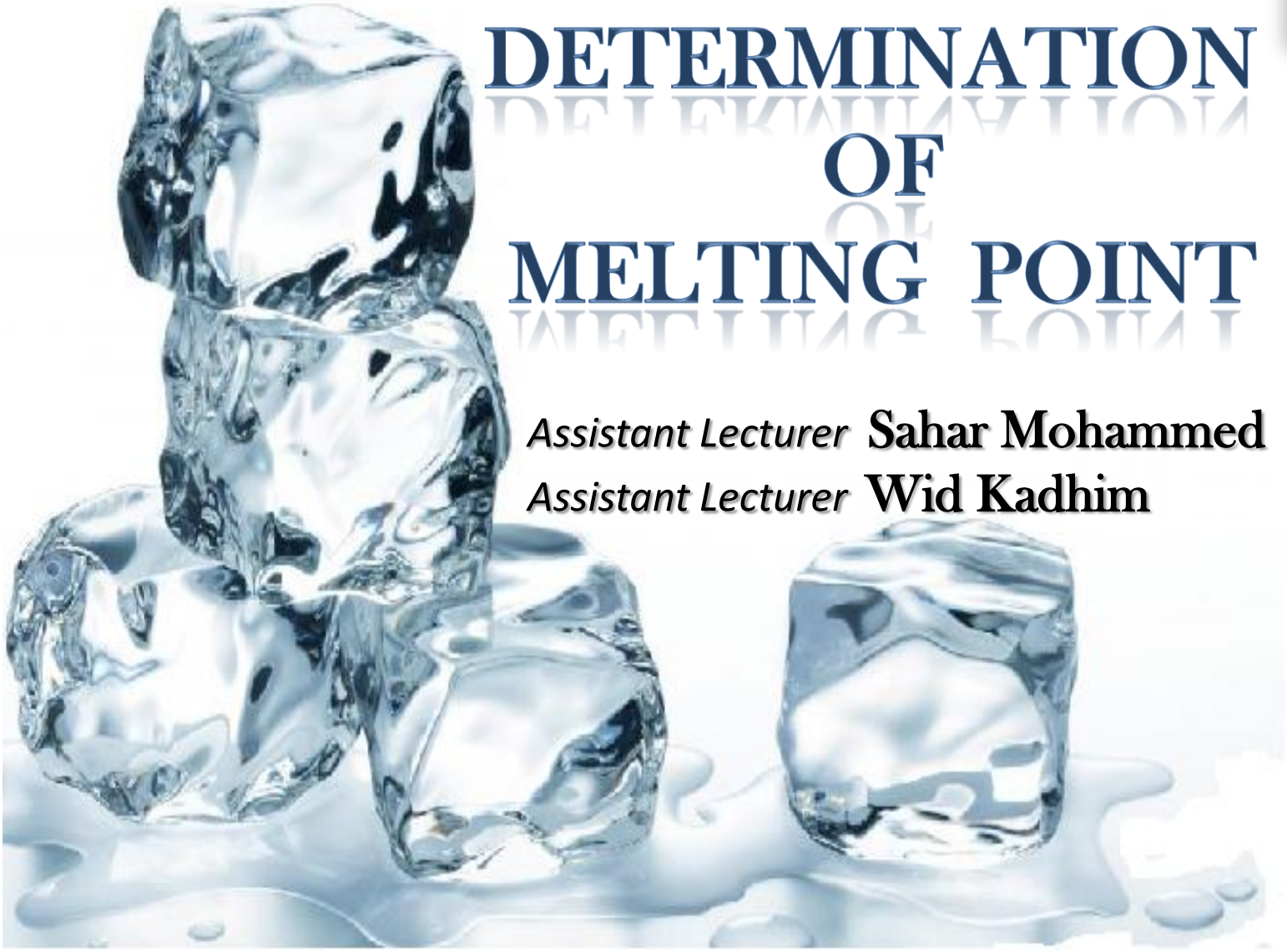
2015 -2016

DETERMINATION OF MELTING POINT



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Physical Properties of Organic Compounds

The physical properties of a compound include such things as its,

Color , Odor , Refractive index, Density, Solubility, Melting point & Boiling point.

The exact values of the physical properties of a cpd. depend on its molecular structure.

in laboratory often depends on making a good prediction of physical properties from the cpd. structure.

The physical properties of a cpd. depend largely upon which kind of bonds hold it's atoms together in a molecule.

There are two kinds of bonds:

1- Ionic Bonds, formed by the transfer of electrons.

