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Solvent Extraction
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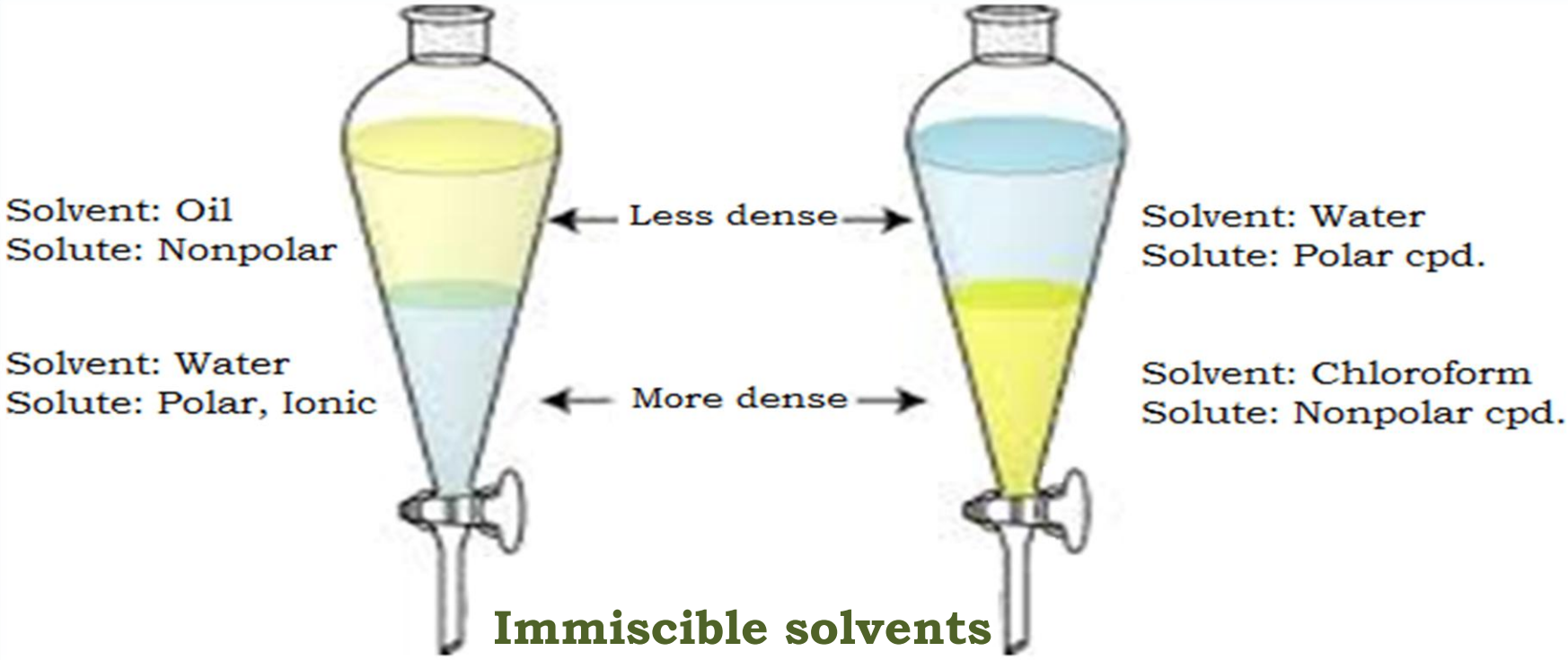
Extraction:

It's a method of separation & purification of organic cpd.s depends on the ability of the cpd. to dissolve in two immiscible solvents, e.g., H_2O & CH_3Cl.



Immiscible solvents are mixtures of liquids Insoluble in each other

Extraction with immiscible solvents is generally employed for:

1- Isolation of dissolved cpd.s from solution.
2- Isolation of solid cpd.s from mixtures.
3- Removal of undesirable impurities From mixtures (washing).
4- Sometimes it's used in organic chemistry laboratories to remove an organic cpd . from a solution when the use of distillation is not convenient.

