Maxwell's Speed Distribution Law

$$P(v) = 4\pi \left(\frac{M}{2\pi RT}\right)^{3/2} v^2 e^{\left(\frac{-Mv^2}{2RT}\right)}$$

$P(v)$: Probability distribution function

M = molar mass

$R = 8.314 \ \frac{J}{mol\,K}$

T = temp (K)

v = molecular speed $\left(\frac{m}{s}\right)$

Allows the calculation of the number of molecules in a gas that are moving with speeds in a particular range.

$P(v)\,dv$ = fraction of molecules with speeds in the interval dv

$$\text{frac} = \int_{v_1}^{v_2} P(v)\,dv$$

$$V_{avg} = \int_0^\infty v\, P(v)\, dv = \sqrt{\frac{8RT}{\pi M}}$$

$$\left(V^2\right)_{avg} = \int_0^\infty v^2 P(v)\, dv = \frac{3RT}{M}$$

$$\Rightarrow \quad V_{rms} = \sqrt{\frac{3RT}{M}}$$

Most Probable speed (V_p)

- speed at which $P(v)$ is maximum

$$V_p = \sqrt{\frac{2RT}{M}}$$