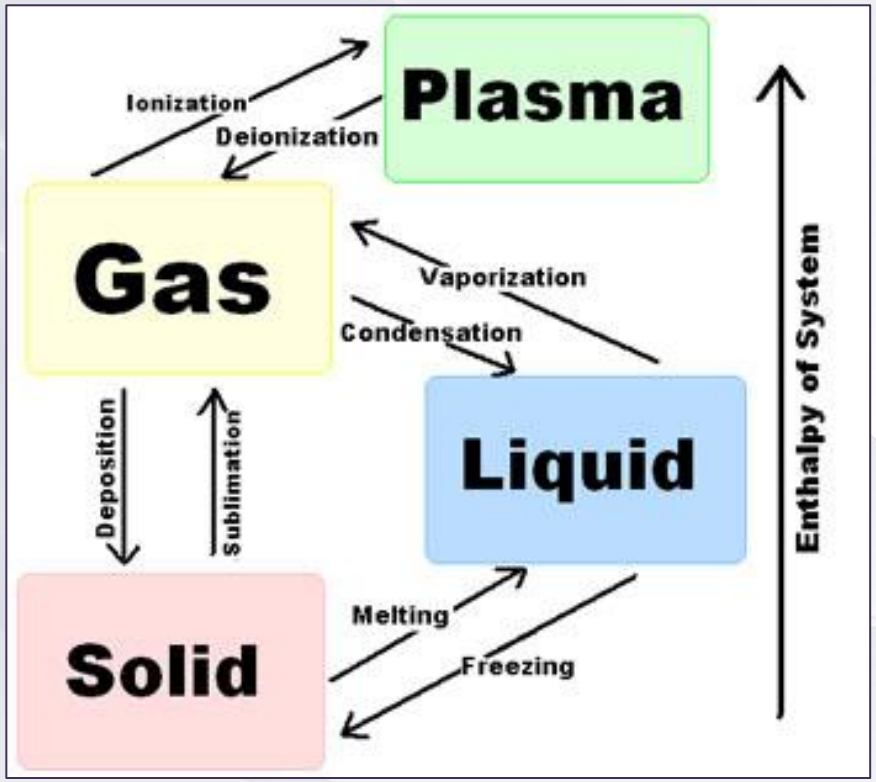
2- Covalent Bonds, formed by the sharing of electrons.

Phases of Matter

Matter ordinarily exists in four phases: Solid , Liquid , Gas and Plasma .

Plasma is a high – temperature phase not encountered in the typical organic chemistry laboratory.

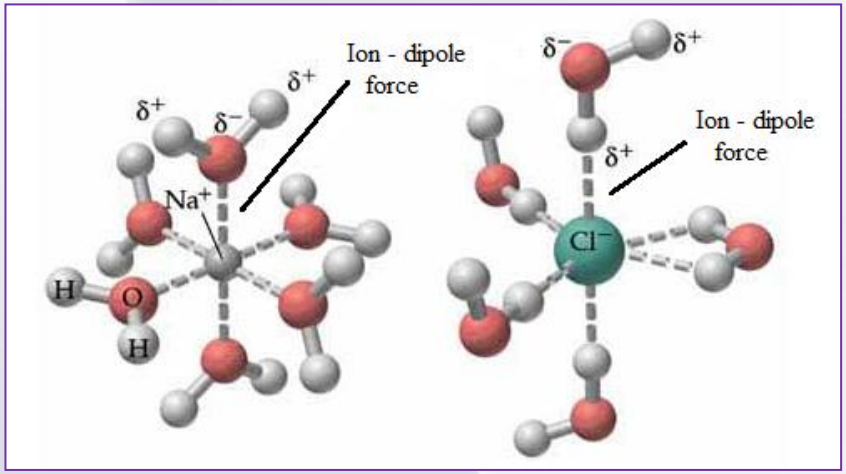
As the environment around the materials is *changed*, for example by varying the temp. or pressure, the systems undergo a phase transition, that is the change from one state of matter into another.



There are four Basic types of Intermolecular Forces :

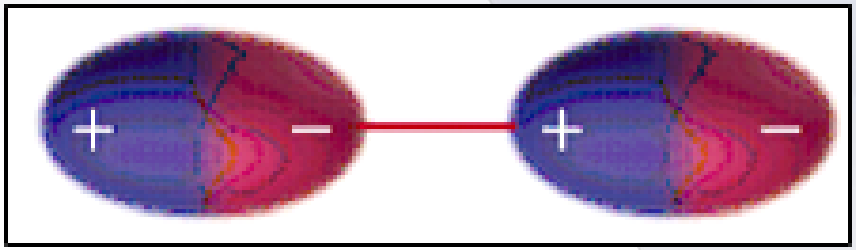
1. Ion - dipole:

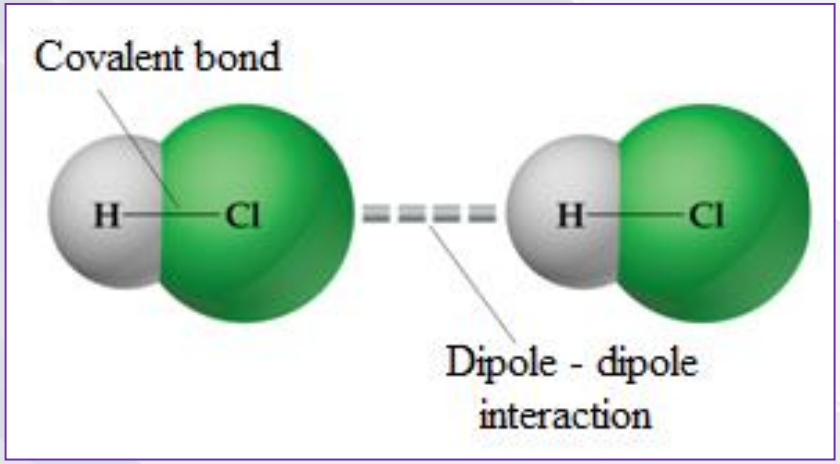
Ion is attracted to polar molecule via this force as ex. (NaCl in water).



