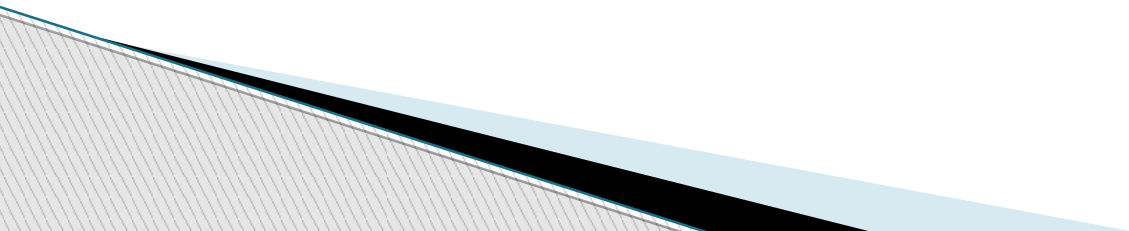


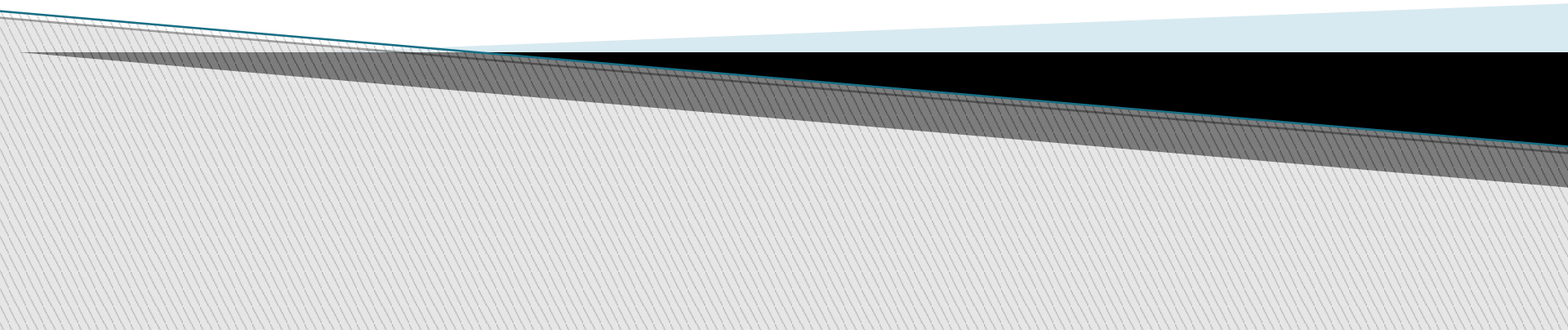
CHAPTER - 2

IS MATTER AROUND US PURE-2 (Separation techniques-1)



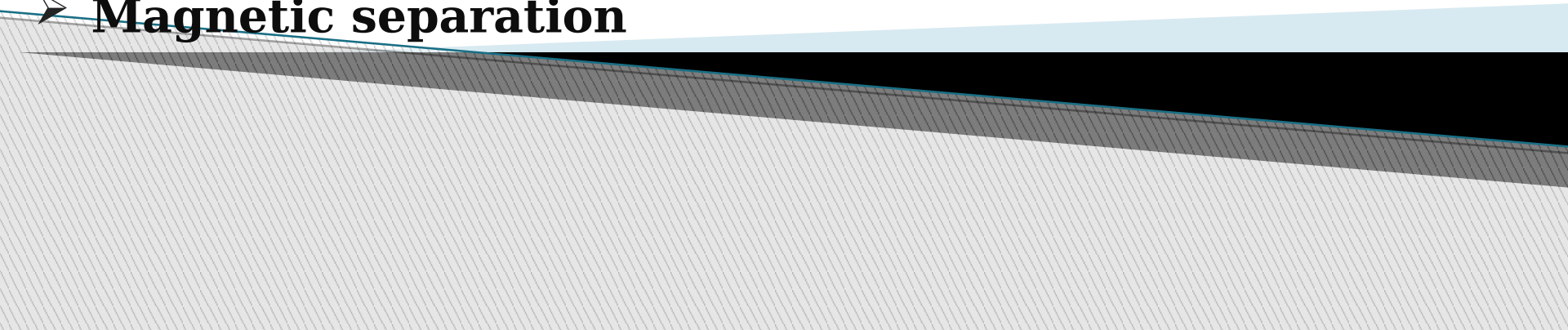
Separating the components of a mixture

The components of a heterogeneous mixture can be separated by techniques which utilize the differences between various physical properties associated with them. The properties can be:

- **Solubility**
 - **Boiling point**
 - **Freezing point**
 - **Sublimable nature**
 - **Magnetic properties etc**
- 
- The bottom of the slide features a decorative graphic consisting of several overlapping, wavy, horizontal bands. The colors transition from a light blue at the top, through a dark grey, to a light grey at the bottom. The waves are more pronounced on the left side and gradually flatten out towards the right.

