CLASS 9

CHAPTER - 2

IS MATTER AROUND US PURE

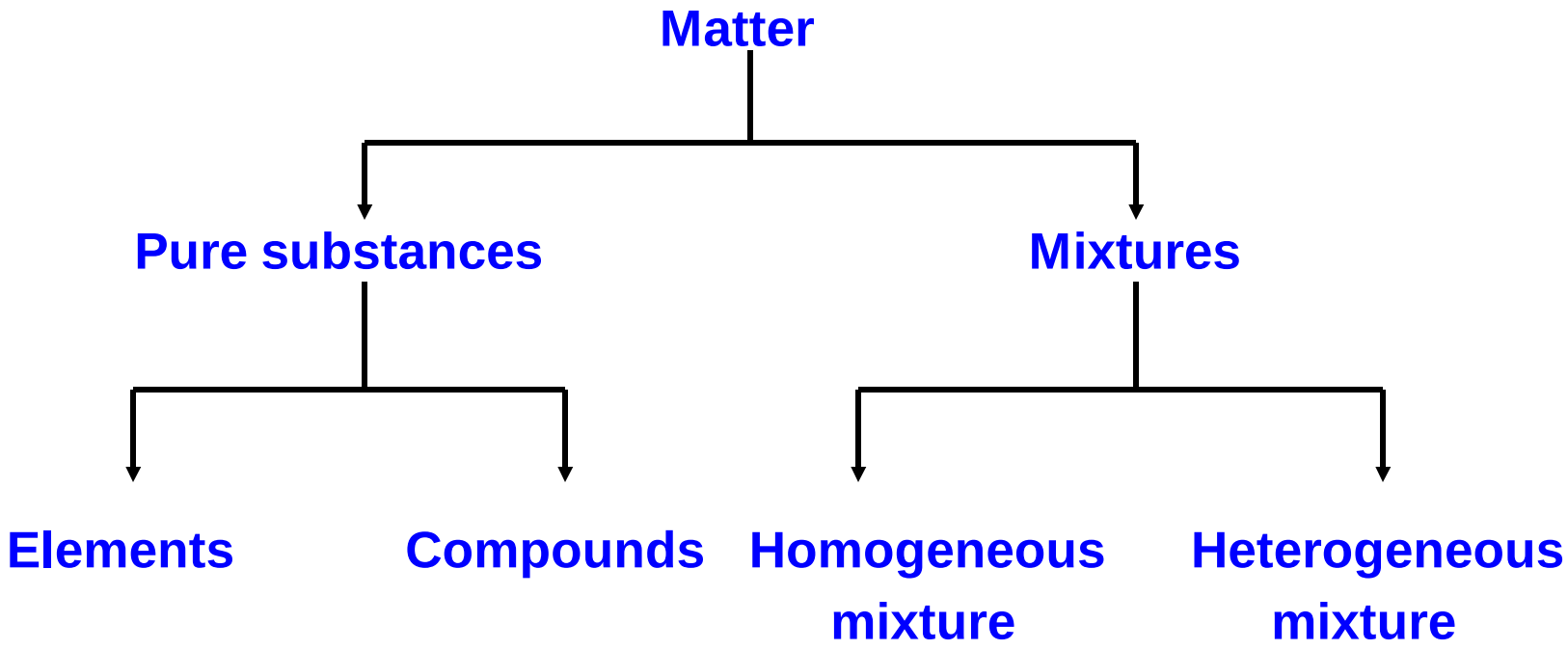
1) Classification of matter :-

i) On the basis of the physical state, matter is classified into three main types. They are solids, liquids and gases.

ii) 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. The are elements and compounds.

Mixtures are of two types. They are homogeneous mixtures and heterogeneous mixtures.



2) Pure substances and mixtures :-

i)Pure substance :- is a substance which consists of a single type of substance (element or compound).

Eg:- iron, copper, hydrogen, oxygen, water, sugar, common salt etc.

ii)Mixture :- is a substance which consists of two or more pure substances. Eg:- sea water, minerals, soil, air, sand and salt, sugar in water, salt in water etc.

Differences between pure substances and mixtures :-

Sl.No.	Pure substance	Mixture
1	Pure substance consists of a single type of substance	Mixture consists of two or more pure substances.
2	Pure substance cannot be separated into other substances by physical methods.	Mixture can be separated into its components by physical methods.
3	Pure substance has its own definite properties.	Mixture shows the properties of its components.

3) Types of mixtures :-

Mixtures are of two types. They are homogeneous mixture and heterogeneous mixture.

i) Homogeneous mixture :- is a mixture which has a uniform composition.

- 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.