2. Dipole – dipole:

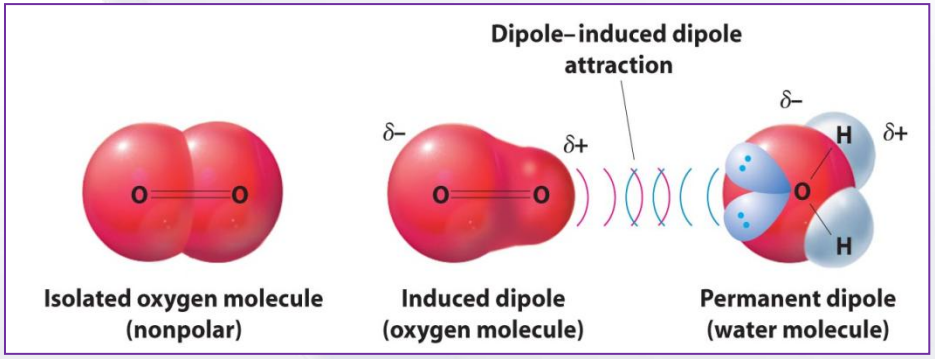
Polar molecules attracted to each other as forces between HCl molecules.





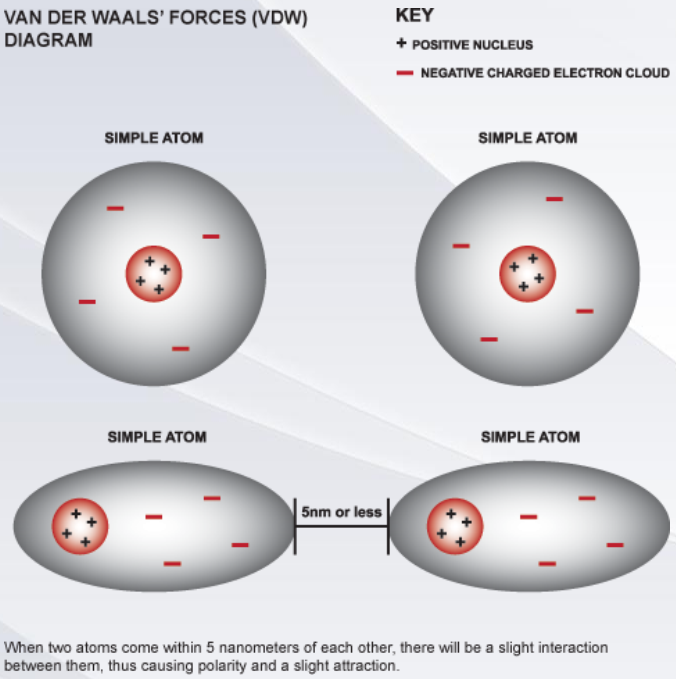
3. Dipole - induce dipole:

Polar molecules attr-acted to nonpolar molecules as for ex. (Oxygen in water) by dipole – induce dipole interaction .



4. Induce dipole -induce dipole:

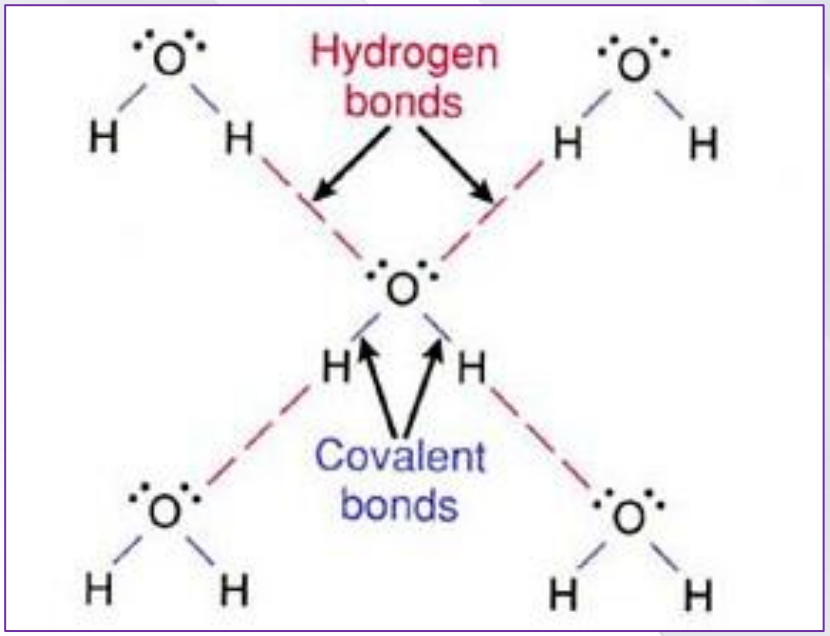
London dispersion forces also called van der Waal's forces Nonpolar molecules attraction for each other due to electron distortion.

