2015 -2016

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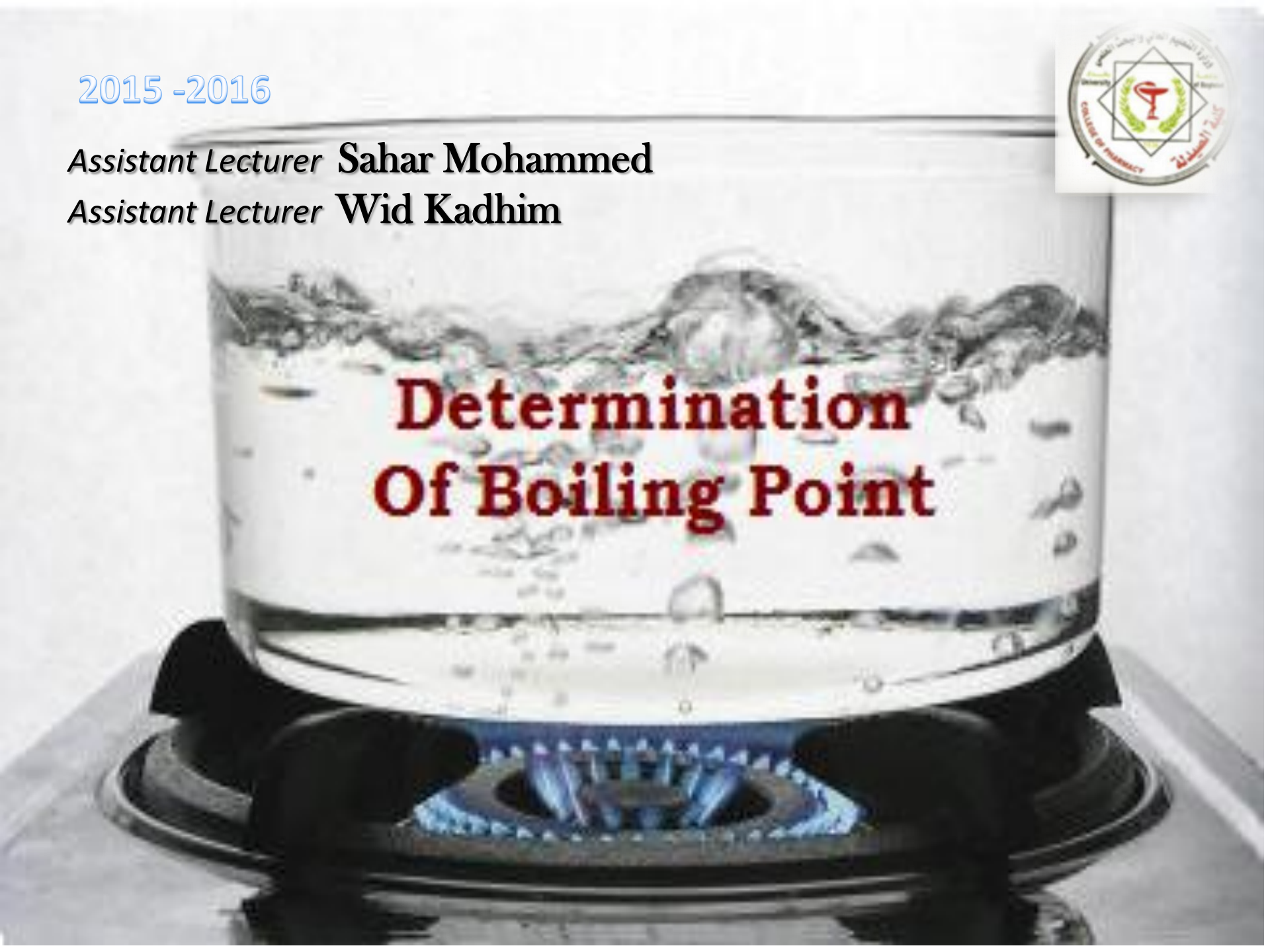
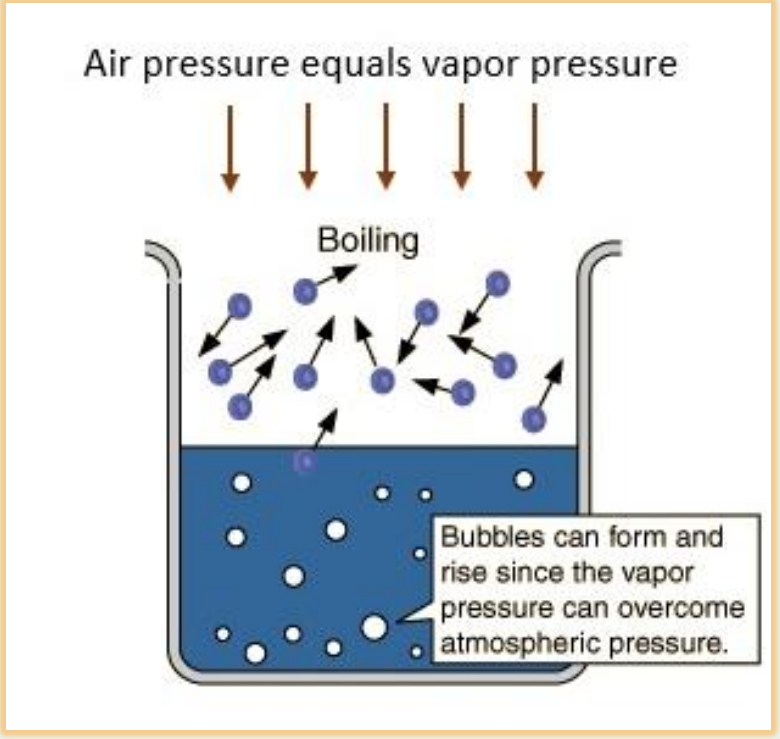


