Doubt Clearing Session

Course on States of Matter for Class XI

akhilesh • Lesson 13 • July 30, 2021

3^{rd}

17

$$\frac{n_{SO_2}}{n_{CH_4}} = \frac{8}{1}\left(\frac{16}{64}\right)^{3/2} = 1$$

$$\frac{r_{SO_2}}{r_{CH_4}} = \frac{1}{1}\sqrt{\frac{16}{64}} = \frac{1}{2}$$

$$\frac{1.5/1}{1.5/t} = \frac{2}{2}\sqrt{\frac{2}{28}}$$

21

$$\begin{array}{cc} O_2 & M \\ 25 & 25 \end{array}$$

21

Vapour Density

$$PM = dRT$$

Effusion

$$r \propto \frac{1}{\sqrt{M}}$$

$$\propto \frac{1}{\sqrt{V.D}}$$

$$2NH_3 \rightarrow N_2 + 3H_2$$

$$\frac{1.5}{\cancel{0.5}} = \frac{2}{\cancel{7}}$$

0.5

Question

from Animesh Ku...

Sir isme percentage by moles he ya by mass ?

129. For the reaction $2NH_3(g) \rightarrow N_2(g) + 3H_2(g)$. What is the % of NH_3 converted if the mixture diffuses twice as fast as that of SO_2 under similar conditions

(A) 3.125 (B) 6.25 (C) 12.5 (D) none

$SO_2 = 64$

$M_{avg} = 16$

$$2NH_3 \longrightarrow N_2 + 3H_2$$

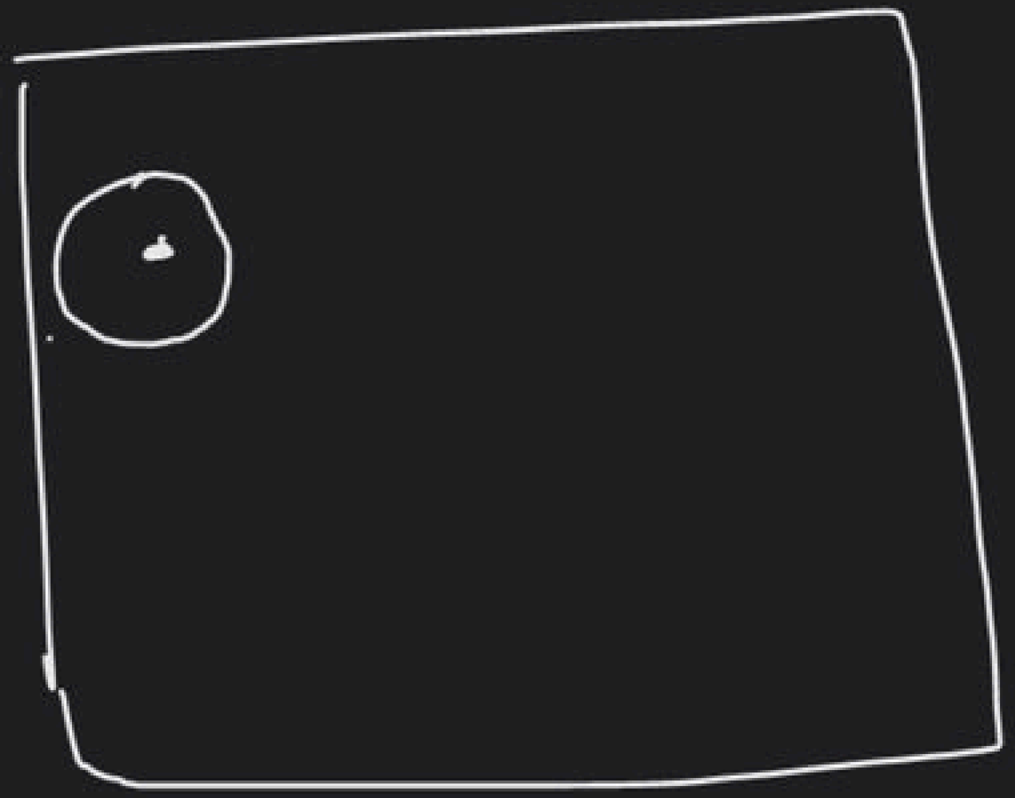
$$1-\alpha \qquad \alpha/2 \qquad 3\alpha/2$$