Eg :- mixture of sugar in water, mixture of salt in water, mixture of copper sulphate in water etc.

ii) Heterogeneous mixture :- 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.

Eg :- mixture of salt and sand, mixture of sulphur and iron filings, mixture of oil and water etc.

4) 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.

Eg :- solution of salt in water, solution of sugar in water, iodine in water (tincture iodine), soda water etc.

Properties of true solutions :-

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

5) Colloidal solution :-

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

Eg :- mixture of starch in water, mixture of egg albumin in water, milk, air containing dust and smoke etc.

Properties of colloidal solution :-

i) Colloidal solution is a heterogeneous mixture.

ii) The particles cannot be seen by the naked eye.

iii) The solute particles cannot be separated by filtration.

iv) The solute particles do not settle down and the solution is stable.

v) The particles scatter a beam of light passing through it and the path of light is visible in the solution.

6) Suspension :-

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

Eg :- solution of sand in water, solution of chalk powder in water etc.

Properties of suspension :-

i) Suspension is a heterogeneous mixture.

ii) The particles can be seen by the naked eye.

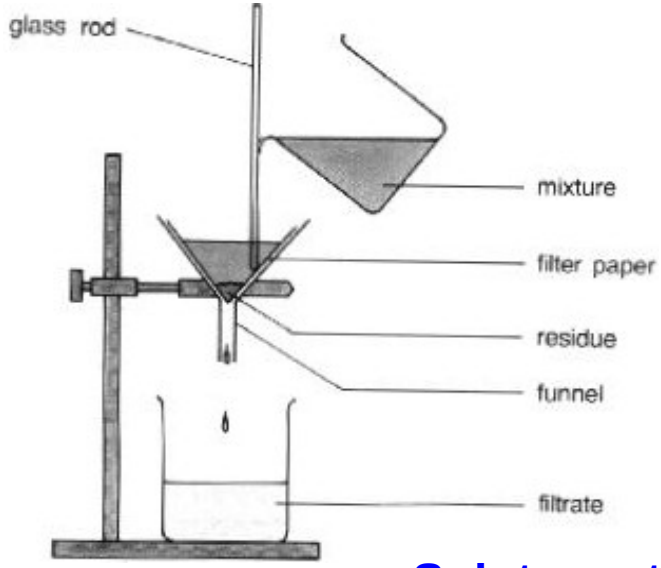
iii) The solute particles can be separated by filtration.

iv) The solute particles settle down and the solution is unstable.

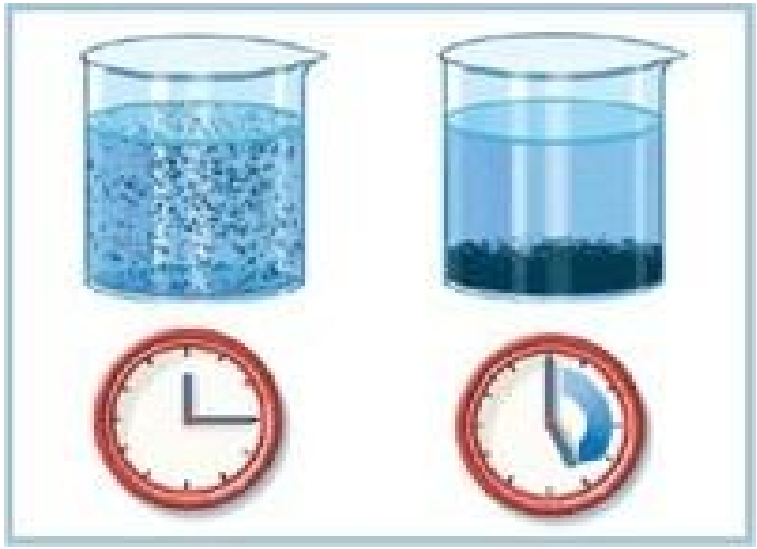
v) The particles scatter a beam of light passing through it and the path of light is visible in the solution.

SUSPENSION

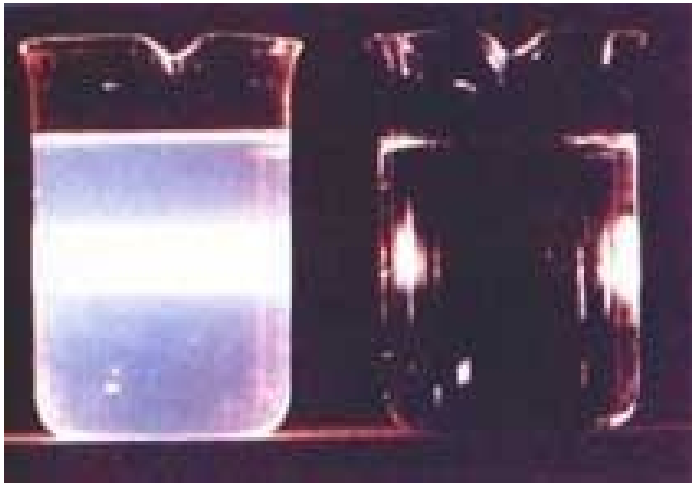
Solute particles can be separated by filtration.