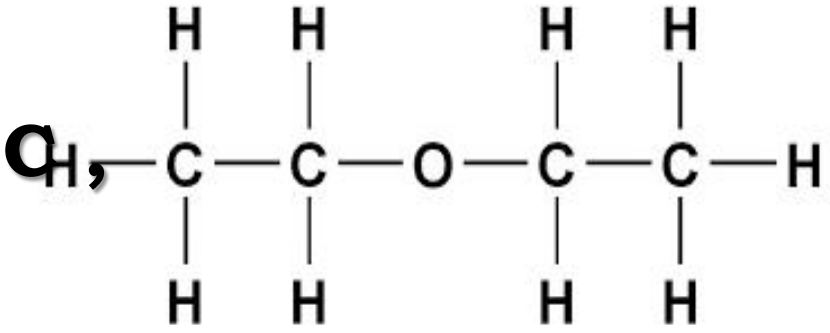
Choosing a solvent for extraction:

1- Readily dissolve the cpd. to be extracted.
2- Have a low boiling point so it can be readily removed.
3- Not react with solute or other solvent.
4- Not be flammable or toxic.
5- Show little or no water solubility (immiscible with water) .
6- Be inexpensive.

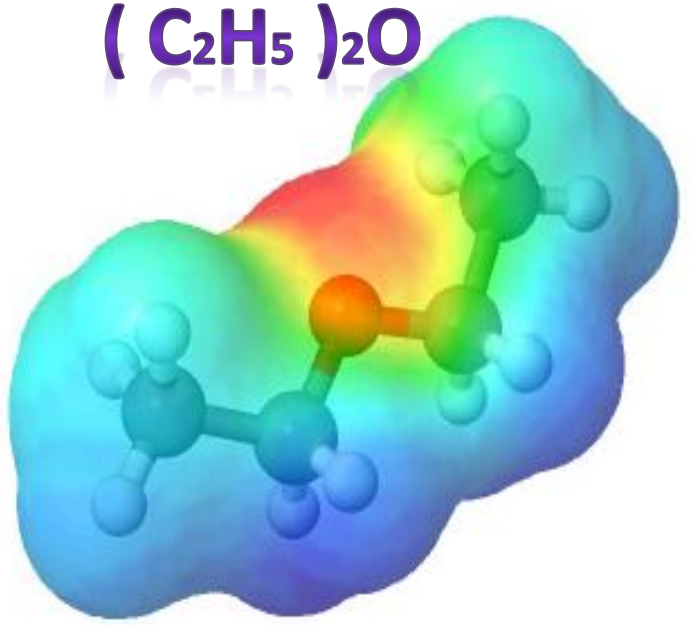
No solvent meets all these criteria,
for ex., ether,

is probably the most common solvent used for extraction but it is flammable

Diethyl ether, Ether,
$C_4H_{10}O$, Colorless liquid,
Boiling point 34.6 °C
Density 0.7134 g / ml ,
Solubility in water 69g/L



$(C_2H_5)_2O$



Ether:

1- Has a high solvating power for hydrocarbons & O containing cpds.

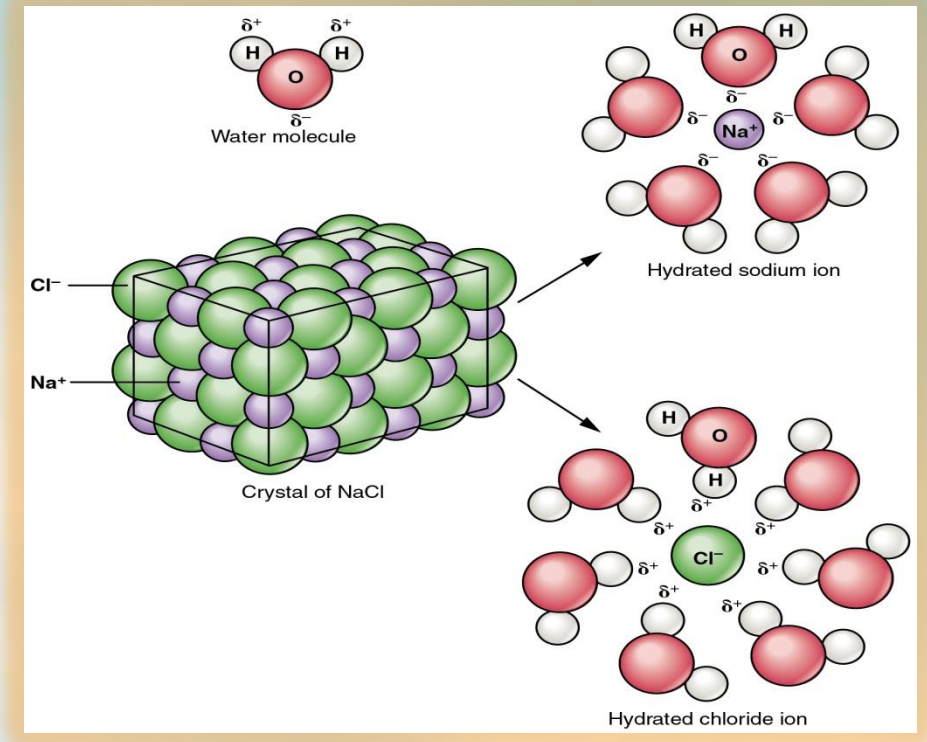
2- Is highly volatile , b.p. 34.6 °C. So that it can be easily removed from the extract at low temp. Thus even highly sensitive cpd.s are not likely to decompose.