Separating the components of a mixture

The differences can be applied in form of simple methods like hand picking, sieving, filtration etc. Sometimes special techniques are used to separate the components of mixtures like :-

- **Evaporation**
 - **Centrifugation**
 - **Using separating funnel**
 - **Sublimation**
 - **Chromatography**
 - **Distillation and fractional distillation**
 - **Magnetic separation**
- 

Evaporation

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

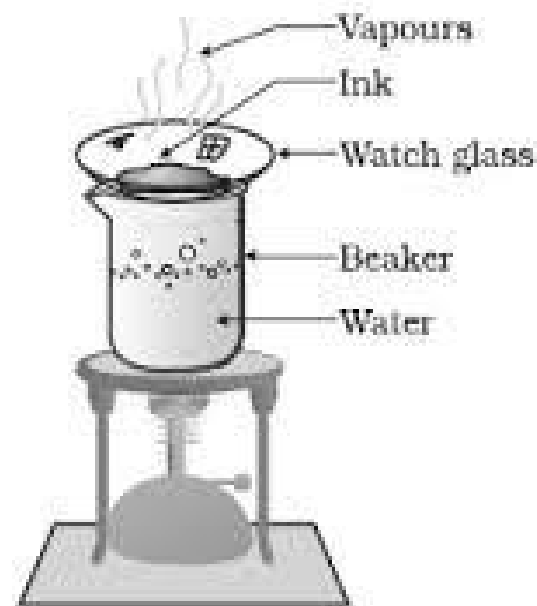
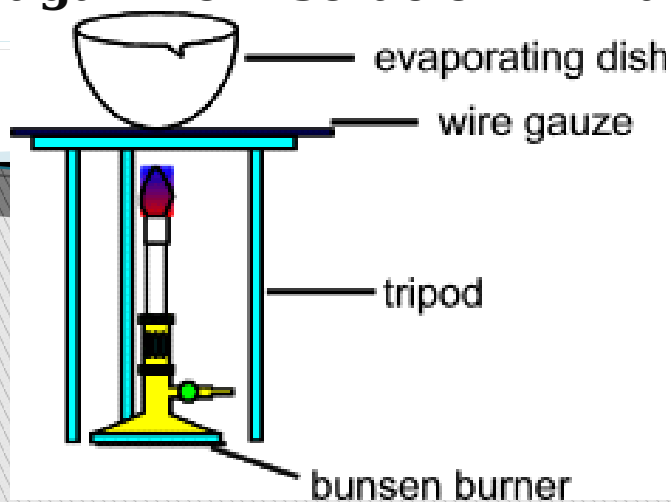
Principle: On heating volatile solvent is evaporated leaving behind the non volatile solute.

Procedure:

1. Apparatus was set up as shown in diagram.
2. Mixture was heated mildly to avoid boiling.
3. Solvent is allowed to escape as vapours leaving behind the solute.

Uses:

4. Separation of dye from ink.
5. Separation of salt/sugar from solution in wa



Centrifugation

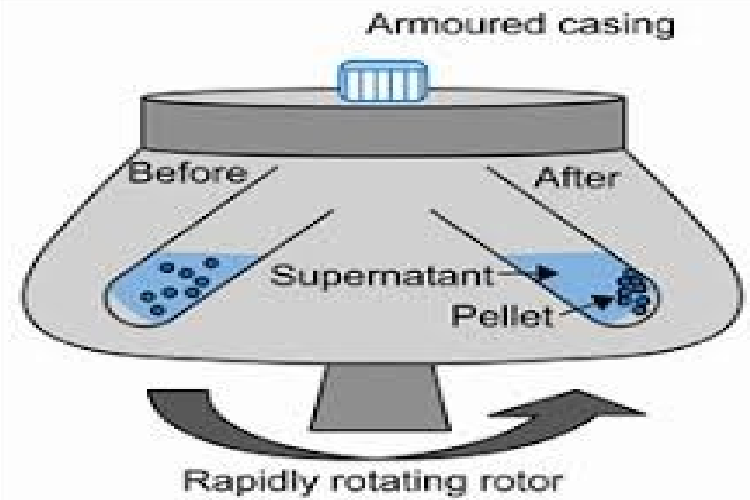
Condition: Method is used for separating a insoluble dispersed component (solute) from a liquid component medium(solvent) by using centrifuge machine.

Principle: The application of the centrifugal force causes the sedimentation suspended component from heterogeneous mixtures (as pellet) leaving behind the liquid medium (as supernatant).

Procedure:

- 1. Bottle or tube containing mixture was installed in a centrifuge.**
- 2. Mixture was rotated at suitable speed to cause separation.**

Centrifugation



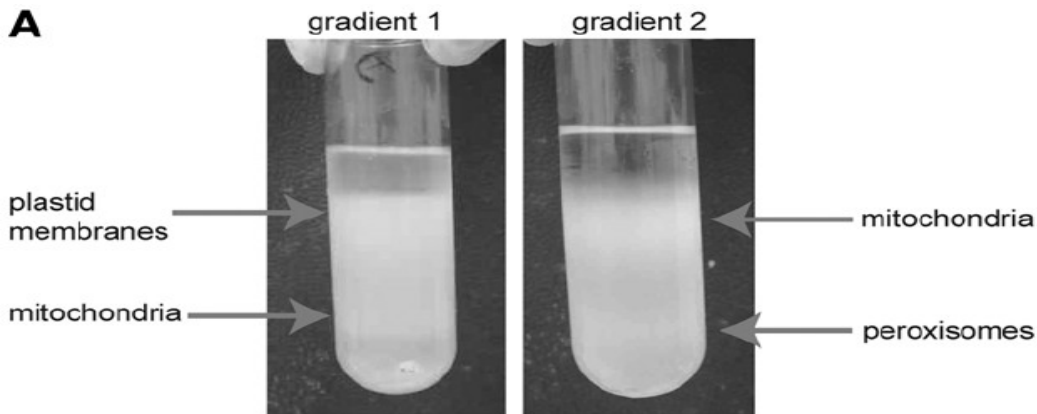
Centrifugation

Uses of Centrifugation:

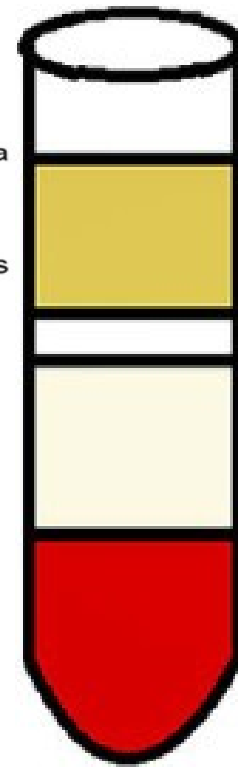
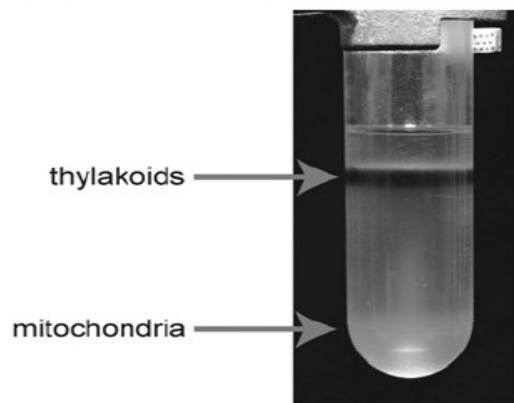
1. Separation of cream from milk.
2. Separation of components of blood like serum & RBC.
3. Drying of clothes in dryer.
4. Separation of cell organelles.



A



B



← Layer 1: Plasma

← Layer 2: White blood cells

← Layer 3: Ficoll

← Layer 4: Erythrocytes/granulocytes

By separating funnel

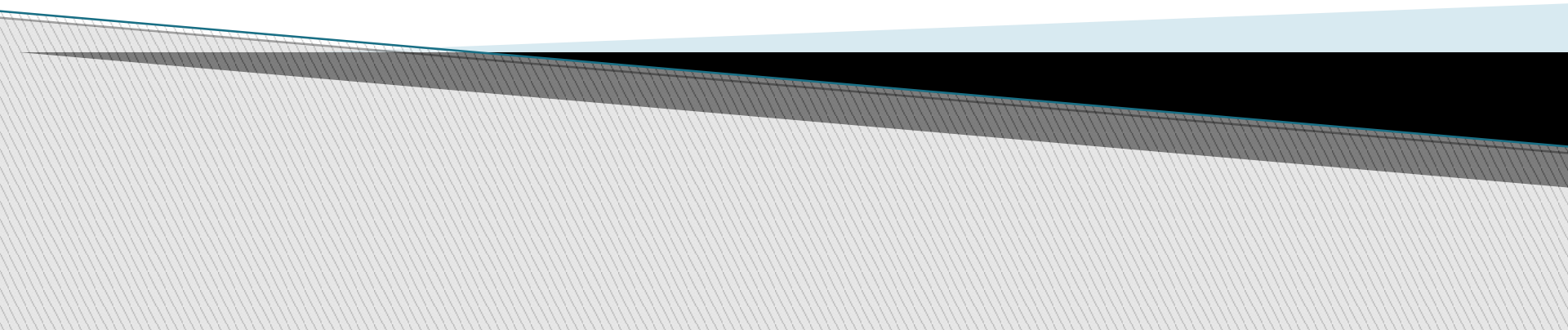
Condition: This method is used if two components are liquid, insoluble and differ significantly in density.

Principle: When mixture is allowed to stand for some time low density liquid separate out and form a separate layer above high density component.

Procedure:

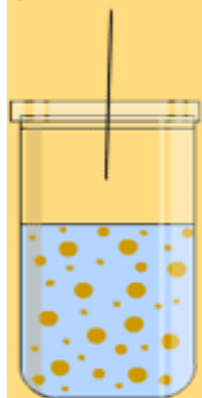
1. Mixture was filled in separating funnel.
2. Mixture was allowed to stand till two separate layers are observed.
3. Open the bottom tap to separate high density component.

