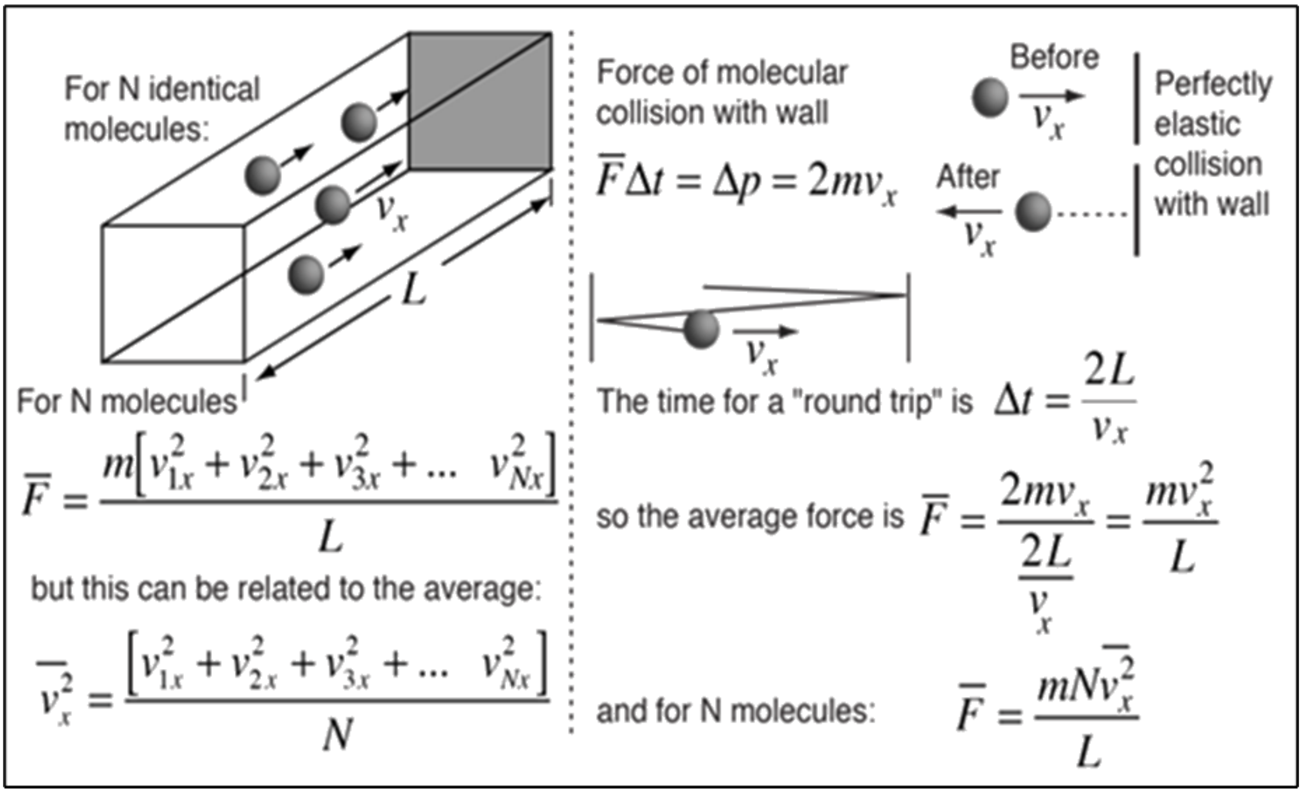
FlexiPrep

Average Kinetic Energy of a Gas Molecule, Significance of the Kinetic Theory of Gases (For CBSE, ICSE, IAS, NET, NRA 2022)

Average Kinetic Energy of a Gas Molecule

The Equation of Force and Pressure



We know that PV = nRT

So, from figure

$$\mathrm{nRT} = \frac{1}{3}\mathrm{mv}^2\ N$$

Multiplying and Dividing by 2 we get-

$$\mathrm{nRT} = \frac{2}{3}\left(\frac{\mathrm{mv}^2}{2}\right) N$$

Rearranging equation we get-

$$\frac{\mathrm{mv}^2}{2} = \frac{3}{2}\frac{\mathrm{nRT}}{N} = \frac{3}{2}\frac{\mathrm{RT}}{\frac{N}{n}}$$

- Here, N is the total number of gas molecules in a given region of space
- n is the number of moles of gas present in a given region of space.
- $\frac{N}{n} = N_A$ Avogadro's number
- Avagadro's number in this context is the number of molecules present in the one mole of gas. $N_A = 6.022140857 \times 10^{23}$.
- Substituting N_A in equation, Average Kinetic Energy of a gas molecule is given by-

$$K.E = \frac{3}{2}k$$

Significance of the Kinetic Theory of Gases

- As we know the Temperature, we can directly figure out the average Kinetic energy of a gas molecule. No matter what gas are you considering, except it is an ideal gas.
- one can accurately calculate the microscopic parameters like Momentum, Velocity, Internal energy, Kinetic energy, Thermal energy etc. and Visa-Versa. , As we Know the macroscopic parameters of gases like Pressure, Volume, Temperature etc. ,