Solute particles settle down and the solution is unstable.



Solute particles scatter light and the path of light is visible.

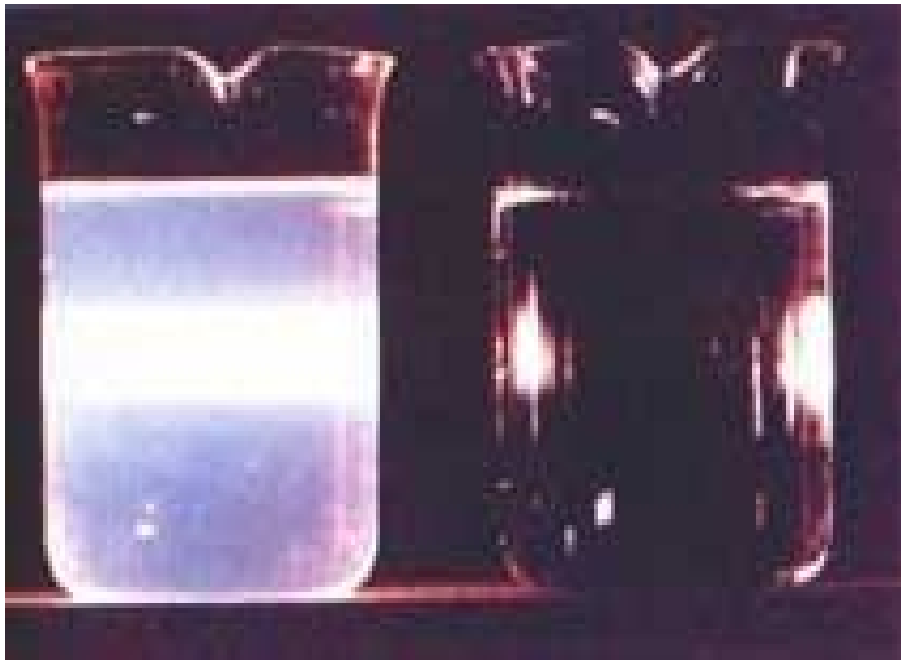


7) Tyndall effect :-

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 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.



8) Saturated 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.

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.

If the mixtures are heated it dissolves some more of the solute.

The solubility of different substances are different.

The solubility of substances varies with temperature.

9) Concentration of a solution :-

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

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

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

The concentration of a solution can be expressed as mass by mass percentage or as mass by volume percentage.

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

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

10) 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 :-

i) Evaporation

ii) Centrifugation

iii) Decantation (Using separating funnel)