Uses:

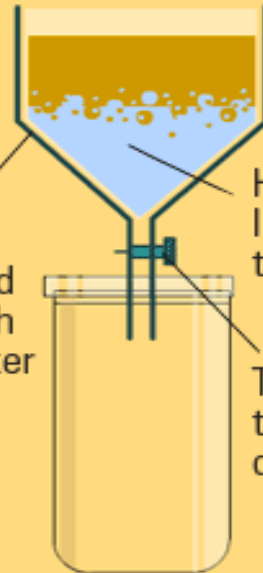
4. Separation of kerosene oil & water.
 5. Separation of vegetable oil & water.
- 

By separating funnel

Mixture of two immiscible liquids with different densities (water + olive oil)



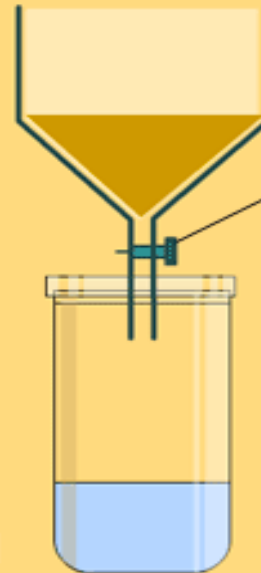
Mixture is poured into a funnel with a tap to the beaker



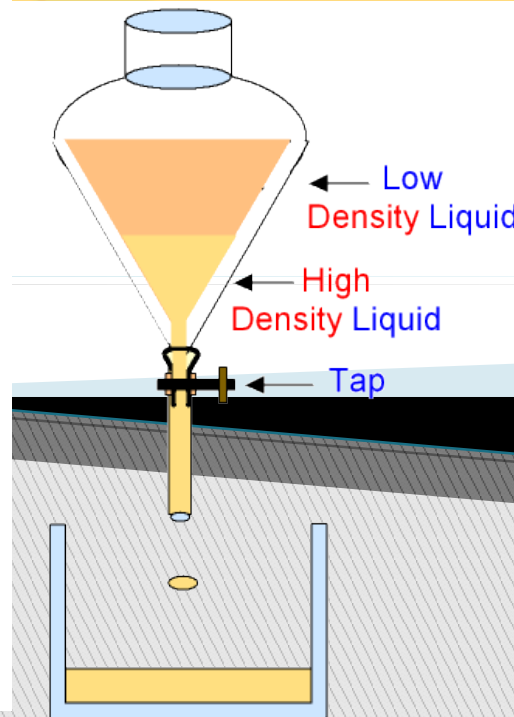
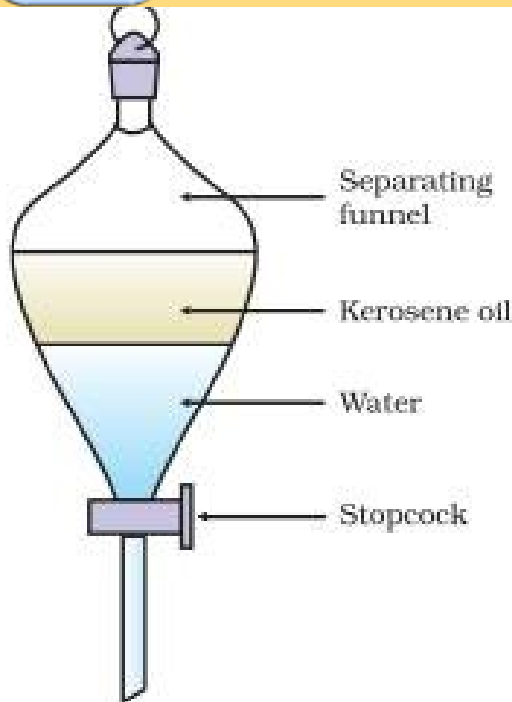
Higher density liquid settles at the bottom.

The tap is opened to let out the high density liquid.

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Tap is closed as soon as the low density liquid gets to the spout.



Sublimation

Condition: This method is used if components of the mixture are solid and one of the component is sublimable.

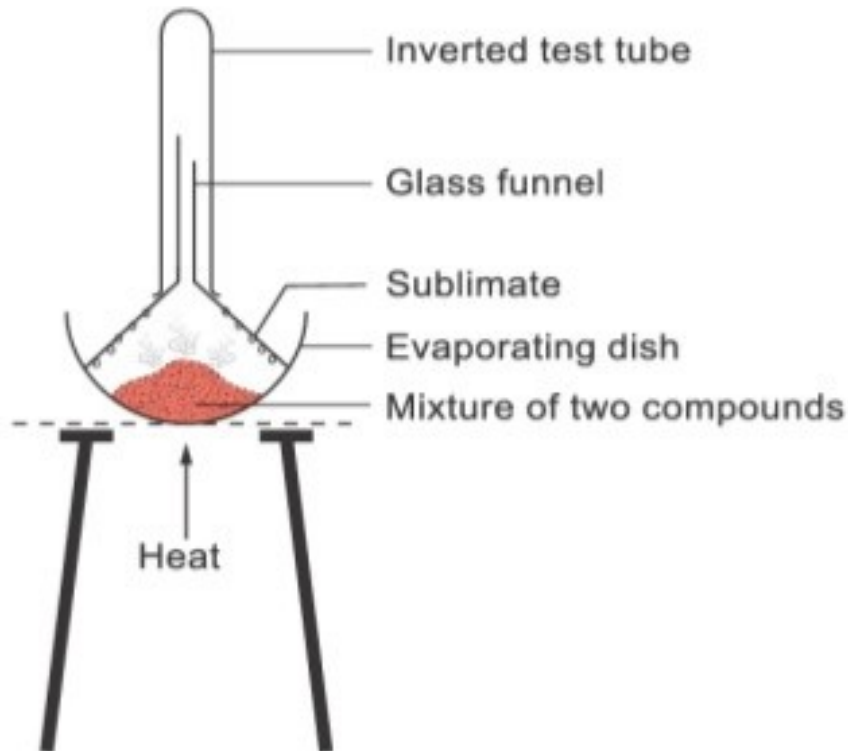
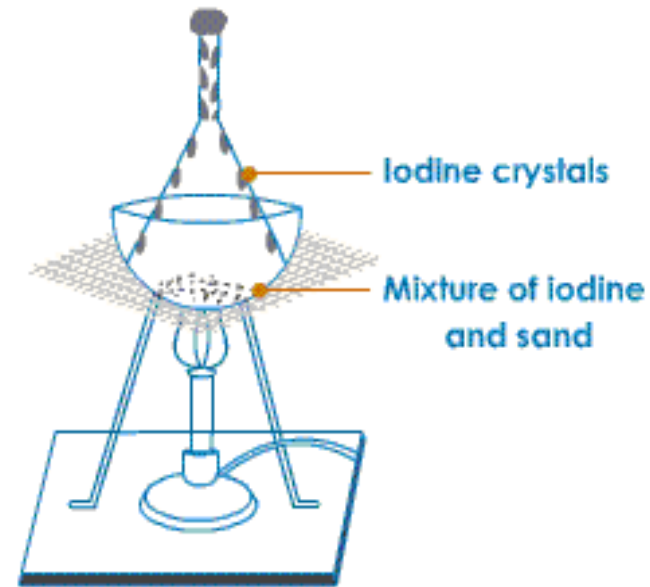
Principle: When mixture is heated sublimable component separate out as vapours which are condensed to obtain pure component.