Determination Of Boiling Point

The Boiling Point of an organic liquid is the temperature at which the vapour & liquid phases are in equilibrium at a given pressure. **Or,**
It is the temperature at which the liquid's vapour pressure equals the atmospheric pressure over the liquid.

The vapour pressure of a compound is the pressure exerted by the compound's vapour above compound's surface.

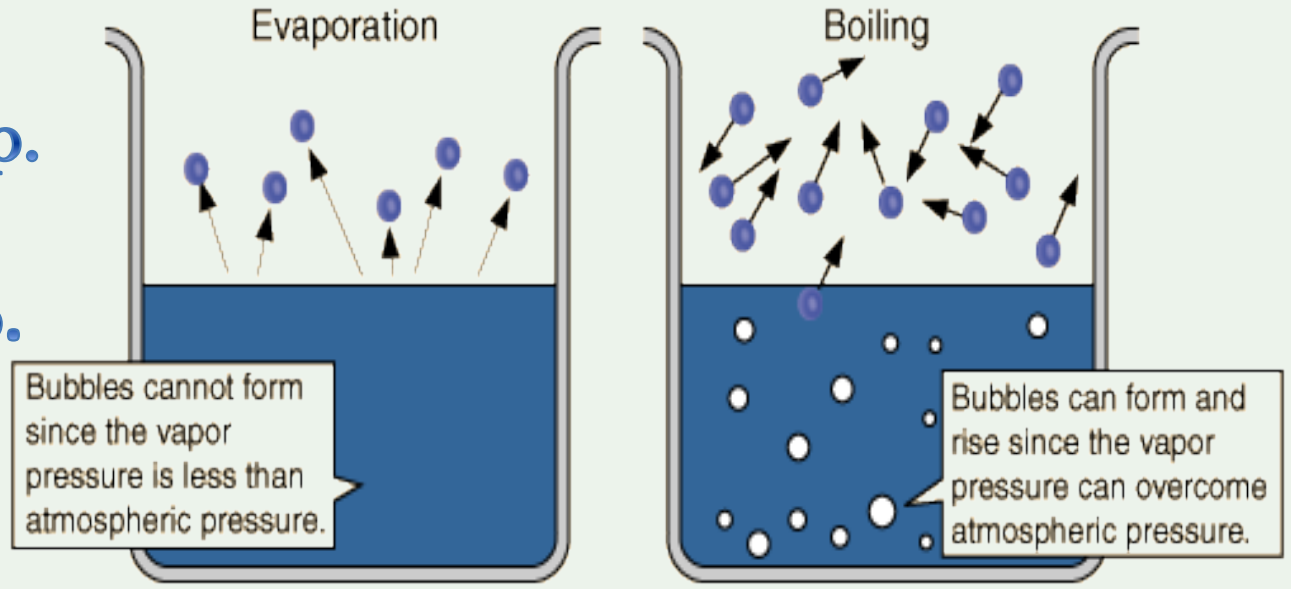


FACTORS AFFECTING THE B.P. OF A LIQUID :

1- Atmospheric pressure :

↓ pressure → ↓ b.p.