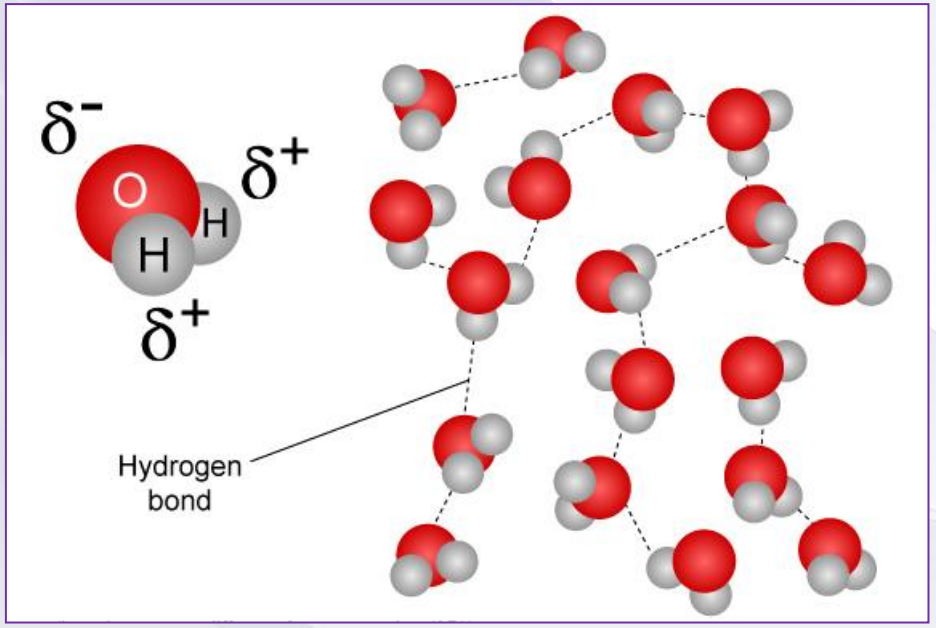


Hydrogen bonding :

Hydrogen bonding is an especially strong kind of dipole – dipole attraction in which a hydrogen atom serves as a bridge between 2 electronegative atoms, holding one by a covalent bond & the other by purely electrostatic forces.

For H-bonding to be important, both electronegative atoms must come from the group: F, O, N.





Melting Point:

The melting point of a solid crystalline compound is the temperature at which the solid and the liquid phase of the cpd. are in equilibrium at a certain pressure usually 1 atmosphere.

Or,

It's the temp. at which the solid begins to change into liquid under a pressure of 1 atmosphere.

The melting point range : is the difference between the temp. at which the sample begins to melt **(T_1)** & the temp. at which the sample is completely melted **(T_2)** .

Melting point rang = $T_2 - T_1$

Organic chemist used melting point to:

1- Get an indication of the purity of cpd.

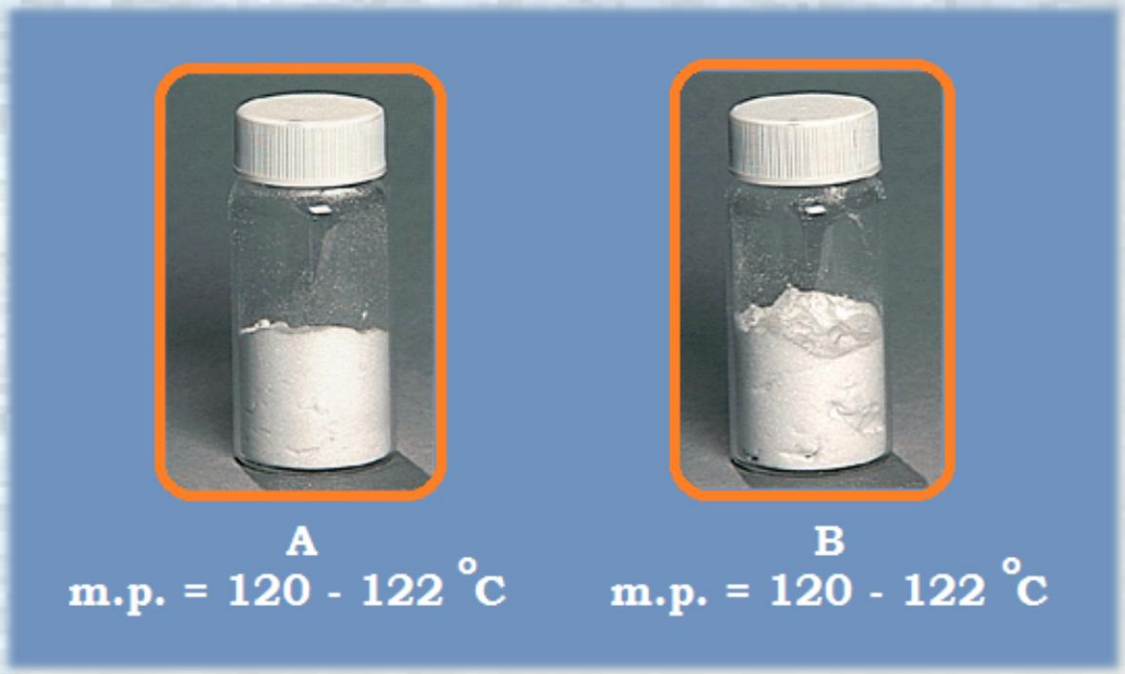
Sample	*Pure*	*Impure*	*Decomposed*
Melting point	Sharpe	Not sharpen	Not sharpen
Melting point range	0.5 – 1 ^{0}C	Wider range	Wider range