Procedure: (Mixture of Ammonium Chloride (NH_4Cl) & common salt)

1. Apparatus was set up as shown in diagram.
2. Mixture was heated till white fumes of NH_4Cl were observed.
3. Mixture was covered using inverted funnel which is sealed with cotton plug.
4. Mixture was heated for 10 min and then allowed to cool for some time.
5. Crystals of NH_4Cl are obtained by scratching inner surface of funnel.

Sublimation

Uses: Sublimation can be used to separate a mixture of solids in which one is sublimable solid and other is non sublimable. Some substances that sublime are iodine, ammonium chloride, naphthalene, camphor E.g. Separation of ammonium chloride from sodium

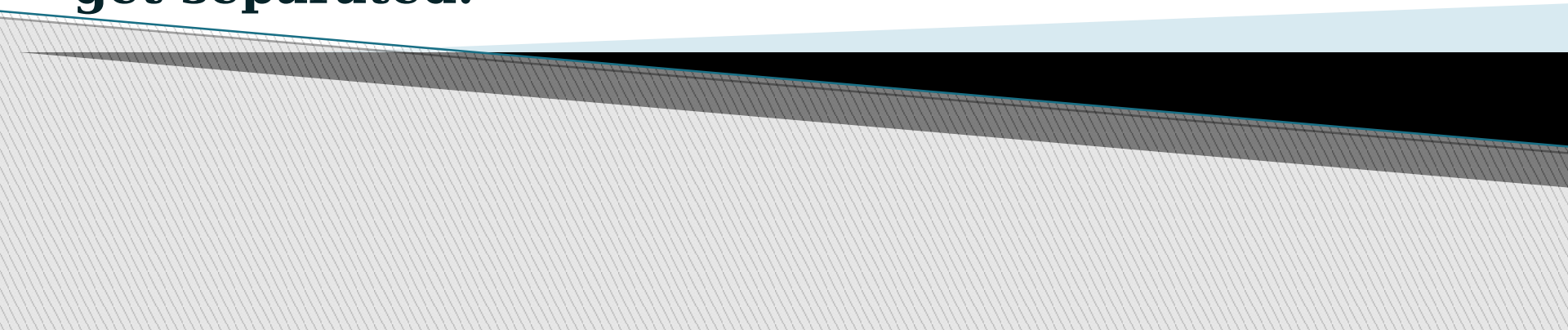


Chromatography

Condition: This method is used if solute differ in solubility in a solvent.

Principle: In *paper (partition) chromatography* compounds in the mixture get separated due to differences in their affinity (solubility) towards water (solvent) moving in stationary phase (i.e. chromatography paper) resulting in separation of different components.

The component which is more soluble in water rises faster and higher in stationary phase thus get separated.



Chromatography

Procedure: (Separation of dyes present in ink)

1. Samples of ink is spotted on to a pencil line drawn on a sheet of chromatography paper.
2. Apparatus was then set up as shown in diagram.
3. Paper strip was suspended with a shallow layer of a suitable solvent (water or alcohol) in it. The solvent level is kept below the line with the spots on it.
4. Solvent was allowed to reach the top of chromatography paper.