iv) Sublimation

v) Centrifugation

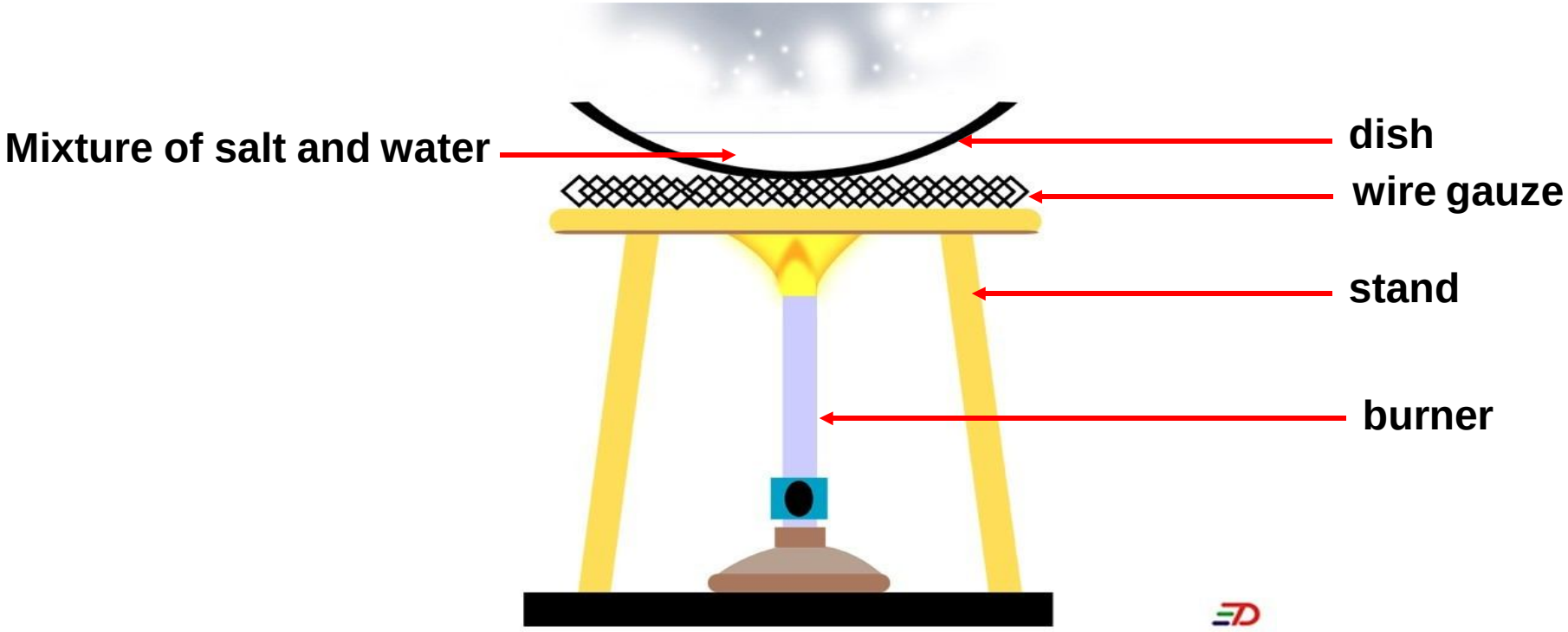
vi) Chromatography

vii) Distillation and fractional distillation

i) Evaporation :-

This method is used for separating a volatile component (solvent) from a non volatile component (solute) by heating the mixture.

Eg :- 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.



ii) Centrifugation :-

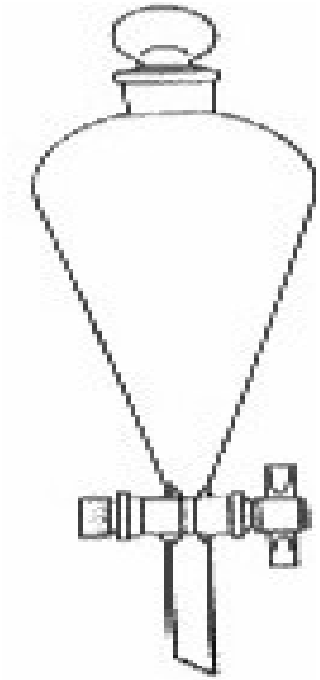
The method of separating denser particles and lighter particles from a mixture by using a centrifuging machine is called centrifugation.

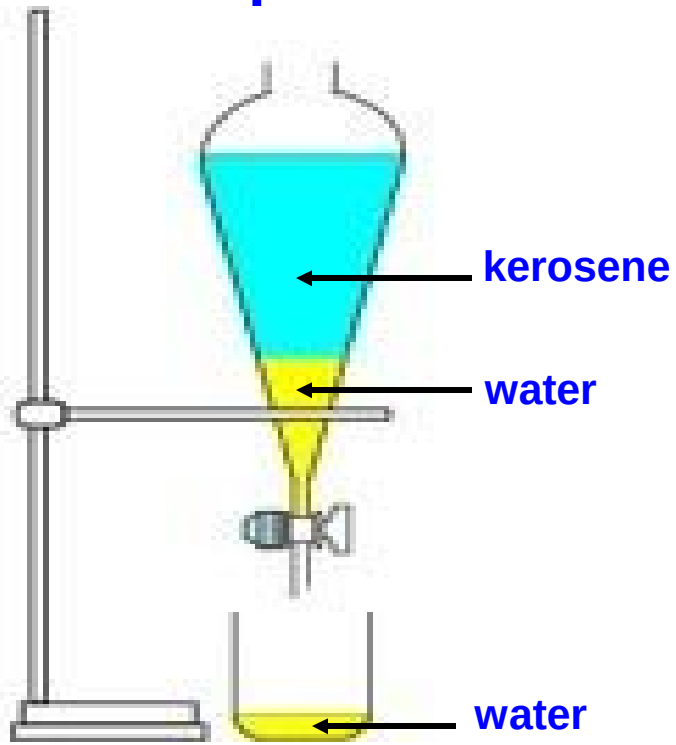
Eg :- If we take some milk in a centrifuging machine and spin it rapidly, the cream separates from the milk because cream is less dense than milk.

iii) Decantation using separating funnel :-

This method is used for separating a mixture of immiscible liquids. Liquids separate into different layers depending on their densities.

Eg :- 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.

