Leaving Cert Chemistry

Free Notes

Gas Laws and Volatile Liquids

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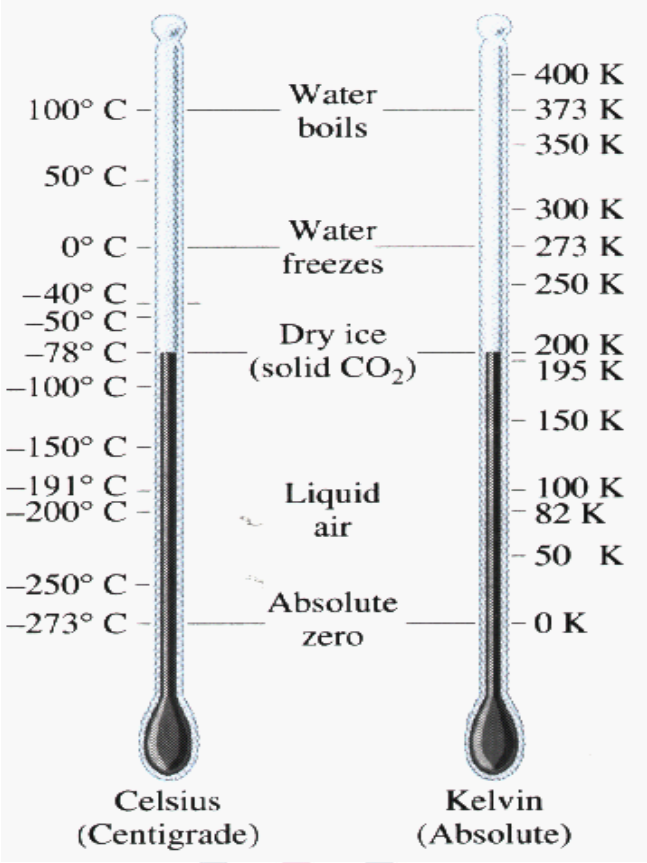
Introduction:

- **Matter is anything that occupies space and has a mass**.
- Three states solids, liquids and gases.
- We will now focus on gases and their properties.
- Gases have particles that allow them to move freely in a container due to it not having a definite shape or size.
- **A gas may be defined as a substance that has no well – defined boundaries but diffuse rapidly to fill its new space it moves into.**
- **Factors that affect the properties of gas laws are temperature, pressure and volume.**

- **Temperature** is a measure/degree of the hotness or coldness of an object
- Measured in **Celsius** or **Kelvin**



- The zero in the Kelvin scale is given as the temperature at which a gas would have no volume.
- This temperature is said to be **absolute zero.**
- Temperature can be converted to and from Kelvin scale to Celsius scale.
- e.g. $0^oC + 273 = 273$ K
- $273 – 273 = 0^oC$

Volume:

- The volume of a gas will be the same as the volume of the container it is in.
- The measurement of volume **is cm^3 or litres L** in laboratory use.
- The cm^3 in the new course is also recognised as dm^3 (cubic decimetre)

Pressure:

- Pressure of gas is the force that allows it exerts itself on each unit area.
- Measured in Newton's per metered squared. Also called Pascal (Pa).
- Written as 1 x 10^5Pa

Volatile Liquids

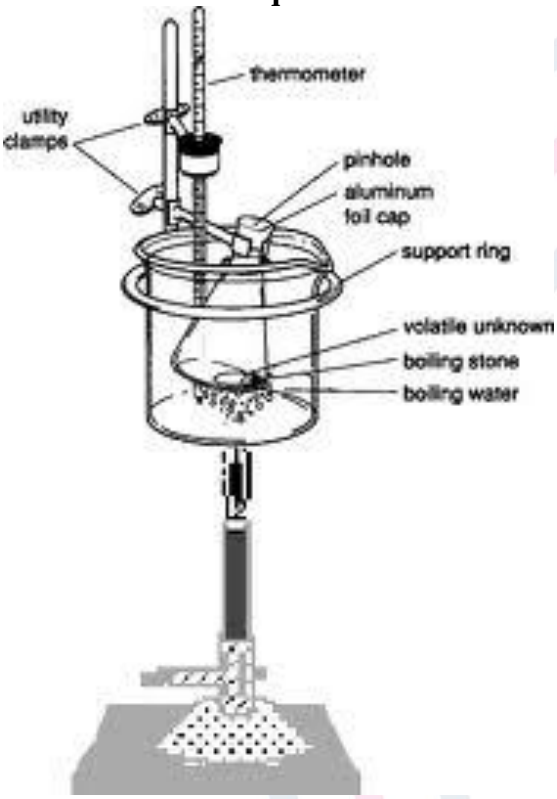
Q) What is a volatile liquid?

- A liquid which has a very low boiling point (easily vaporised)
- Example: Propanone – boiling point is 21^{o}C

Q) Define relative molecular mass

- Average mass of all the molecules in a compound measured relative to the carbon 12 isotope.

Q) Draw a diagram of the apparatus you would use to determine the relative molecular mass of a volatile liquid.



Q) Describe four measurements taken during the above experiment.

1) Temperature

- Use a thermometer, read the temperature of the water.

2) Volume

- Fill the conical glass with water and pour the water into a graduated cylinder.
- The volume of the vapour equals the volume of the conical flask.

3) Pressure

- Found using a barometer

4) Mass of a liquid

a) Find the mass of flask, foil and elastic band (use electronic balance)
b) Add liquid to the flask, secure the tin foil with elastic band on the foil and put a hole in it.
c) Heat until all the liquid has vaporised (all air is expelled)
d) Allow the flask to cool, dry the outside and reweigh and allow to re entering.
The mass of the liquid is got by subtraction

Q) Give 2 precautions taken during this experiment.

1) Make sure pin hole isn't too big (not to expel too much vapour)
2) Dry the sides of the flask
3) Make sure that the flask is well emerged in water (so that all the liquid is vaporised)

Theory of Gas Laws

Q) What is an ideal gas?

- This is a gas that obeys all the assumptions of kinetic theory on all conditions of temperatures and pressures.

Q) List 4 assumptions of the kinetic theory

1) Gases are made up of particles which are constantly moving and colliding with each other
2) The kinetic energy if the particles in a sample of gases are proportional to temperature
3) No attractive forces form between the particles of the gas.
4) The gas particles are so small and so widely separated from each other, their volume is Negligible

Note: in reality an ideal gas does not exist, but **under certain conditions of temperatures and pressures real gases can come close to ideal behaviour**.

Q) Under what conditions of temperatures and pressures do real gases come closest to ideal behaviour?

- When there are no attractive between gas particles and when the gas particles occupy a small gas volume.

1) High temperature: the particles will be far apart from each other and will have the least attractive forces.

2) Low pressure

Q) Give two ways real gases depart from ideal behaviour

1) Between the particles of real gases there are attractive forces i.e. Van Der Waals, dipole – dipole and hydrogen bonds.
2) At low temperature and high pressure, particles in a gas are close together and do occupy a considerable volume.

Q) Under what conditions do real gases depart from ideal behaviour?

- Strong attractive forces between the particles
- This will occur at: High Pressure and Low Temperature

Q) Select from the list of gases you expect to deviate least from ideal behaviour

1) NH_3
2) N_2
3) H_2

3) Hydrogen

Reason:

- Smallest relative molecular mass and occupy smallest volume (also weakest attractive forces between the molecules)