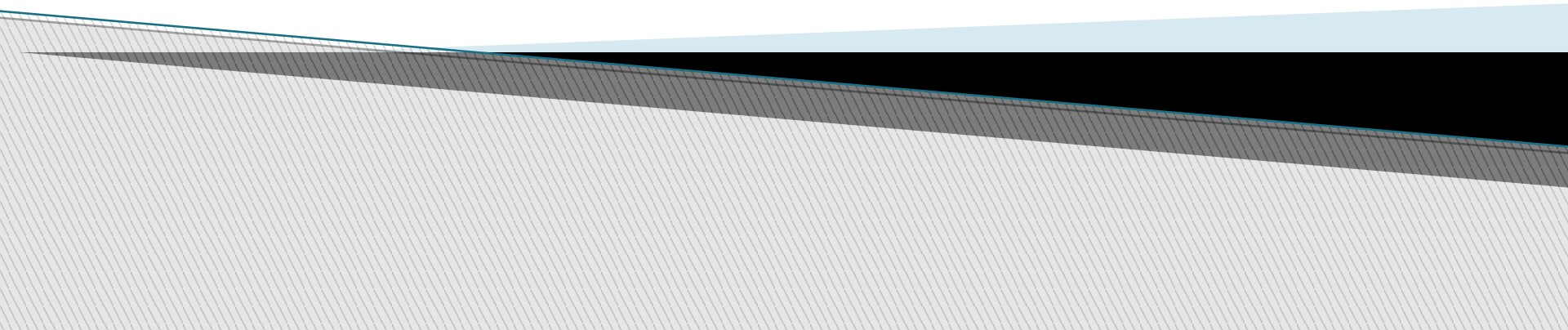
Uses:

5. Separation of pigments of chlorophyll.
6. Separation of proteins & amino acids.
7. Separation of coloured components (dye) from ink.

Distillation

This method is used if the components of a mixture are liquid, miscible with each other and differ in boiling point by at least 25°C.

Procedure: (Separation of acetone & water)

- 1. Apparatus was then set up as shown in diagram.**
 - 2. Solution was heated at 56.5°C as boiling point of acetone is 56°C.**
 - 3. Vapours of acetone are condensed and collected in a separate container as distillate.**
- 

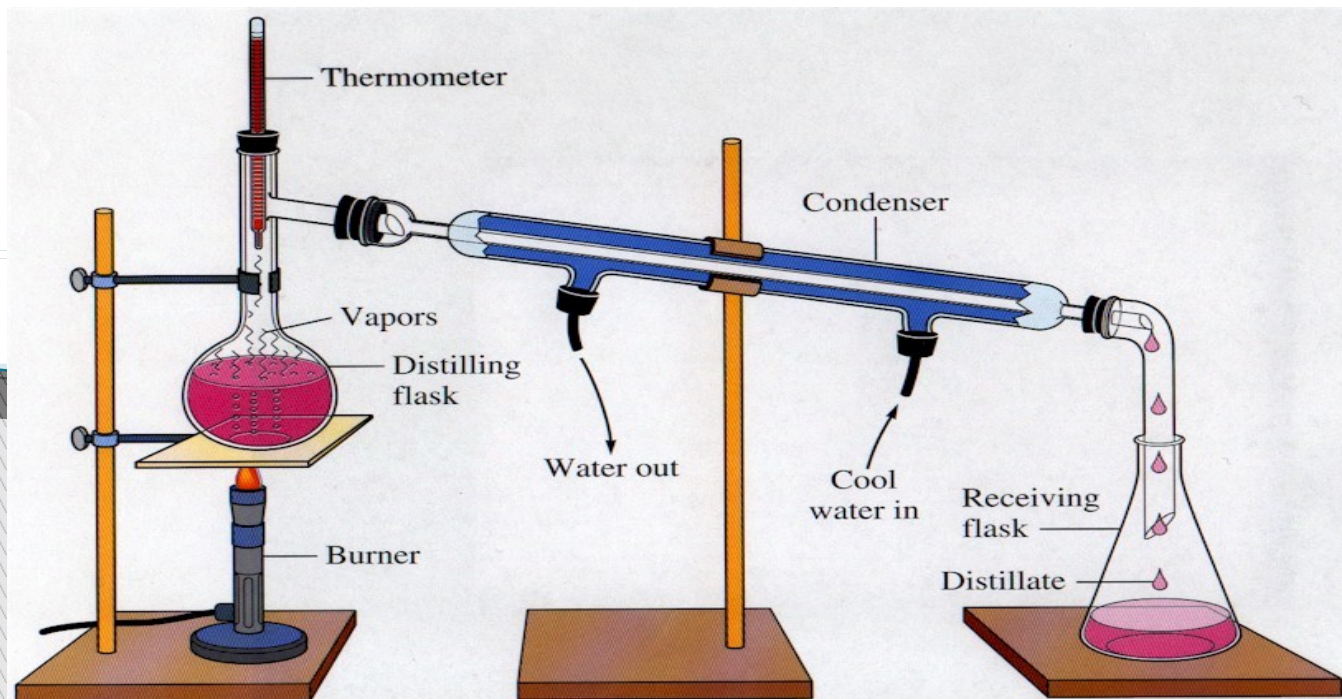
Distillation

Procedure: (Separation of acetone & water)

1. Apparatus was then set up as shown in diagram.
2. Solution was heated to 79°C as boiling point of ethanol is 78.2°C .
3. Vapours of ethanol are condensed and collected in a separate container as distillate.