2- Help in identification of organic cpd.

Compound name	Compound formula	Compound Melting point
Sodium chloride	**NaCl**	**801 °C**
Sodium acetate	**CH3COO Na**	**324 °C**
Glacial acetic acid	**CH3COOH**	**16.6 °C**

Mixed Melting Point:

How can you know whether the 2 samples are the same or different?



Answer:

We mix them and measure the m.p. for the resultant mixture,

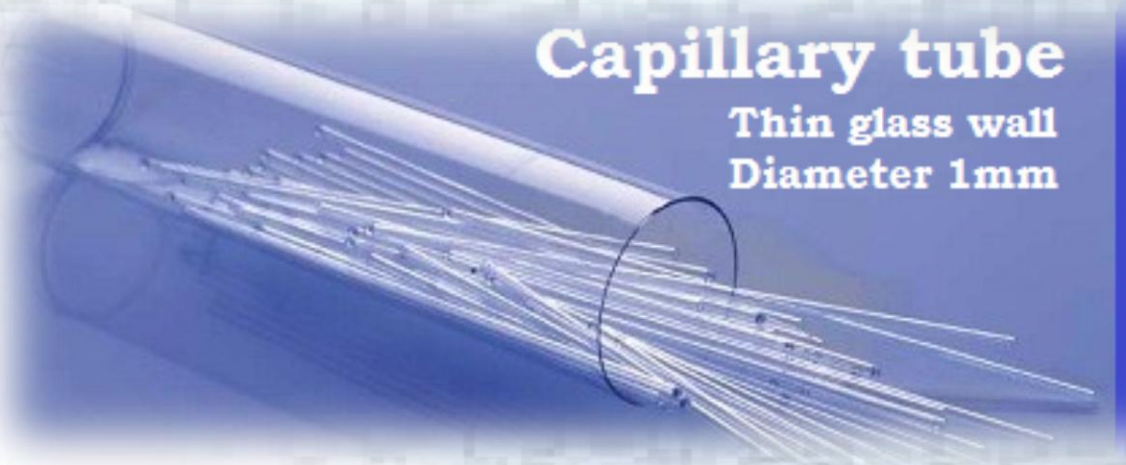
If,

m.p. of mixture < m.p. of original & wider m.p. range → different cpd.

m.p. of mixture = m.p. of original & same m.p. range → same cpd.

General Technique for m.p. Determination:

Capillary Tube method.