↑ pressure →↑ b.p.



2- Molecular weight :

For a homologous series of molecules,

↑ m.wt. → ↑ b.p.

↓ m.wt. → ↓ b.p.

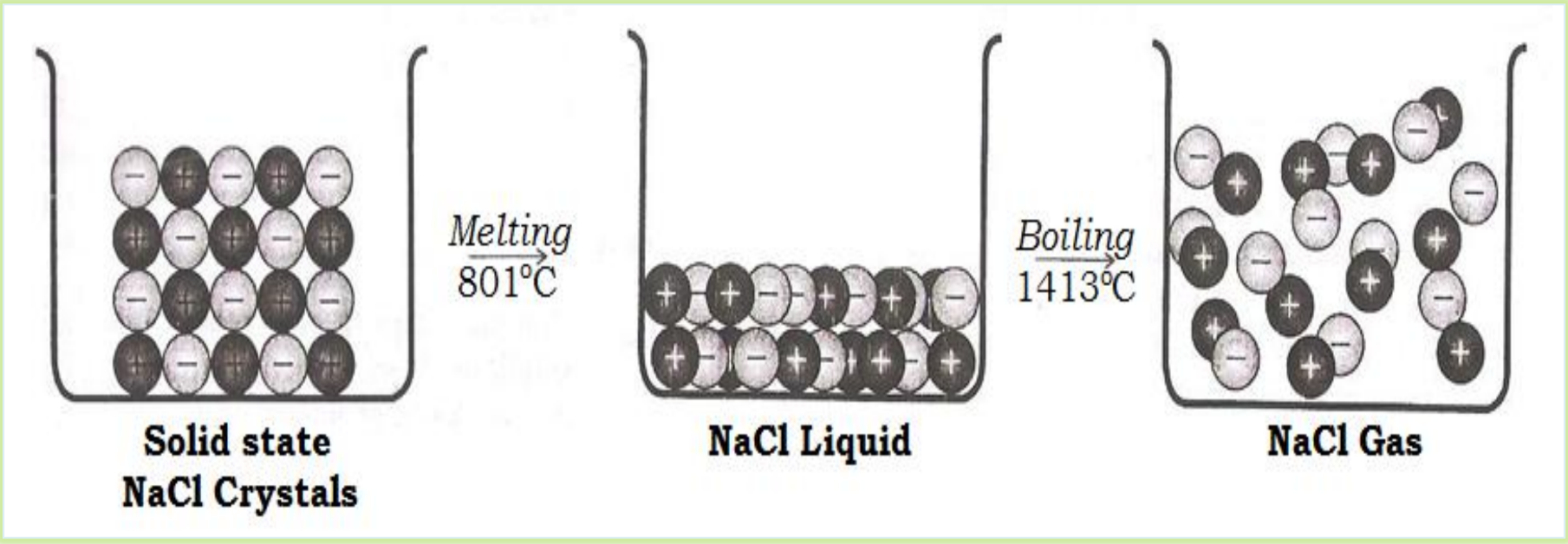
Number of Carbons in R	Boiling Points (°C)			
	R—H	R—Cl	R—OH	R—COOH
1	–160	–24	65	101
2	–89	12	78	118
3	–42	47	97	141

3- Intermolecular forces :

A- Ionic compound :

In the liquid state the units of ionic compound is ions.

Interionic forces :



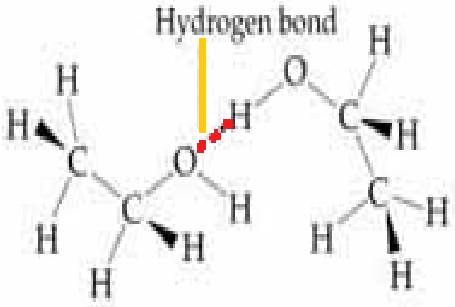
A great deal of energy is required for a pair of oppositely charged ions to break away from the liquid ; So , boiling occurs only at a very high temperature.