Uses:

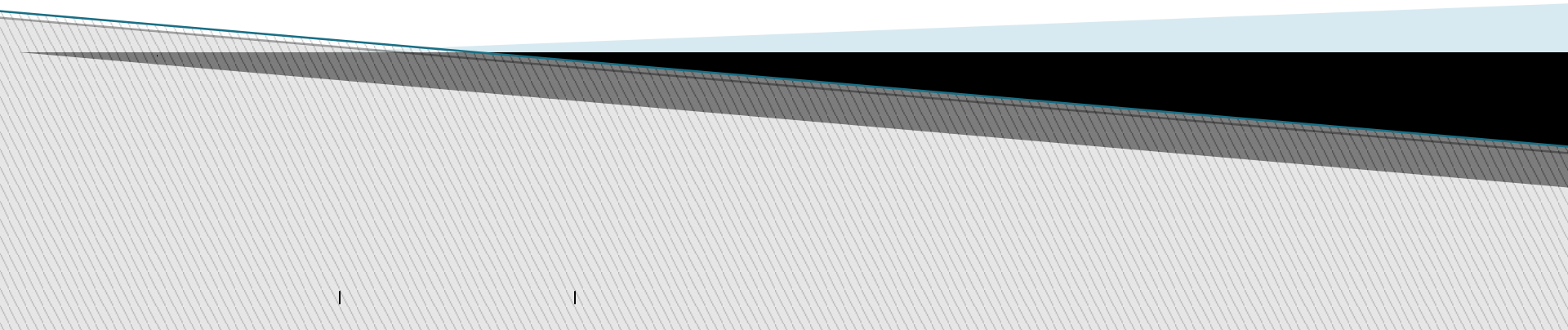
4. Separation of ethanol, acetone from water.
5. Preparing distilled water in lab.
6. Preparation of alcoholic beverages.



Fractional Distillation

Condition: This method is used if components are liquid, miscible and differ in boiling point by at least 5°C.

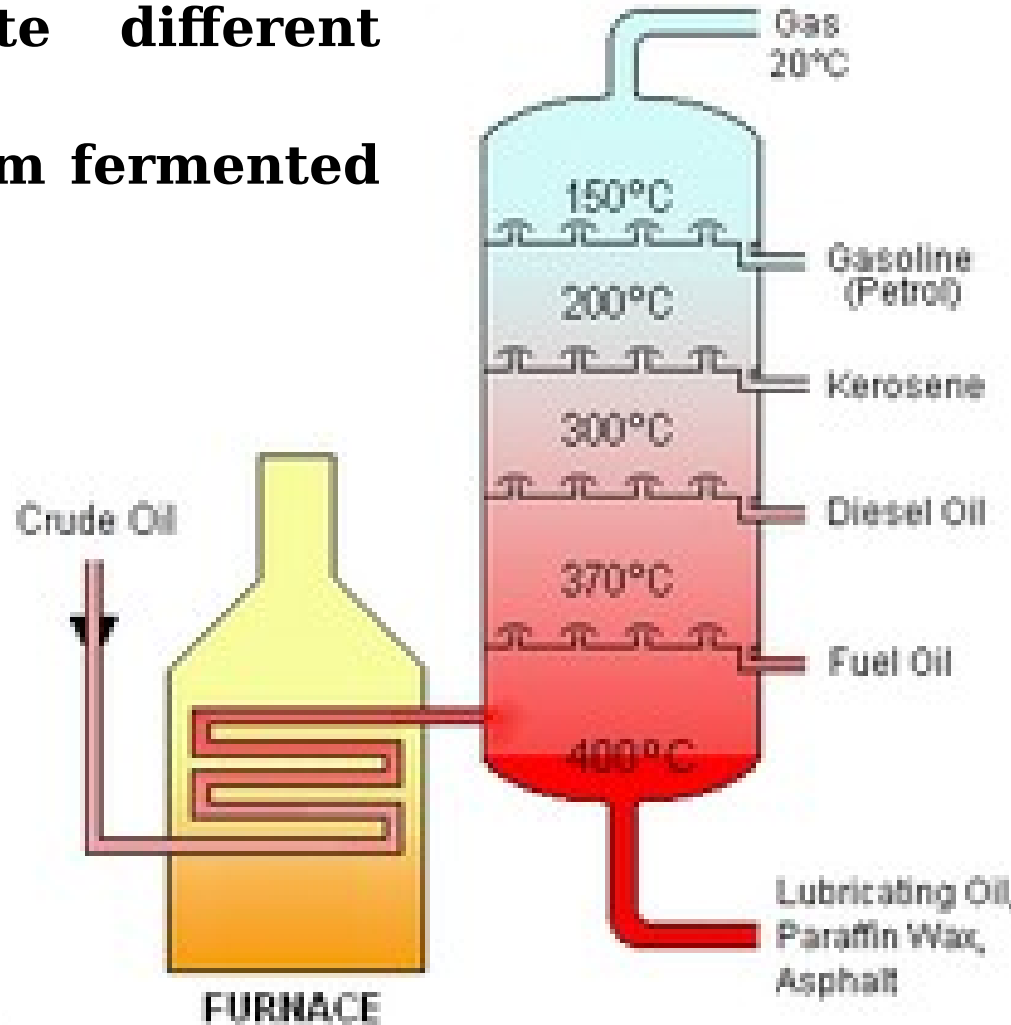
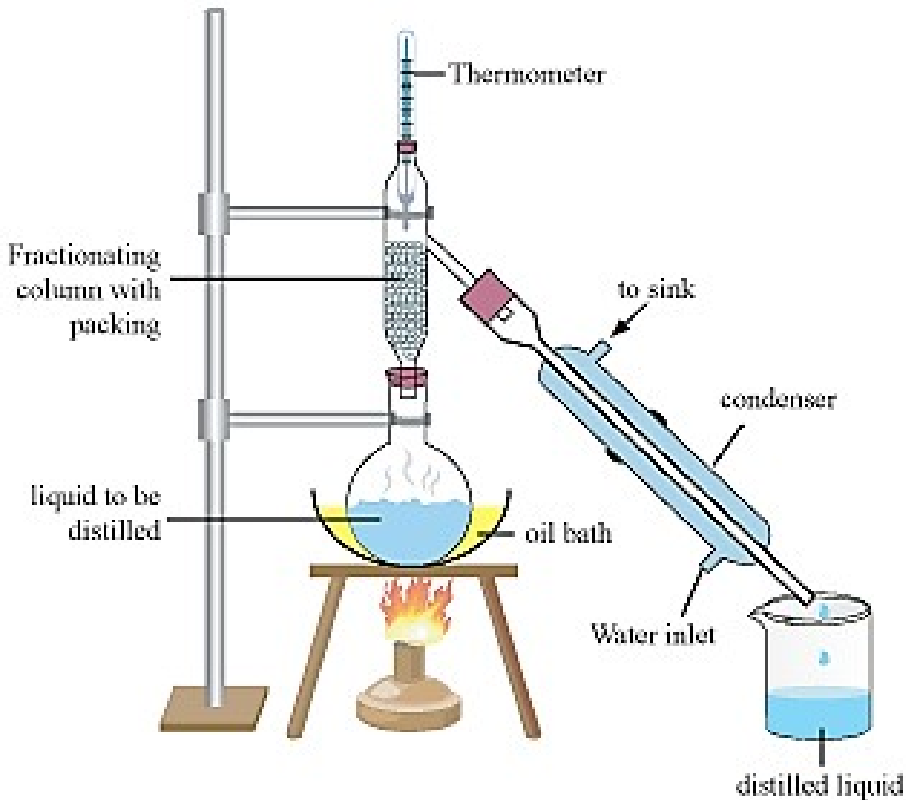
Procedure: (Separation of acetone & water)