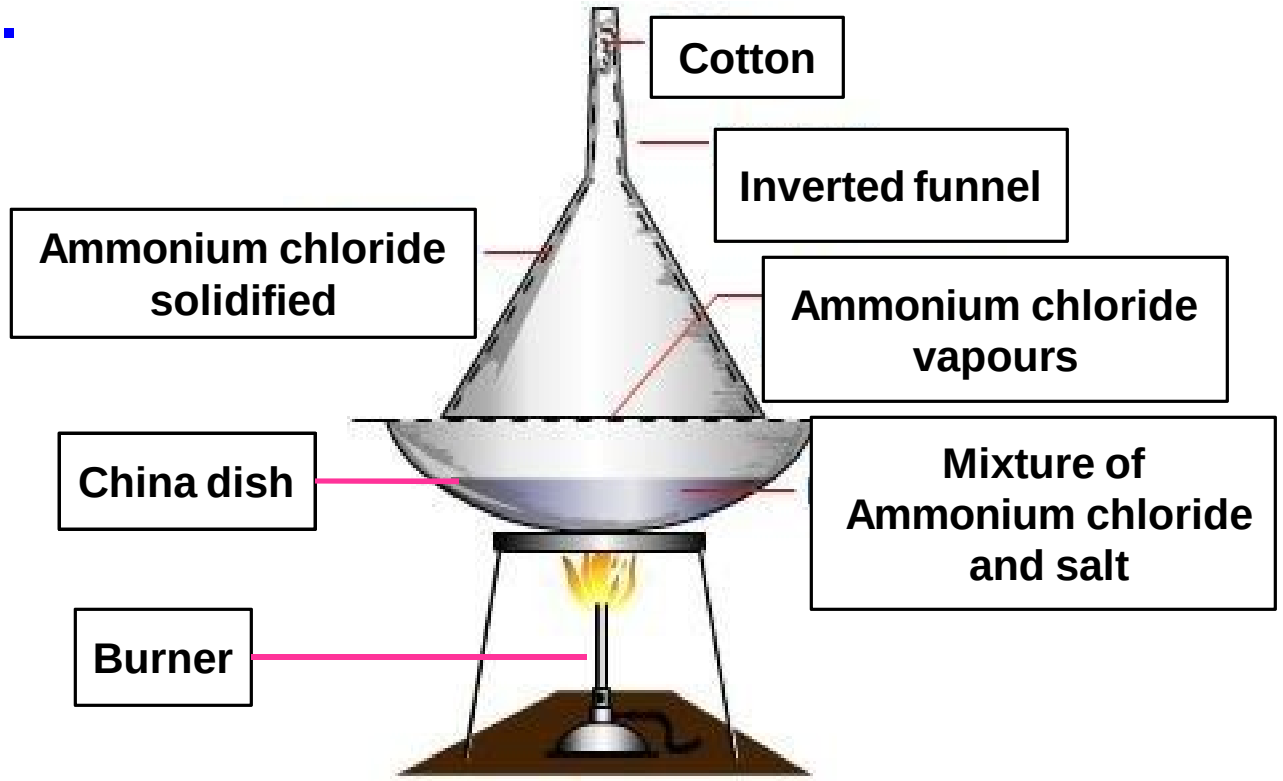




iv) Sublimation :-

This method is used to separate a mixture of a sublimable component from a non sublimable component by heating the mixture.

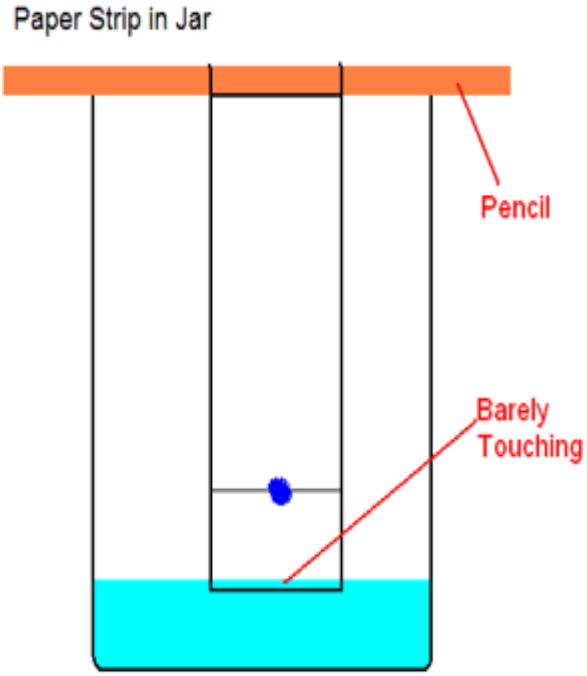
Eg :- If a mixture of ammonium chloride and common salt is heated, the ammonium chloride sublimes and can be cooled and solidified and collected and salt is left behind.