B- Non ionic compound :

The units of a non - ionic compound is molecules, weak intermolecular forces here :

a- Intermolecular hydrogen bond :

Liquids whose molecules are held together by hydrogen bonds are called *associated liquids* **. breaking these H-bonds takes a considerable energy.**



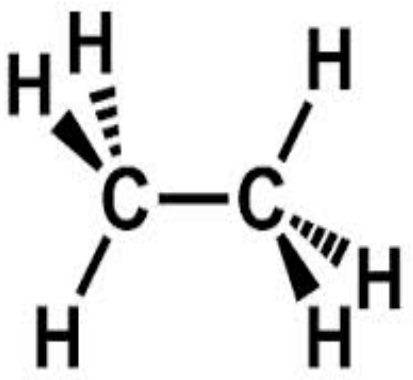
Ethanol
b.p. 78 °C

$CH_3—O—CH_3$

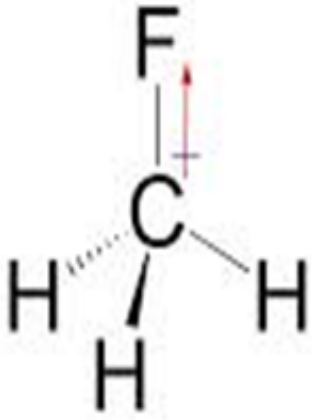
Dimethyl ether
b.p. -23 °C

b- Dipole – dipole interaction forces :

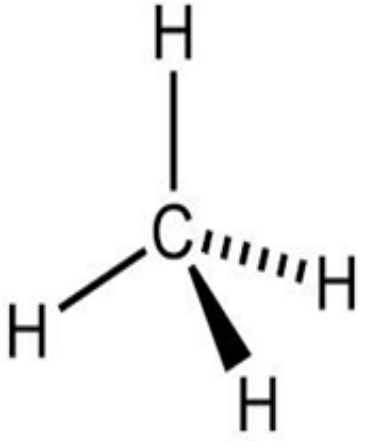
It takes place in polar molecules ; It's the attraction of the + ve end of one polar molecule for the - ve end of another polar molecule.



