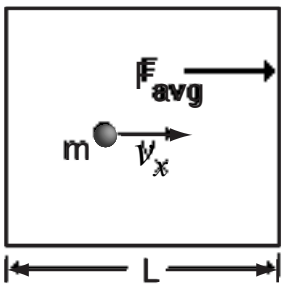

$$F_{average} = \frac{mN\overline{v_x^2}}{L}$$

and assuming random speeds in all directions

$$\overline{v^2} = \overline{v_x^2} + \overline{v_y^2} + \overline{v_z^2} = 3\overline{v_x^2}.$$

Then the pressure in a container can be expressed as

$$P = \frac{F_{avg}}{A} = \frac{mN\overline{v^2}}{3LA} = \frac{mN\overline{v^2}}{3V} = \frac{N}{3V}m\overline{v^2}.$$

Expressed in terms of average molecular kinetic energy:

$$P = \frac{2N}{3V}\left[\overline{\frac{1}{2}mv^2}\right]$$

This leads to a concept of **kinetic temperature** and to the **ideal gas law**.