Ideal Gas Law

$$PV = nRT$$

Re-arrange the constants

$$PV = nRT$$

$$PV = nN_a\left(\frac{R}{N_a}\right)T$$

Ideal Gas Law expressed with Boltzman's Constant

$$PV = nRT$$

$$PV = nN_a\left(\frac{R}{N_a}\right)T$$

$$PV = NkT$$

Ideal Gas Law

$$PV = nRT = NkT$$

Force During a Elastic Molecular Collision

$$F = ma$$

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$$F = ma$$

$$= m\frac{\Delta v}{\Delta t}$$

Force During a Elastic Molecular Collision

$$F = ma$$

$$= m\frac{\Delta v}{\Delta t}$$

$$= \frac{\Delta(mv)}{t}$$

Force on the molecule per collision

$$F = \frac{\Delta(mv)}{t}$$

Force on the molecule per collision

$$F = \frac{\Delta(mv)}{t}$$

$$\frac{-mv - (mv)}{2L / v}$$

Force on the molecule per collision

$$F = \frac{\Delta(mv)}{t}$$

$$\frac{-mv-(mv)}{2L/v}$$

$$= \frac{-2mv^2}{2L}$$

Force on the molecule per collision

$$F = \frac{\Delta(mv)}{t}$$

$$\frac{-mv - (mv)}{2L / v}$$

$$= \frac{-2mv^2}{2L}$$

$$= \frac{-mv^2}{L}$$

Force on the side of a cube per molecular collision

$$F = \frac{mv^2}{L}$$

Total force on a side of a cube

$$F = \frac{mv^2}{L}$$

$$= \left(\frac{N}{3}\right)\left(\frac{m\overline{v^2}}{L}\right)$$

Total force on a side of a cube

$$F = \frac{mv^2}{L}$$

$$= \left(\frac{N}{3}\right)\left(\frac{m\overline{v^2}}{L}\right)$$

$$= \frac{N}{3L}(mv_{rms}^2)$$

Converting Force into Pressure

$$P = \frac{F}{A}$$

Pressure on a side of the cube

$$P = \frac{F}{A}$$

$$= \frac{F}{L^2}$$

Pressure on side of the cube

$$P = \frac{F}{A}$$

$$= \frac{F}{L^2}$$

$$= \frac{\frac{N}{3L}(mv^2_{rms})}{L^2}$$

Pressure on side of the cube

$$P = \frac{F}{A}$$

$$= \frac{F}{L^2}$$

$$= \frac{\frac{N}{3L}(mv_{rms}^2)}{L^2}$$

$$= \frac{N}{3L^3}(mv_{rms}^2)$$

Pressure on side of the cube

$$P = \frac{F}{A}$$

$$= \frac{F}{L^2}$$

$$= \frac{N}{3L^3}(mv_{rms}^2)$$

$$= \frac{N}{3V}(mv_{rms}^2)$$

Pressure on side of the cube

$$P = \frac{N}{3V}(mv^2_{rms})$$

Pressure on side of the cube

$$P = \frac{N}{3V}\left(mv_{rms}^2\right)$$

$$PV = \frac{N}{3}\left(mv_{rms}^2\right)$$

Pressure on side of the cube

$$P = \frac{N}{3V}(mv_{rms}^2)$$

$$PV = \frac{N}{3}\left(mv_{rms}^2\right)$$

$$PV = \frac{2N}{3}\left(\frac{mv_{rms}^2}{2}\right)$$

Pressure x Volume

$$P = \frac{N}{3V}(mv_{rms}^2)$$

$$PV = \frac{N}{3}\left(mv_{rms}^2\right)$$

$$PV = \frac{2N}{3}\left(\frac{mv_{rms}^2}{2}\right)$$

$$PV = \frac{2N}{3}\left(\overline{KE}\right)$$

Pressure on each side of the cube

$$P = \frac{N}{3V}(mv_{rms}^2)$$

$$PV = \frac{N}{3}\left(mv_{rms}^2\right)$$

$$PV = \frac{2N}{3}\left(\frac{mv_{rms}^2}{2}\right)$$

$$PV = \frac{2}{3}N\left(\frac{3}{2}kT\right) = \frac{2}{3}N(\overline{KE})$$

$$\frac{3}{2}kT = \overline{KE} = \frac{1}{2}mv_{rms}^2$$

Conclusion

$$(\overline{KE}) = \frac{3}{2}kT$$

$$\frac{mv^2_{rms}}{2} = \frac{3}{2}kT$$

Related Links

- http://www.zappinternet.com/video/fiqXvoBloZ/Kinetic-Theory-Of-Gases