1. Apparatus was then set up as shown in diagram.
 2. Solution was heated at 56.5°C as boiling point of acetone is 56°C.
 3. Vapours of acetone are condensed and collected in a separate container as distillate.
- 

Fractional Distillation

Uses:

1. It is used for obtaining different gases from the air.
2. It is used to separate different components of crude oil.
3. Separation of ethanol from fermented alcohol.

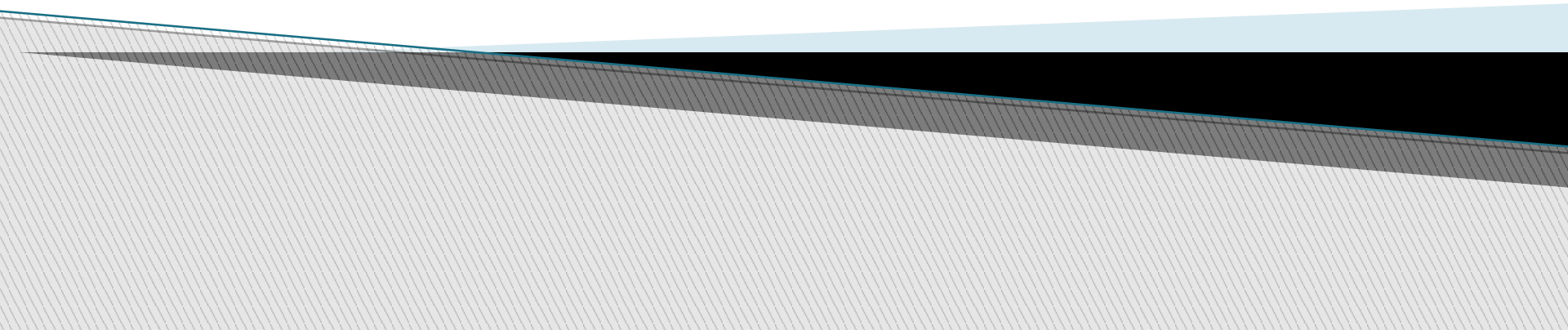


Purification of solids by crystallization

Condition: This method is used if impurity is more soluble than substance to be purified.

Principle: When saturated solution of impure sample is cooled pure crystals of substance separate out leaving behind the impurities in dissolved state.

Procedure: (Purification of impure sample of CuSO_4)

1. Saturated solution of impure sample was prepared by heating up to 70°C .
 2. Evaporate the solution till blue crystals are observed.
 3. Solution was cooled once crystals appear and allowed to stand for overnight.
 4. Blue crystals of pure salt are separated by filtering the mixture.
- 

Purification of solids by crystallization

Uses:

1. Purification of salts like CuSO_4 .
2. Purification of drugs in pharmacology.



Separation by magnet

Condition: This method is used if either impurity or pure substance is magnetic in nature.

Procedure (Mixture of Sulphur & iron fillings): Sample was taken in a china dish and a small magnet was passed through mixture. Iron fillings are magnetic thus adhere with magnet leaving behind Sulphur as pure substance.

Uses:

1. Separation of iron fillings from w
2. Separation of iron ore from soil.