3- Is very slightly soluble in water.

Ether, is used extensively as an extracting solvent. It's very slightly soluble in water & it's efficiency in use can be ↑ by the addition of a small amount of an ionizable salt, NaCl , to the water layer. This lead to an ↑ in the polarity of this soln. that result in a ↓ in the solubility of a non polar cpd. This is known as "salting out " process.

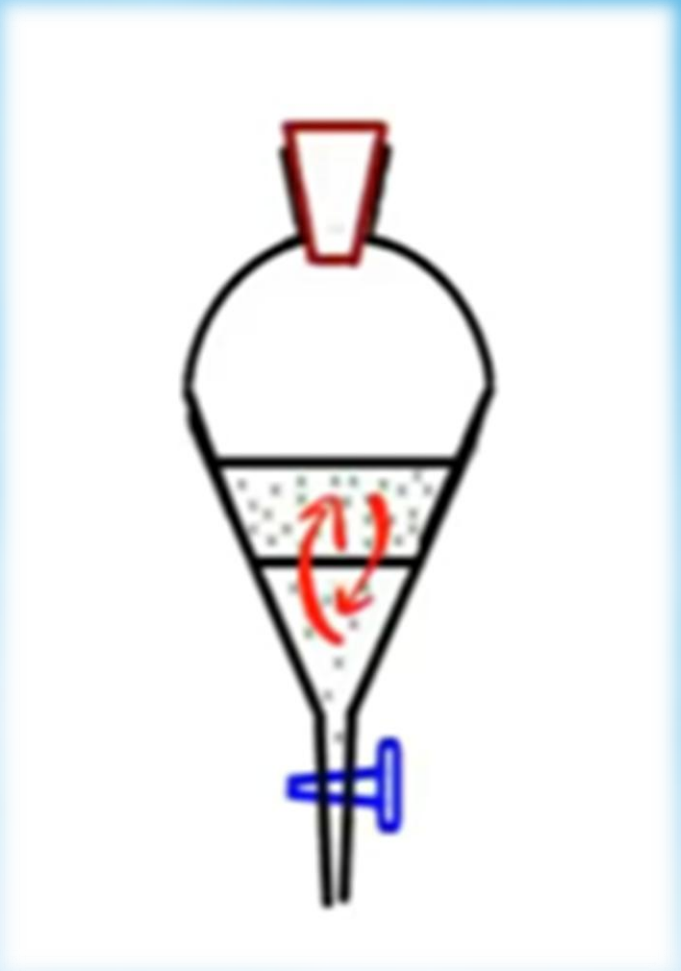
SALTING OUT ,

In aqueous soln.s of organic molecules, salt is added to separate the organic material from the salty aqueous phase.



Partition coefficient:

Partition coefficient **is the ratio of concentrations of a compound in the two phases of a mixture of 2 immiscible liquids at equilibrium Normally one of the solvents is aqueous while the 2nd is organic.**



$$K = \frac{\text{Conc. of compound in organic solvent}}{\text{Conc. of compound in water}}$$

$$K = \frac{\text{Solubility of compound in organic solvent } (g/100ml)}{\text{Solubility of compound in water } (g/100ml)}$$

$$K = \frac{C_{org}}{C_{w}} = \frac{\text{Wt.}_{org} / V_{org}}{\text{Wt.}_{w} / V_{w}}$$

Where,

C_{org} : Concentration of the solute in the organic layer.

C_{W}: Concentration of the solute in the aqueous layer.

Wt._{org}: Weight of the solute in the organic layer.

Wt._{W}: Weight of the solute in the aqueous layer.

V_{org} : Volume of the organic solvent.

V_{W}: Volume of the aqueous solvent.

