

Topic :- Maxwell - Boltzmann speed

Distribution law :-

The Maxwell - Boltzmann equation for distribution of energy among the molecules of an ideal gas is give by

$$n(E)dE = \frac{2AN}{(\pi KT)^{3/2}} E^{1/2} e^{-E/KT} dE \quad \text{--- (1)}$$

A classical ideal gas is defined as an assembly of non-interacting molecules, each distinguishable from one another. Therefore, the molecules has no internal degrees of freedom all the energy of the gas molecules is completely kinetic in nature.

Thus,

$$E = \frac{1}{2}mv^2, \text{ Hence } dE = mv dv$$

Substituting these values of E and dE in equation (1), the number of molecules $n(v)dv$ whose speeds lie between v and $(v+dv)$ is given by

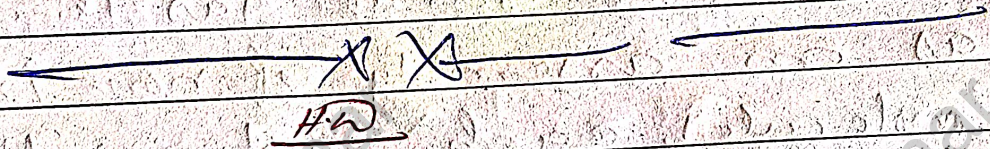
$$n(v)dv = \frac{2AN}{(\pi KT)^{3/2}} \left(\frac{1}{2}mv^2 \right)^{1/2} e^{-\frac{mv^2}{2KT}} mv dv$$

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$$= \frac{2AN}{(\pi KT)^{3/2}} \cdot 2 \left(\frac{m}{2} \right)^{3/2} v^2 e^{-\frac{mv^2}{2KT}} dv$$

$$\Rightarrow n(v)dv = 4AN \left(\frac{m}{2\pi KT} \right)^{3/2} v^2 e^{-\frac{mv^2}{2KT}} dv$$

This equation is known as the Maxwell or Maxwell-Boltzmann law of distribution of speeds among the molecules of a gas. In this $n(v)$ is the number of molecules per unit speed range.



Q Define the Maxwell law of distribution of speeds among the molecules of gas.