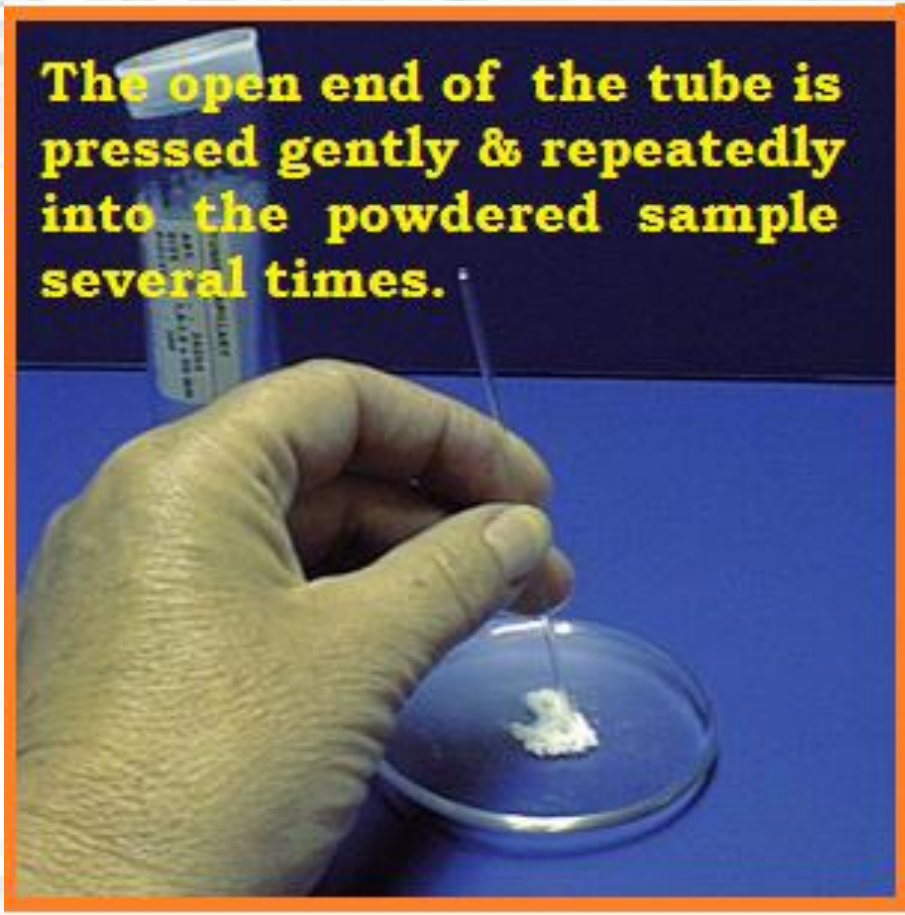


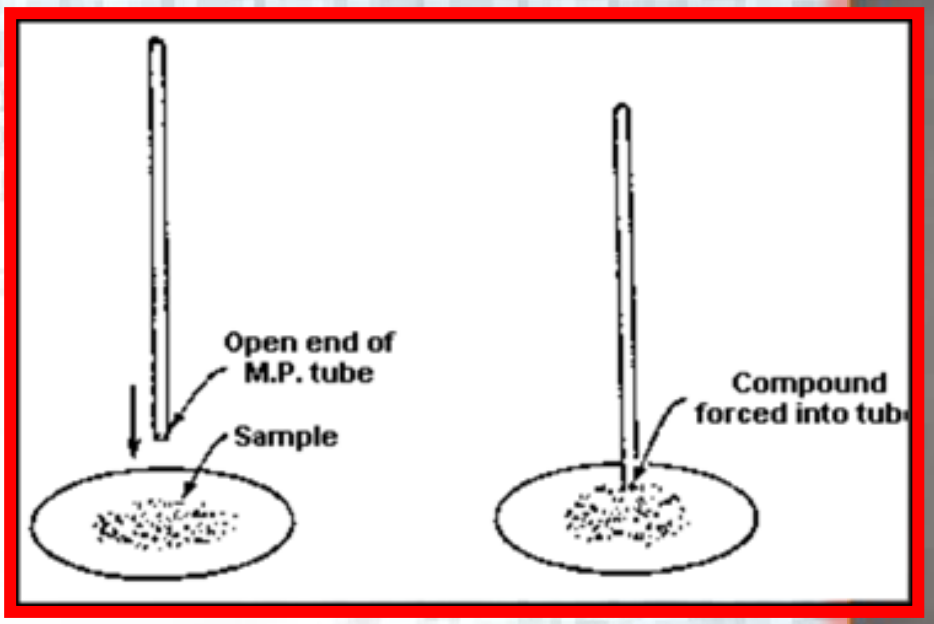
Tube tilted to prevent water condensation inside

Stages for correct sealing

Wrong !
Tube has been overheated

Filling a capillary tube:





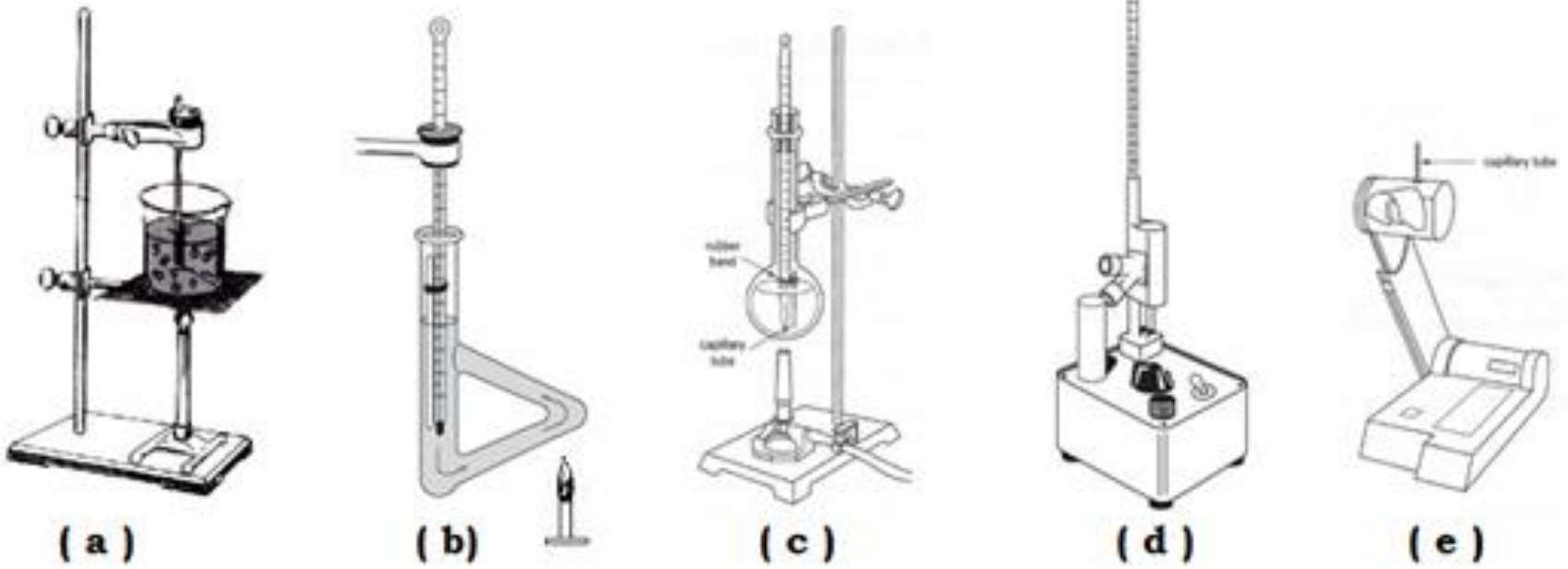
Any compound being loaded into a capillary tube must be:

1- Fully dried.

2- Homogeneous.

3- In powdered form.

Melting Point Apparatus:



a- Hot - oil m.p. bath.

b- Thiele apparatus.

c- Long necked flask.

d- Mel-temp apparatus.

e- Digital m.p. measuring apparatus.

Number of Experiment: **I**

Name of Experiment: **Determination of the Melting Point of an unknown sample.**

Aim of Experiment:

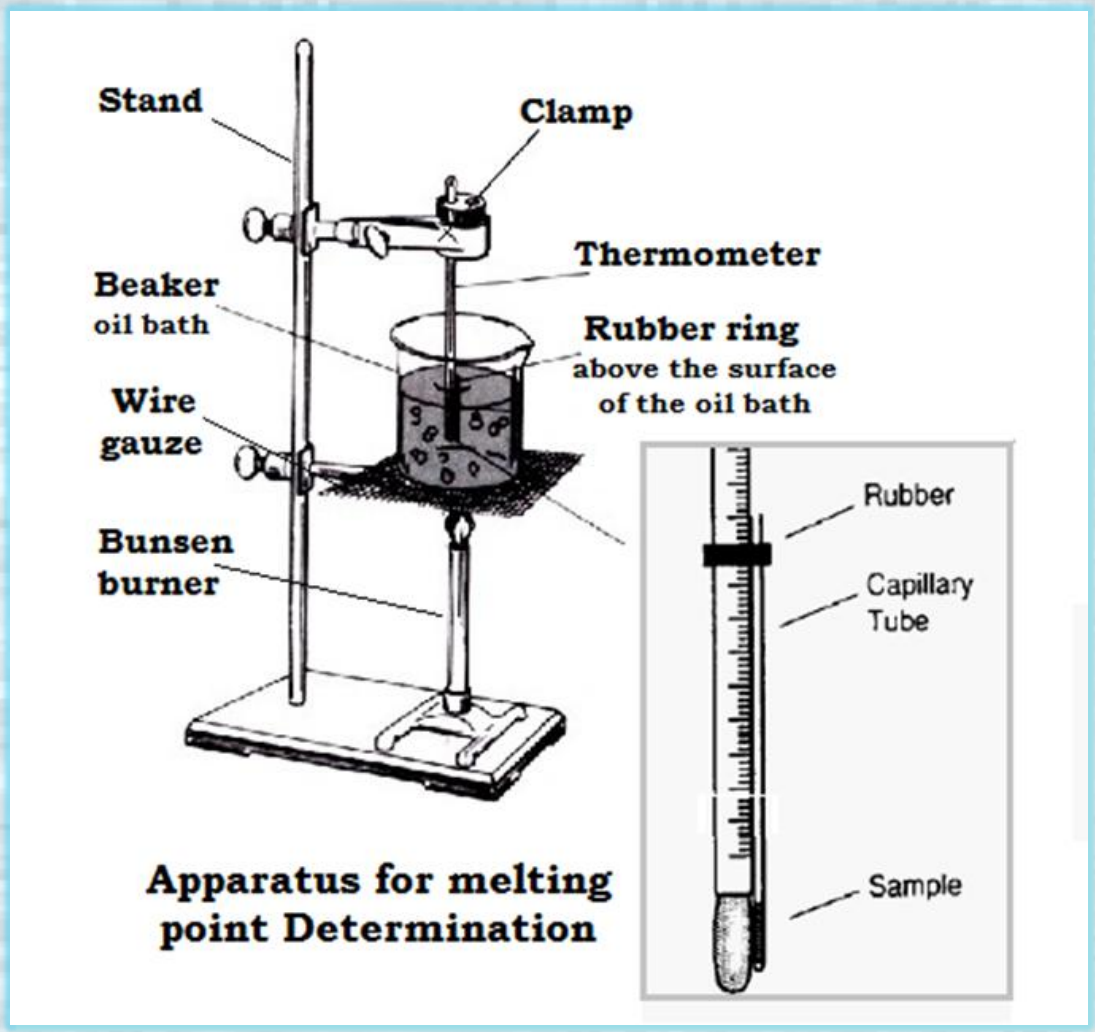
1- Identification of an unknown cpd. using it's m.p.