Ethane
molar mass 30.03 g/mol
m.p. -182.8°C
b.p. -88.5 °C



Flouromethane
molar mass 34.03 g/mol
m.p. -137.8 °C
b.p. -78.4 °C

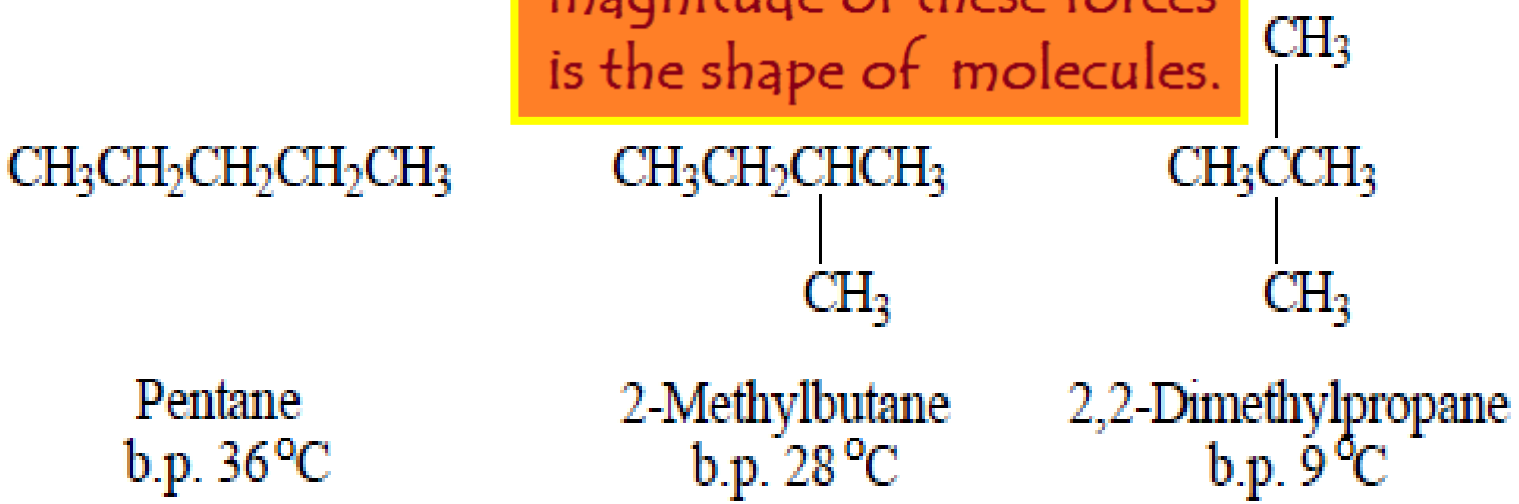


Methane
molar mass 16.04 g/mol
m.p. -182.5°C
b.p. -161.5 °C

c- van der Waals forces:

Also called induced polarizations or induced dipoles have a very short range act between portions of different non - polar molecules that are in close contact, i.e. , between the surface of molecules.

The major factor in the magnitude of these forces is the shape of molecules.

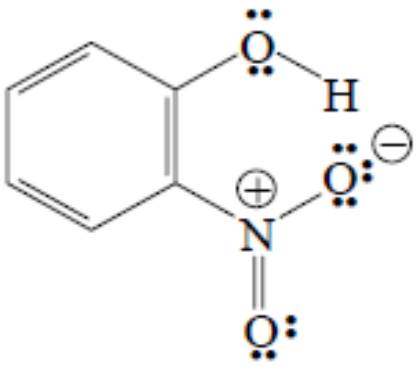


↓Branching of molecule →↑ S.A. →↑ Van der Waals → ↑ b.p.

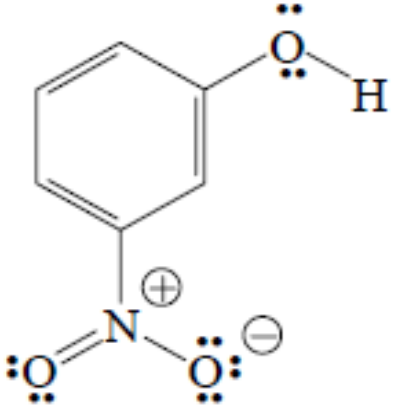
↑Branching of molecule →↓ S.A. →↓ Van der Waals → ↓ b.p.

4- intramolecular hydrogen bond:

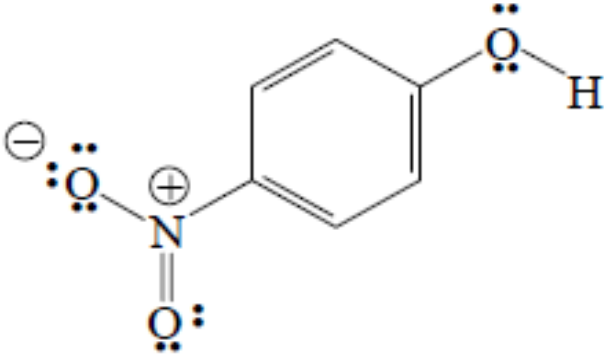
It's much more important than an intermolecular H - bond in determining the properties of the molecule.



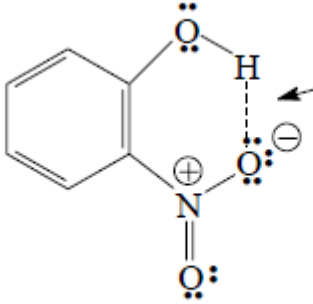
2-Nitrophenol
b.p. 215 °C



3-Nitrophenol
b.p. 263 °C



4-Nitrophenol
b.p. 279 °C



2-Nitrophenol

intramolecular H-bond prevents an intermole. H-bond from forming.

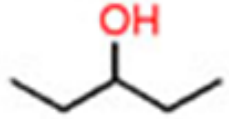
Thus, there are no strong intermolecular forces to be overcome in going from the liquid phase to the gas phase.