Name of experiment: Solvent Extraction

Aim of experiment:

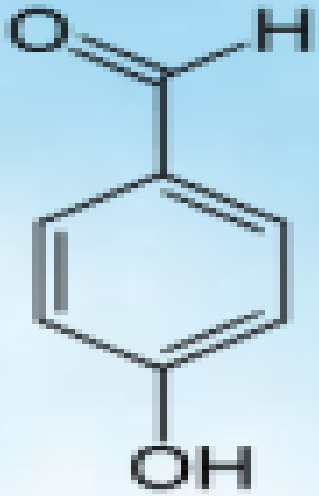
Separation of 4-hydroxybenzaldehyde from an unknown mixture containing NaCl and 4-hydroxybenzaldehyde.

Properties of the cpd.s to be separated:

4-Hydroxybenzaldehyde:

Molecular formula*: $C_7H_6O_2$, *molar mass*:122.12 *g/mol

Yellow-tan powder, Soluble in ether, Slightly soluble in water, Sublimes.

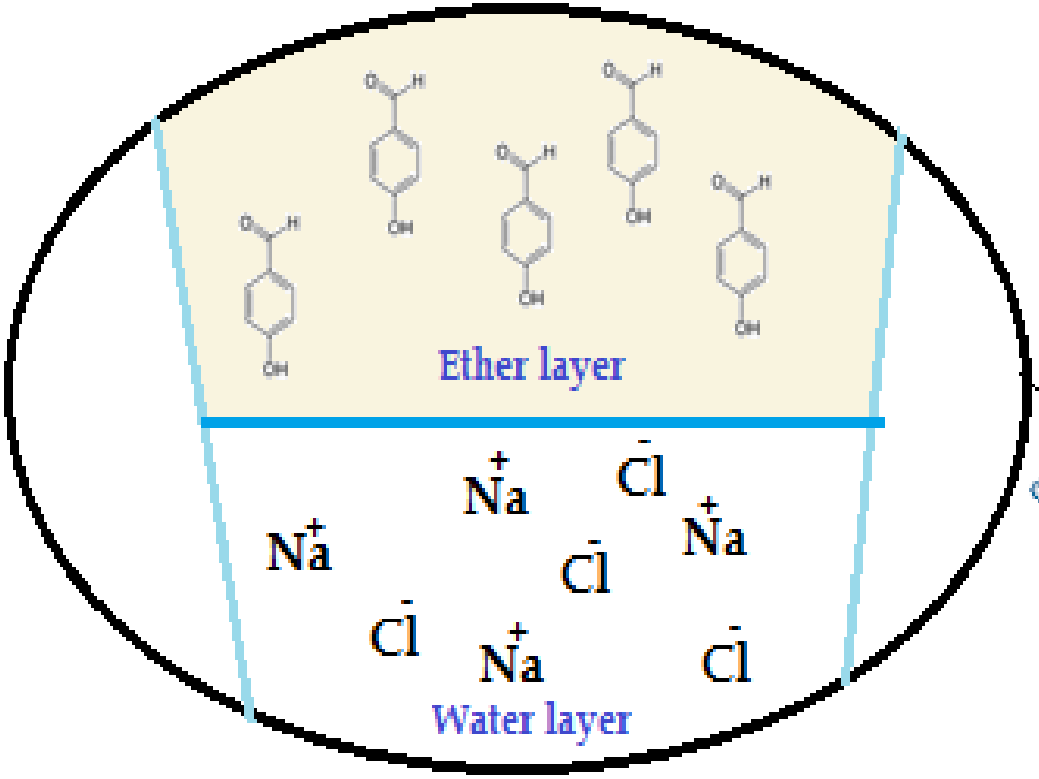


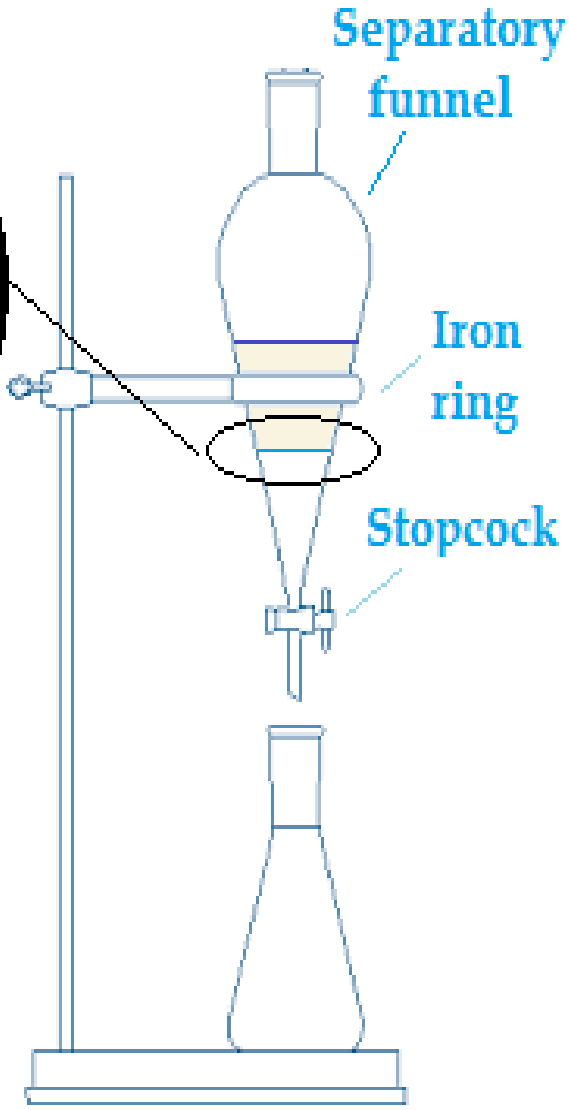
Sodium chloride:

***Molecular formula* : NaCl ,**

molar mass* :58.44 *g/mol

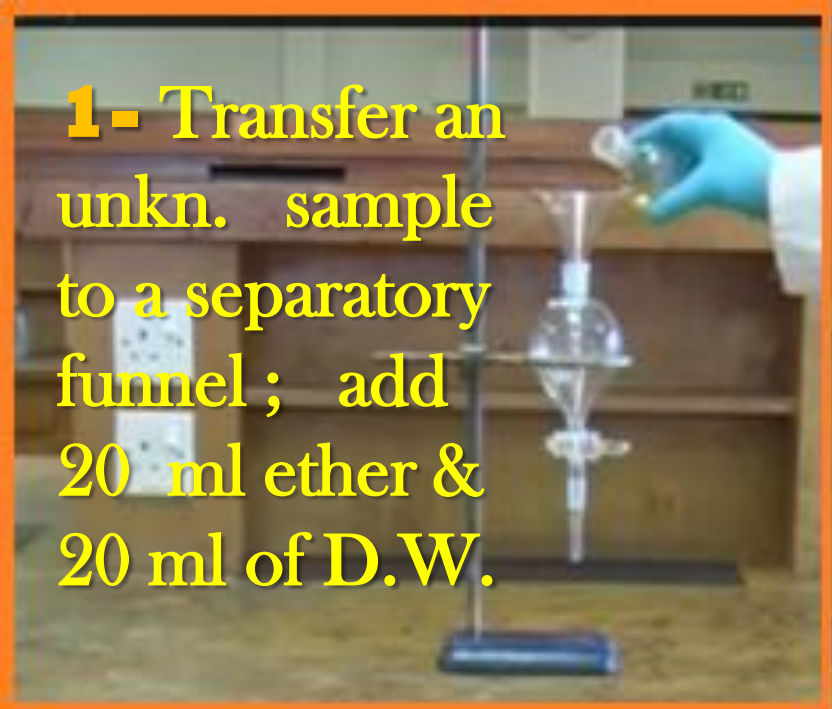
Ionic cpd, Colorless crystals, Soluble in water.