2- Determination of purity of a cpd. using the m.p. as a physical property.

Procedure:

1- Preparation of the unknown sample as mentioned before.

2- The capillary tube is attached to a thermo - meter by a rubber ring in such a way that the closed end is attached to the bottom of the thermometer's bulb.



Apparatus for melting point Determination

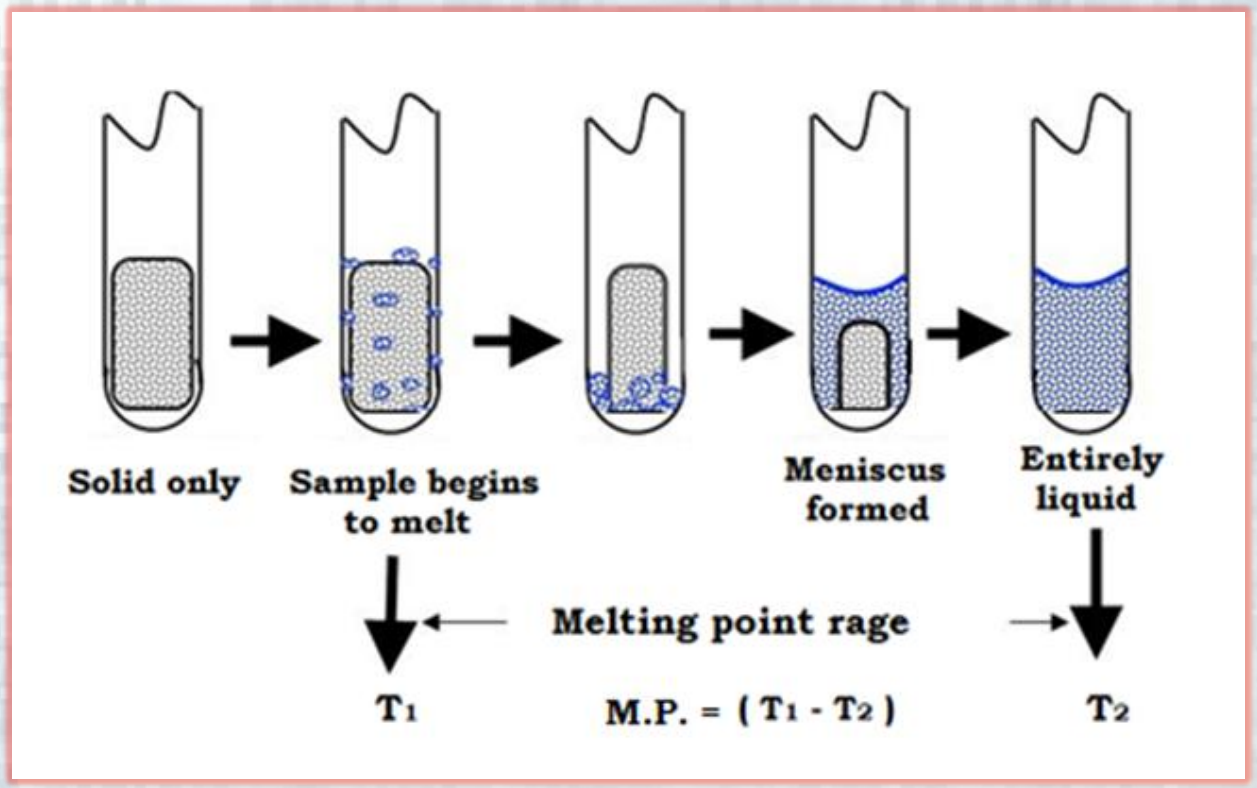
3- Then both of them are placed in an oil – bath , (the rubber ring should be above the surface of the oil - bath).

4- Heating is started gradually.

5- The range between the temperature at which the powdered solid inside the capillary tube begins to liquefy (T_1) & the temperature at which a clear liquid is observed inside the capillary tube (T_2) is recorded as the observed m.p. range.

$m.p.\ rang = T_2 - T_1$

$m.p. = (T_1 - T_2)$



Notes:

* For oil bath, glycerin or paraffin can be used, but glycerin is preferred since it's safer than paraffin.

* The temperature of the oil bath should rise very slowly.

* Gentle heating with continuous stirring is necessary

* After completing the experiment, the oil liquid must be allowed to cool before using it again.


Salt is added on snow covered roads?
Ice melts at ---- ?
What happens to the freezing point if salt is added?

Among these 3 samples of the same cpd. , which of them is the purest one?

m.p.
115 – 119°C

m.p.
118 – 120 °C

m.p.
121- 122°C

Two of these bottles contain benzoic acid and one m-nitrophenylacetic acid.

1

m.p.=120 –122 °C

2

m.p.=120 –122°C

3

m.p.=120 -122°C

Run mixed melting points to confirm identification :

Mixed 1 and 2 m.p. = 120 - 122°C

Mixed 1 and 3 m.p. = 114 - 117°C

Mixed 2 and 3 m.p. = 115 - 118°C