

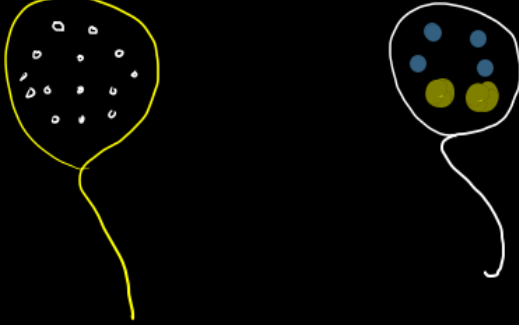
Semester-I, Chemistry Core-2, Lecture-1 Unit-1 Gaseous State

Postulates / Assumptions of Kinetic Theory of Gases:

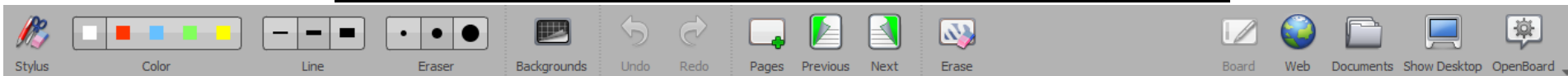
The theory was first proposed by Bernoulli (1738) and it was later extended by Clausius, Maxwell, Boltzmann, Van der Waal & Jeans.

The main assumptions of Kinetic Molecular Theory (KMT) of gases: -

1) Every gas is made up of large no. of extremely small particles called molecules. All the molecules of a particular gas are identical in mass & size.

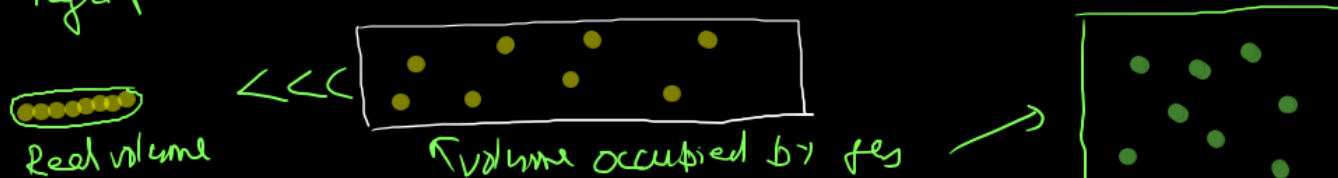


Unit-1 Gaseous State, Lecture-1 Postulates of Kinetics Theory of Gases



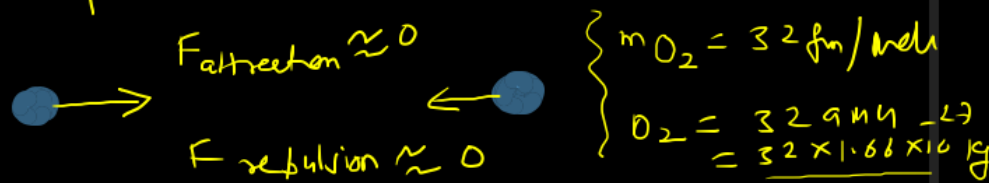
(i)

The molecules of gases are separated from each other by very large distances so that actual volume of the molecule is negligible as compared to the total volume occupied by gas.



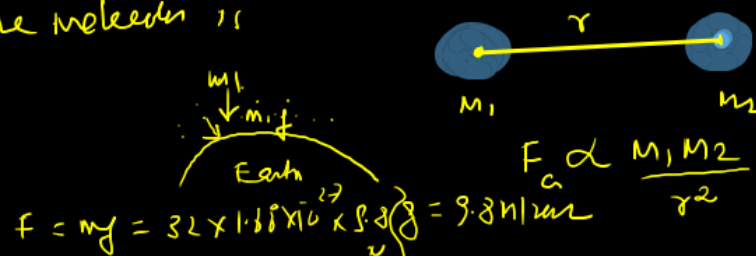
(ii)

The distance of separation between molecules of gases are large enough so that the force of attraction or repulsion between them are negligible.



(iii)

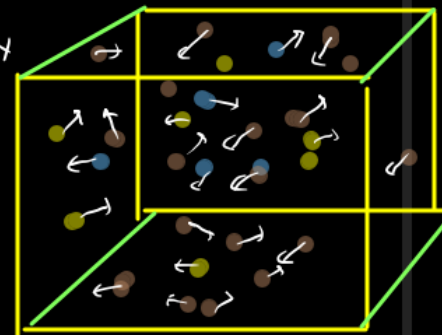
The force of gravitation on the molecules is also supposed to be negligible.



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V

The molecules are supposed to be moving continuously in different directions with different velocities. ∴ They keep colliding with each other & with wall of closed container.



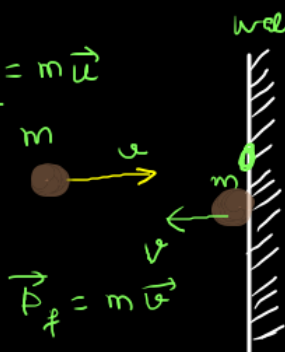
VI

The molecules of gas exert pressure on the wall of container by the continuous collision $\vec{p}_i = m\vec{u}$ with wall.

✓ Pressure = $\frac{\text{Force}}{\text{Area}}$

Newton's 2nd Law of motion:

Force \propto rate of change of momentum
 $\propto \frac{dp}{dt} \Rightarrow F = ma$

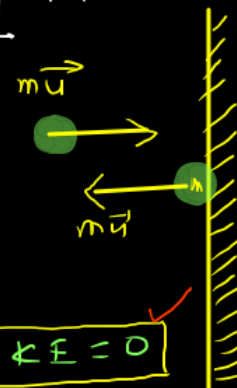


on collision with the wall

Change in momentum = Δp
 $\Delta p = p_f - p_i = m v - m u$
 $\frac{\Delta p}{\Delta t} = \frac{m v - m u}{\Delta t} = m \left(\frac{dv}{dt} \right) = m a$

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(vii) The molecules are supposed to be perfectly elastic hard spheres so that kinetic energy remains conserved; & does not change into any other form. The energy may be transferred in course of collisions of molecules with each other



(1) As KE is conserved.

Total K.E. Initial = Total K.E. final $\Rightarrow \Delta KE = 0$

$$\Rightarrow \frac{1}{2} m_1 u_1^2 + \frac{1}{2} m_2 u_2^2 = \frac{1}{2} m_1 v_1^2 + \frac{1}{2} m_2 v_2^2$$

(2) Linear momentum is also conserved.

$$\sum p_i = \sum p_f$$

$$m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2$$

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VIII

Molecules are moving in different directions with different velocities. That means they possess different kinetic energy.

However, the average K.E of molecules has been found directly proportional to the temperature in Kelvin scale (Absolute temperature) of the gas.

$KE_{av} \propto T_{\text{kelvin}}$

So they are the postulates of kinetic molecular model / Theory of gases.