5- Branching:

In homologous series, with in the same molecular weight, as

↑ branching of the molecule → ↓ b.p.

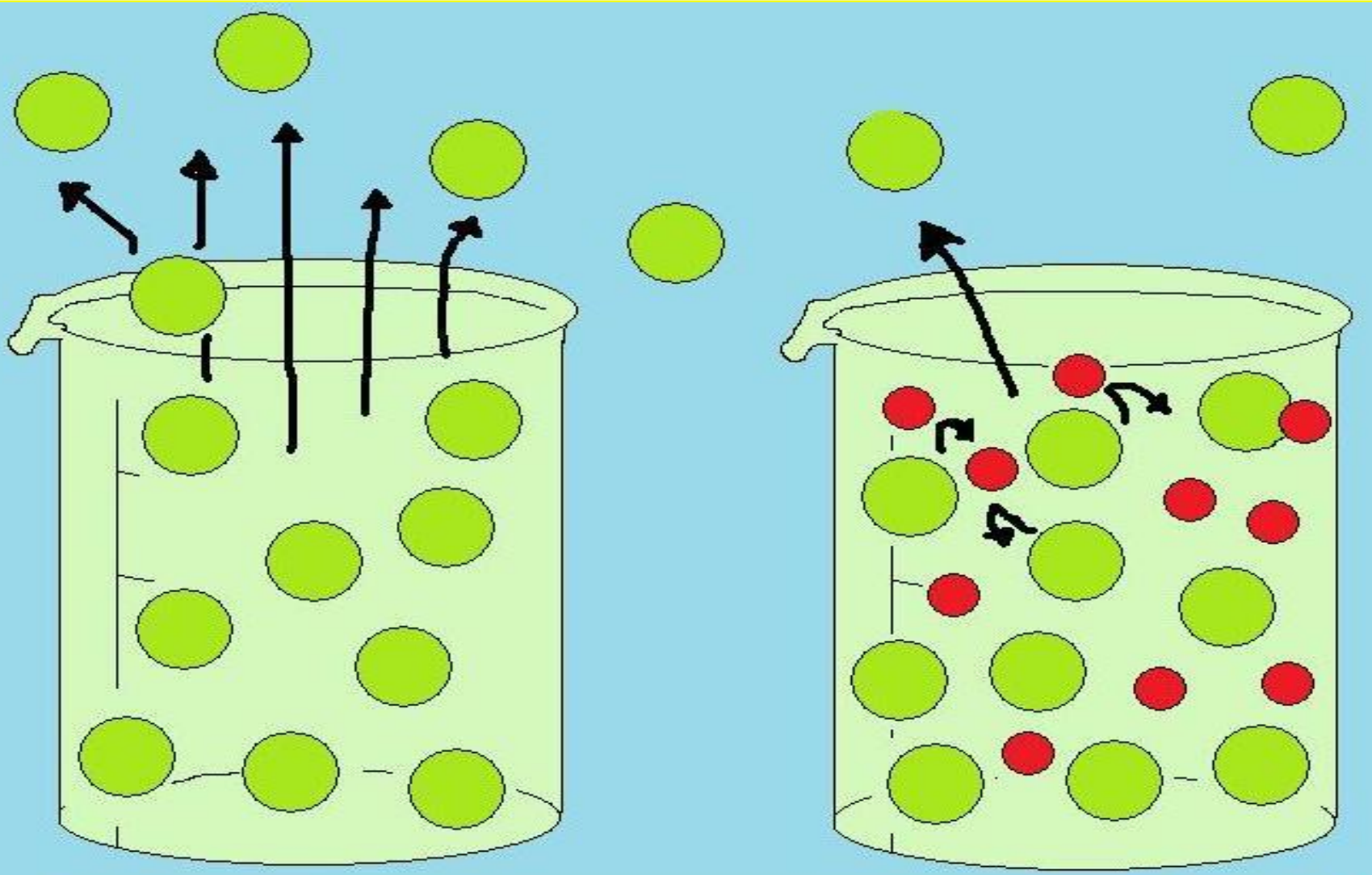
& vice versa

				
Name	**Pentane**	**2,2-Dimethylpropane**	**1-Pentanol**	**3-Pentanol**
Ch. formula	C_5H_{12}	C_5H_{12}	$C_5H_{12}O$	$C_5H_{12}O$
Molar mass	72.15 g/mol	72.15 g/mol	88.15 g/mol	88.15 g/mol
m.p.	-130.5 °C	-21 °C	-78 °C	-63.7 °C
b.p.	36 °C	9 °C	137 °C	115 °C

6- Presence of impurities :

Pure liquids have sharp b.p. while mixtures show a b.p. range.