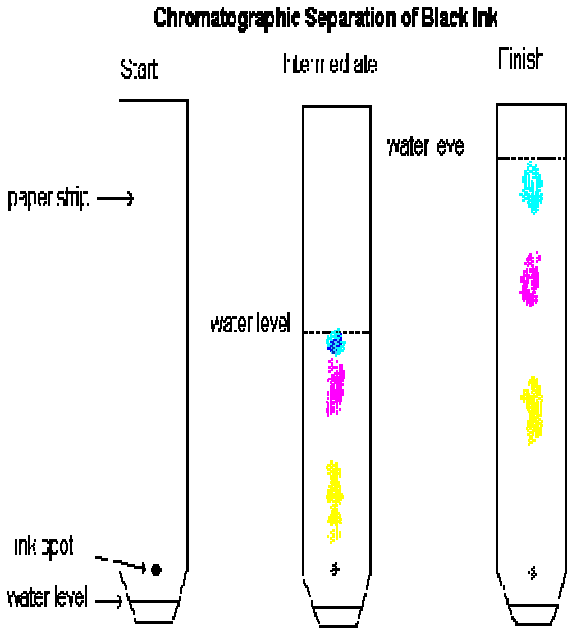


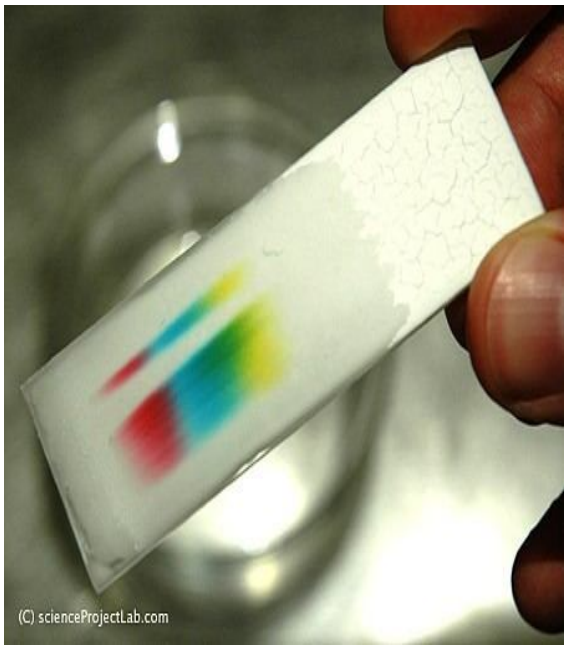
v) Chromatography :-

This method is used for separating coloured components from a liquid by using a filter paper or blotting paper.

Eg :- 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 get separated.





