5.0 KINETIC THEORY OF MATTER, GAS LAW

The kinetic Theory of matter states that all matters are made up of very tiny particles which are in constant motion and possess kinetic energy. Matter exist in 3 states (Solid , Liquid , Gases)

5.1 SUMMARY (KINETIC THEORY)

[a.] In Solid: The cohesive forces between particles are very strong. The particles only vibrate and rotate about a fixed position, and possess very little energy.

[b.] In Liquid: The cohesive forces between particles are weaker than those in solids. The particles move about randomly, but only within a restricted space only. They possess more kinetic energy than the particles in solid.

[c.] In Gases: The cohesive forces between the particle are negligible. The particles move about freely at random and at high speeds. Of all the three states, the particles in the gaseous state possess greatest amount of energy.

A substance can exist as a solid, a liquid or a gases. Change of state is brought about by a change in temperature. As a substance changes from a gas to a liquid, then to a solid, its particles become less energetic and lose their random motion gradually to finally get arranged in an orderly pattern.

* Solid ---to---> Gas = Sublime
* Solid ---to---> Liquid = Freeze
* Liquid ---to---> Gas = Evaporation
* Liquid ---to---> Solid = Melting
* Gas ---to---> Solid = Sublime
* Gas ---to---> Liquid = Condense

The phenomena supporting the kinetic theory of matter are Osmosis, Diffusion, Dialysis & Brownian movement.

[a] Osmosis: is a special case of diffusion which involves the movement of water molecules, through a semi-permeable membrane, from a region of higher concentration to lower concentration.

[b.] Diffusion: describe the movement of solute particles through a medium from a region of higher concentration to a region of lower concentration.

## 5.2 STUDY OF GASES

Matter in the gaseous state has different characteristics from that in the solid and liquid states. This is investigated by many of the early scientist like Boyles, Charles, Grahams & Dalton. The chemical behavior of gases was studied by Gay-Lussac.

## 5.3 KINETIC THEORY OF GASES

[1] The gas molecule move randomly in a straight lines, colliding with one another & with wall of the container.

[2] The collisions of gas molecule are perfectly elastic, When two molecule collide, their individual energies may change, and one may move faster while other slow down, but their total K.E remain the same.

[3] The actual volume occupied by the gas molecules themselves is negligible relative to the volume of the container.

[4] The cohesive forces between the gases molecules are negligible.

[5] The temperature of the gas is a measure of the average kinetic energy (K.E) of the gas particles.

## 5.4 GAS LAW'S

* Boyle's Law states that the volume V of a given mass of gas is inversely proportional to its pressure P, Provided that the temperature remains constant. Formula: $V = K/P$ (Where v = volume, p = pressure , k= constant), $V_1 P_1 = V_2 P_2$.

* Charles' Law states that the volume of a given mass of gas is directly proportional to its temperature in kelvin, provided that pressure remains constant. Formular: $V = KT$ or $k = v/t$ (Where v= volume, T= kevin temp. k= constant), $V_1/T_1 = V_2/T_2$

* Dalton's Law of partial pressure states that if there is a mixture of gases which do not react chemically together, then the total pressure exerted by the mixture is the sum of the partial pressure of the individual gases that make up the mixture. Formular: $P_{total} = P_A + P_B + P_C$ ....

* Gay Lussac Law of combining volumes states that when gaseous reactants combine together to give gaseous product, they do so in simple ratios of their volumes, provided that the temperature and pressure remains constant.

* Avogadro's Law states that equal volume of all gases with the same temperature and pressure contain the same number of molecule.

* Graham's law of diffusion states that at a constant temperature and pressure, the rate of diffusion of a gas is inversely proportional to the square root of its density.

## 5.5 TEMPERATURE CONVERSION

The equivalent temperature on the Celsius and Kelvin scales which should be remembered are as follows;

0 degree °Celsius = 273 kelvin
-273 degree °Celsius = 0k

To convert Celsius to temperature (0 degree °Celsius) to Kelvin in temperature (k), add 273 to the formula

Formula;
K = degree °C + 273

To convert Kelvin temperature to a Celsius temperature is by Subtracting 273 from kelvin temperature.

Formula;
Degree °C = K - 273

## REVISION EXERCISE

[1] What is boyle's law and give formula ?
[2] What is Charles' law and give formula ?
[3] What is Dalton's law of combination ?
[4] What is Avogadro's law ?
[5] What is Graham's law of diffusion and give formula ?
[6] What is osmosis ?
[7] What is diffusion ?
[8] State the kinetic theory of gases ?
[9] Solid to liquid give what ?
[10] Liquid to gas give what ?
[11] Gas to liquid give what ?
[12] Liquid to solid give what ?
[13] Gas to solid give what ?
[14] Solid to gas give what ?

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