Presence of impurities raises the boiling point of a particular liquid.



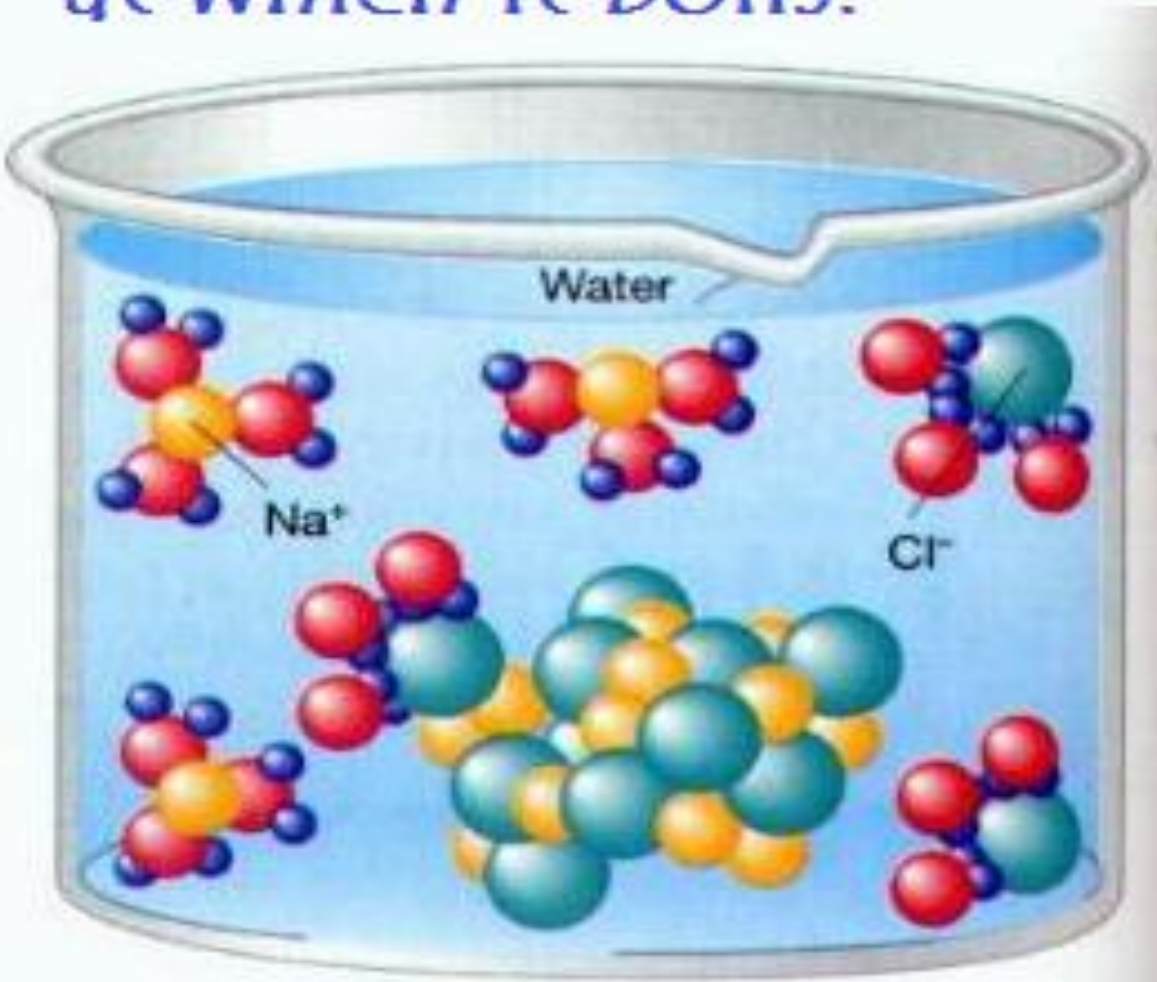
System A

In system A, the liquid particles easy shift into the gas phase at the normal boiling pressure. There are no obstacles for the liquid particles as there is in System B.