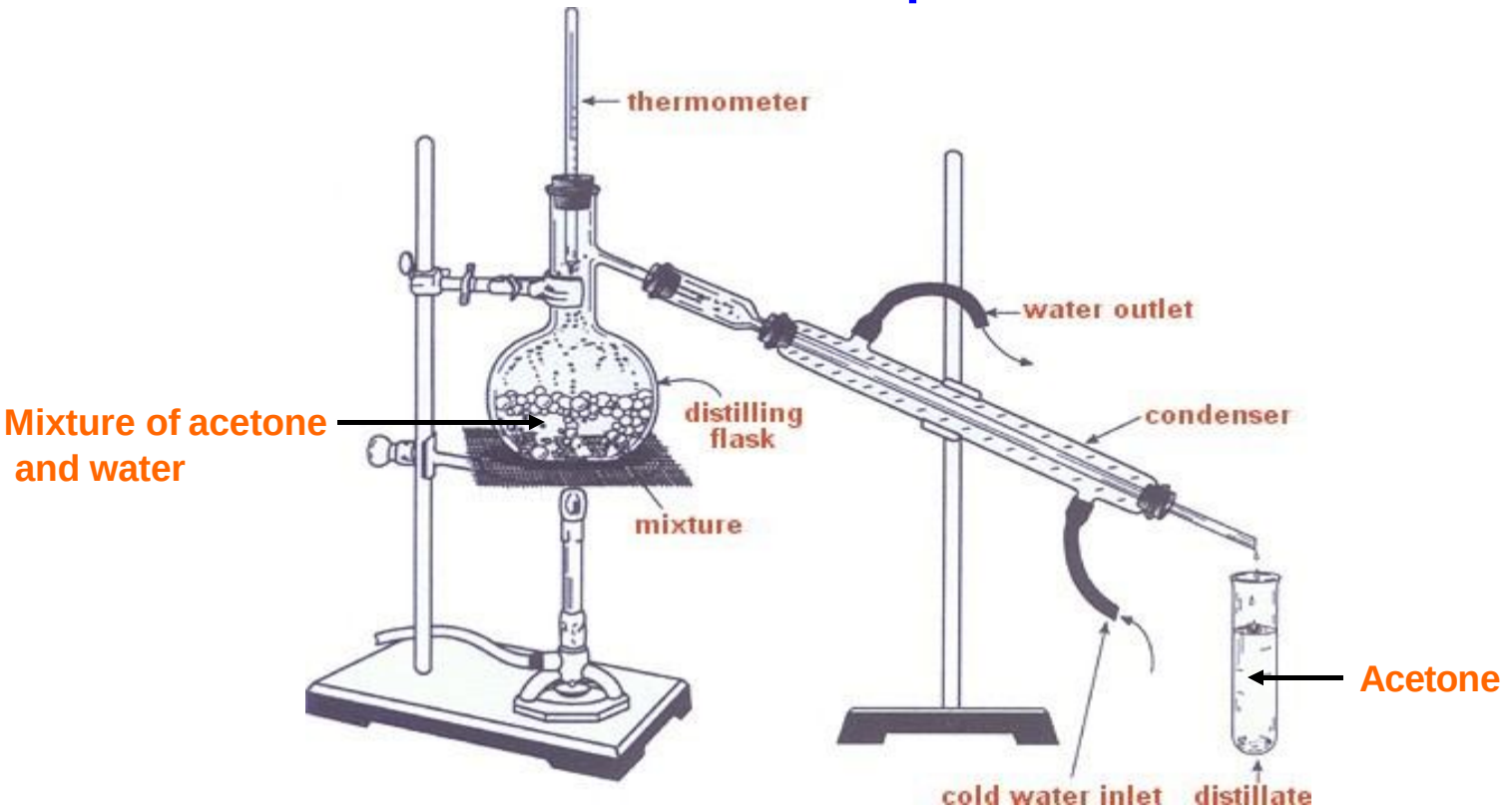


vi) Distillation :-

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.

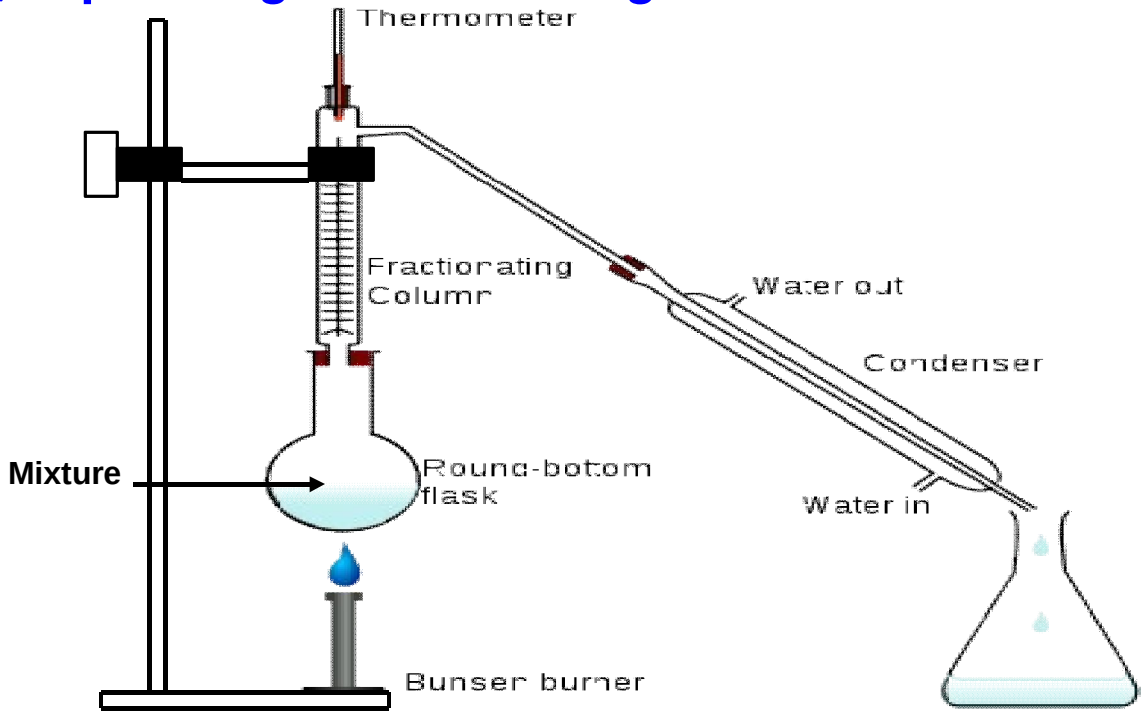
Eg :- If a mixture of acetone and water is heated in a distillation apparatus, the acetone which has a lower boiling point than water first boils and cools and condenses and is separated from the water.



