. I- Material -→ **Iron** reacts with acids and release H_2 g.
	Reac.→ $Fe + 2HCl \rightarrow FeCl_2 + H_{2\,g}$
	Gr. II- Whole material reacts with acids.
	Reac. → $FeS + 2HCl \rightarrow FeCl_2 + H_2Sg$

Note: When we Perform all the above steps with both the elements (iron and sulphur) separately, we obtain results according to gr. I.

Q*•1. Did the material obtained by the two groups look the same?* ***Ans. No.***

Q•2 Which group has obtained a material with magnetic properties? ***Ans. Gr. I***

Q•3. Can we separate the components of thematerial obtained? ***Ans. Yes in gr. I, By magnet. And No in gr. II.***

Q•4. On adding dilute sulphuric acid or dilute hydrochloric acid, did both the groups obtain a gas? Did the gas in both the cases smell the same or different? Ans. The gas obtained by Group I is hydrogen, it is colourless, odourless and combustible– The gas obtained by Group II is hydrogen sulphide. It is a colourless gas with the smell of rotten eggs.

Conclusion→ The products obtained by both the groups show different properties, though the starting materials were the same. Group I has carried out the activity involving a physical change whereas in case of Group II, a chemical change (a chemical reaction) has taken place.

- The material obtained by group I is a **mixture** of the two substances. The substances given are the elements– iron and sulphur.
- The properties of the **mixture** are the same as that of its constituents.
- The material obtained by group II is a **compound**.
- On heating the two elements strongly we get a **compound**, which has totally different properties compared to the combining elements.
- The composition of a compound is the same throughout.