

## Root Mean Square velocity or (R.M.S) velocity

It is defined as the square root of the mean value of the squares of the velocities of all molecules at a particular temperature.

Let two molecules moving with ~~velocities~~ velocities 3 and 4 cm per second respectively.

Their average velocity is  $\frac{3+4}{2} = \frac{7}{2} = 3.5$

But ~~the~~ their R.M.S velocity is square root of  $\sqrt{\frac{3^2+4^2}{2}}$  i.e.  ~~$\sqrt{\frac{3+4}{2}}$~~   $= \sqrt{\frac{9+16}{2}} = \sqrt{\frac{25}{2}} = \sqrt{12.5}$   
 $= 3.535$

If a container contains a gas having  $n$  molecules and at a particular moment the velocity of molecules are  $c_1, c_2, c_3, \dots, c_n$  then —

$$\text{R.M.S velocity} = \sqrt{\frac{c_1^2 + c_2^2 + c_3^2 + \dots + c_n^2}{n}}$$

$$\text{and average velocity} = \frac{c_1 + c_2 + c_3 + \dots + c_n}{n}$$

from kinetic gas equation —

$$C^2 = \frac{3PV}{M} = \frac{3RT}{M}$$

$$\therefore C = \sqrt{\frac{3RT}{M}}$$

where  $M$  is molecular wt. of the gas.