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.

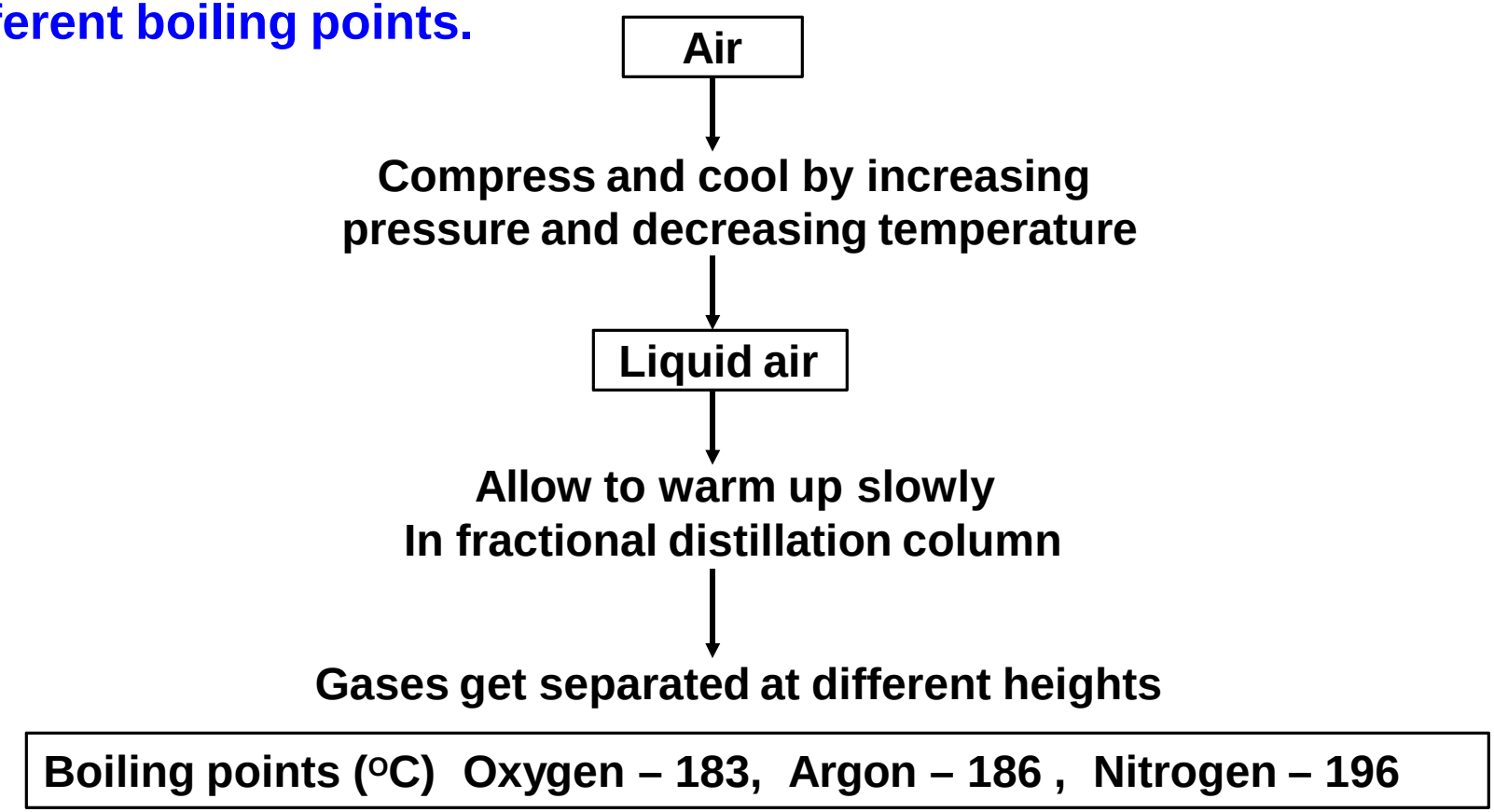
Fractional distillation is used for separating the components of petroleum, separating the different gases from air etc.



11) 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.



12) Purification of solids by crystallisation :-

Crystallisation is the process of obtaining a pure solid in the form of crystals from its solution.

Eg :- By crystallisation we can obtain pure copper sulphate from its solution.

Dissolve about 5g of copper sulphate in minimum amount of water. Filter the solution to remove the impurities. Evaporate the solution in a china dish to get a saturated solution. Cover the solution with a filter paper and alllow it to cool. Pure copper sulphate crystals are formed.