Kinetic Theory of Gases Important Formula for NEET & JEE.

Boltzmann's Constant

The Boltzmann constant, denoted by k or k_B in thermodynamics, is a physical constant that connects the average kinetic energy of gas particles to the temperature of the gas.

$$k_B = \frac{nR}{N}$$

k_B is the Boltzmann's Constant

R is the gas Constant

n is the Number of Moles

N is the Number of Particles in one mole (the Avogadro number)

Total Translation K.E of Gas

$$K.E = \left(\frac{3}{2}\right) nRT$$

n is the number of moles

R is the Universal gas Constant

T is the absolute Temperature

Maxwell Distribution Law

The Maxwell-Boltzmann distribution, often known as the Maxwell distribution, is a statistical description of the distribution of molecular energy in a classical gas.

$V_{rms} > V > Vp$

V_{rms} is the RMS speed

V is the Average Speed.

Vp is the most probable speed

RMS Speed (V_{rms})

Atoms or molecules that move at varying speeds and in arbitrary directions make up gases. Finding a single velocity value for the particles is possible by using the root mean square velocity (RMS velocity). The root mean square velocity formula is used to calculate the average speed of a gas particle.

$$V_{rms} = \sqrt{\frac{8kt}{m}} = \sqrt{\frac{3RT}{M}}$$

R is the universal gas constant.

T is the absolute temperature.

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M is the molar mass.

Average Speed

$$\vec{v} = \sqrt{\frac{8kt}{\pi m}} = \sqrt{\frac{8RT}{\pi M}}$$

Most Probable Speed (V_p)

The speed that displays the highest amount of gas molecules moving at a given time is the one that is considered to be the most likely. The greatest value on the Maxwell's distribution map represents the speed that is most frequent.

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

The Pressure of Ideal Gas

$$P = \frac{1}{3} V_{rms}^2$$

P is the density of molecules

Equipartition of Energy

Equipartition of energy is a statistical mechanics principle that states that, on average, an equal amount of energy will be attributed to each degree of freedom in a system that is in thermal equilibrium.

$K = \frac{1}{2} K_B T$ for each degree of freedom

K=$\left(\frac{f}{2}\right) K_B T$ for molecules having f degrees of freedom

K_B is the Boltzmann's Constant

T is the Temperature of the gas.

Internal Energy

$$U = \left(\frac{f}{2}\right) nRT$$

For n moles of an ideal Gas.