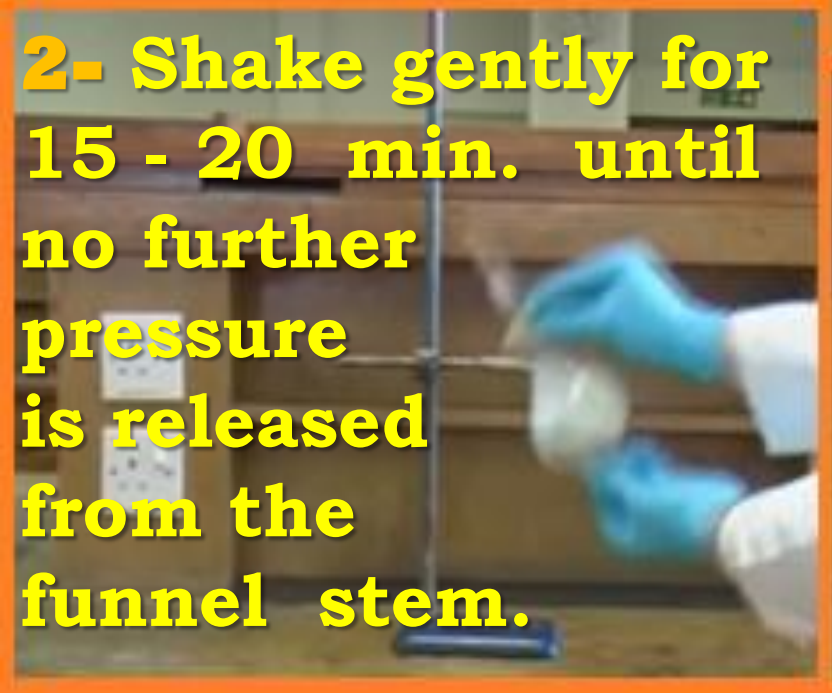


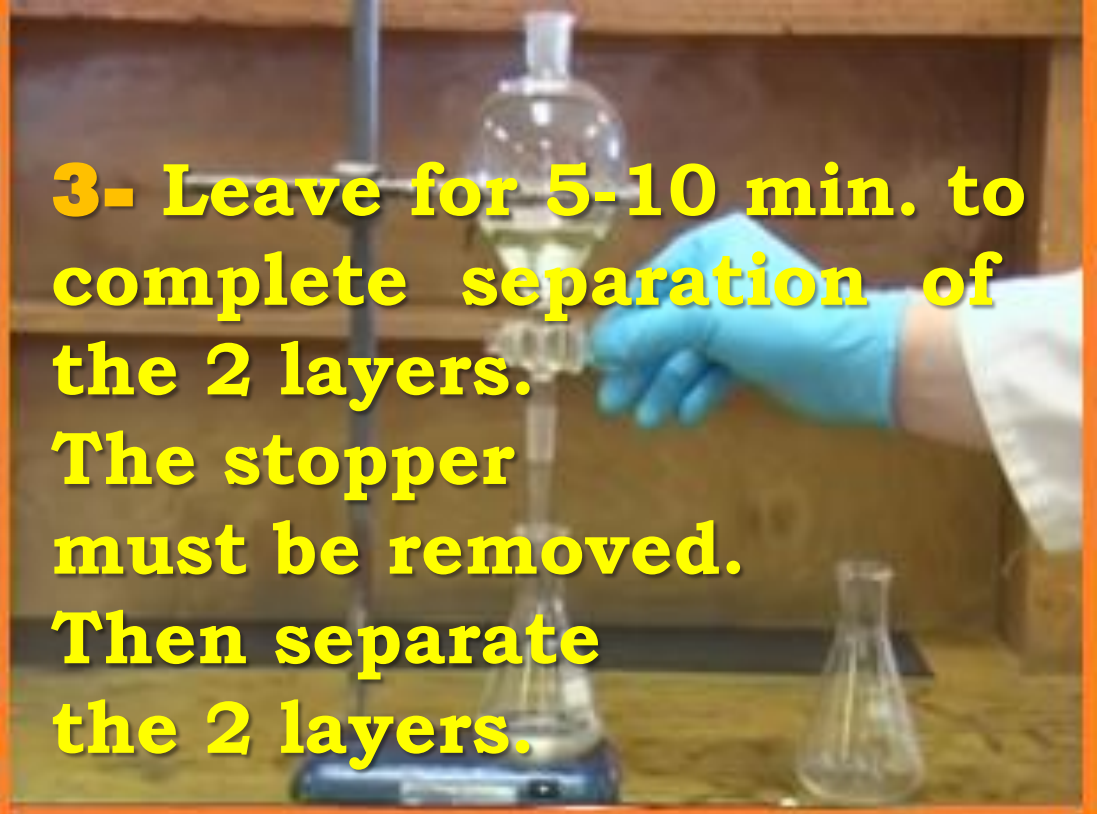


Density of water = 1 g / ml

Density of ether = 0.71 g / ml


1- Transfer an unkn. sample to a separatory funnel ; add 20 ml ether & 20 ml of D.W.


2- Shake gently for 15 - 20 min. until no further pressure is released from the funnel stem.


3- Leave for 5-10 min. to complete separation of the 2 layers.
The stopper must be removed.
Then separate the 2 layers.


4- Dry the ethereal layer