System B

In system B, the solute particles prevent the liquid particles from escaping the system to turn into gas. This requires the liquids to possess more energy to become a gas.

Adding salt to water will increase the temp. at which it boils.



Number of Experiment: II

Name of Experiment: Determination of the Boiling point of an unknown sample.

Aim of Experiment:

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

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

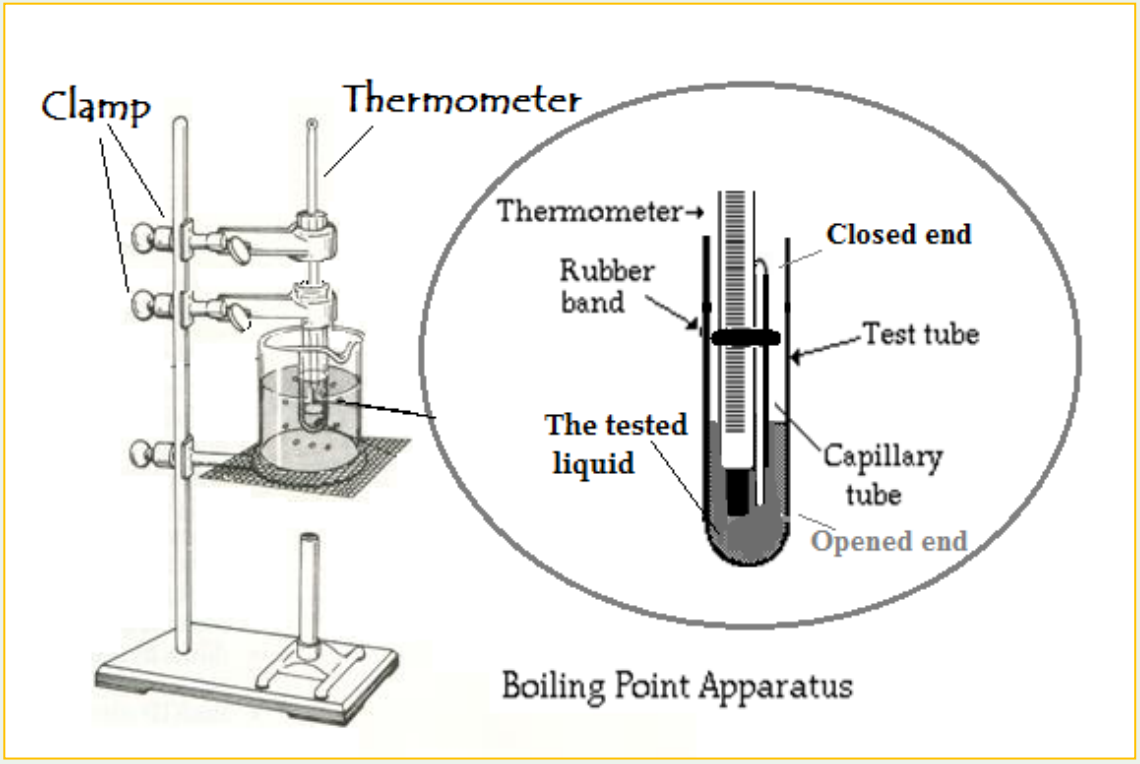
Procedure:

1- A 5 cm capillary tube closed from one end is inverted upside down & is attached to a thermometer by a rubber ring.

2- Place them in a clean & dry test tube containing a small quantity of a liquid whose boiling point is to be measured, the rubber ring should be above the surface of the liquid.

3-The whole assembly is to be placed in an oil bath.

4- Start heating with continuous stirring until a rapid stream of bubbles comes out of the capillary tube.



5- Remove the flame & allow the oil bath to cool so that the bubble stream will become slower and slower as the temperature drops until a point is reached at which bubbling ceases & the liquid starts to raise inside the capillary tube.

6- Record this temperature as the b.p. of the liquid.