$$16 = \frac{17}{1+\alpha}$$

Kinetic theory of Gases :→

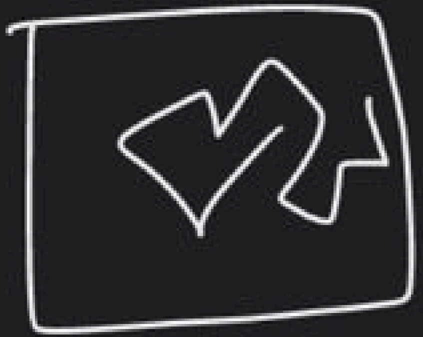
Postulates of KTG :→

1. Actual volume of molecules is considered negligible w.r.t container because gases are highly compressible.



(2) There is no intermolecular forces betn the molecules at ordinary T & P.
This is based on the fact that gases occupy all available space

(3) Molecules are always in constant random motion



(Brownian motion)
(gravity has no effect)

This is based on the fact that molecules do not settle down on ground.

(4) During random motion, they collide with each other and with the wall of container. These collisions are <u>perfectly elastic</u> in nature.

(5) Pressure is exerted by the gas as a result of collision of the molecules with the wall of container

(6) Speed of molecule in container changes continuously with time.

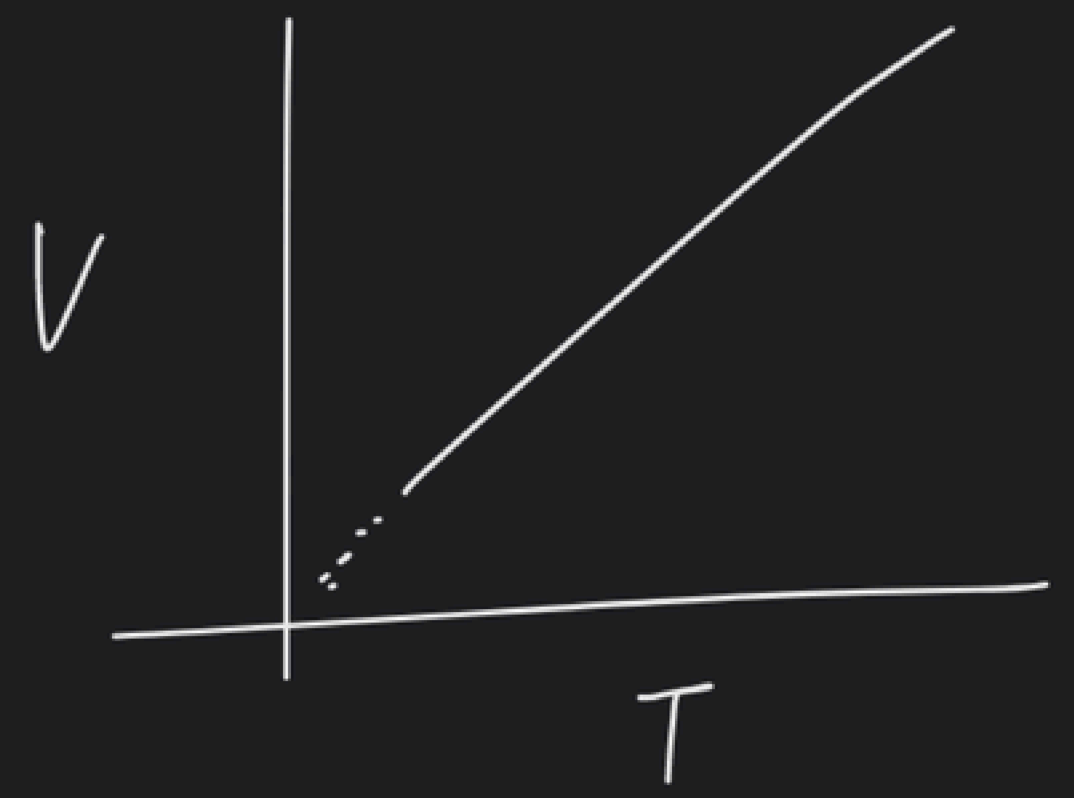
100 — 200 m/sec $\quad \underline{n_1}$

200 — 300 m/sec $\quad n_2$

300 — 400 m/sec $\quad n_3$

but distribution of speeds remains constant at a particular temp.

(7) KE of molecules is directly proportional to absolute temp.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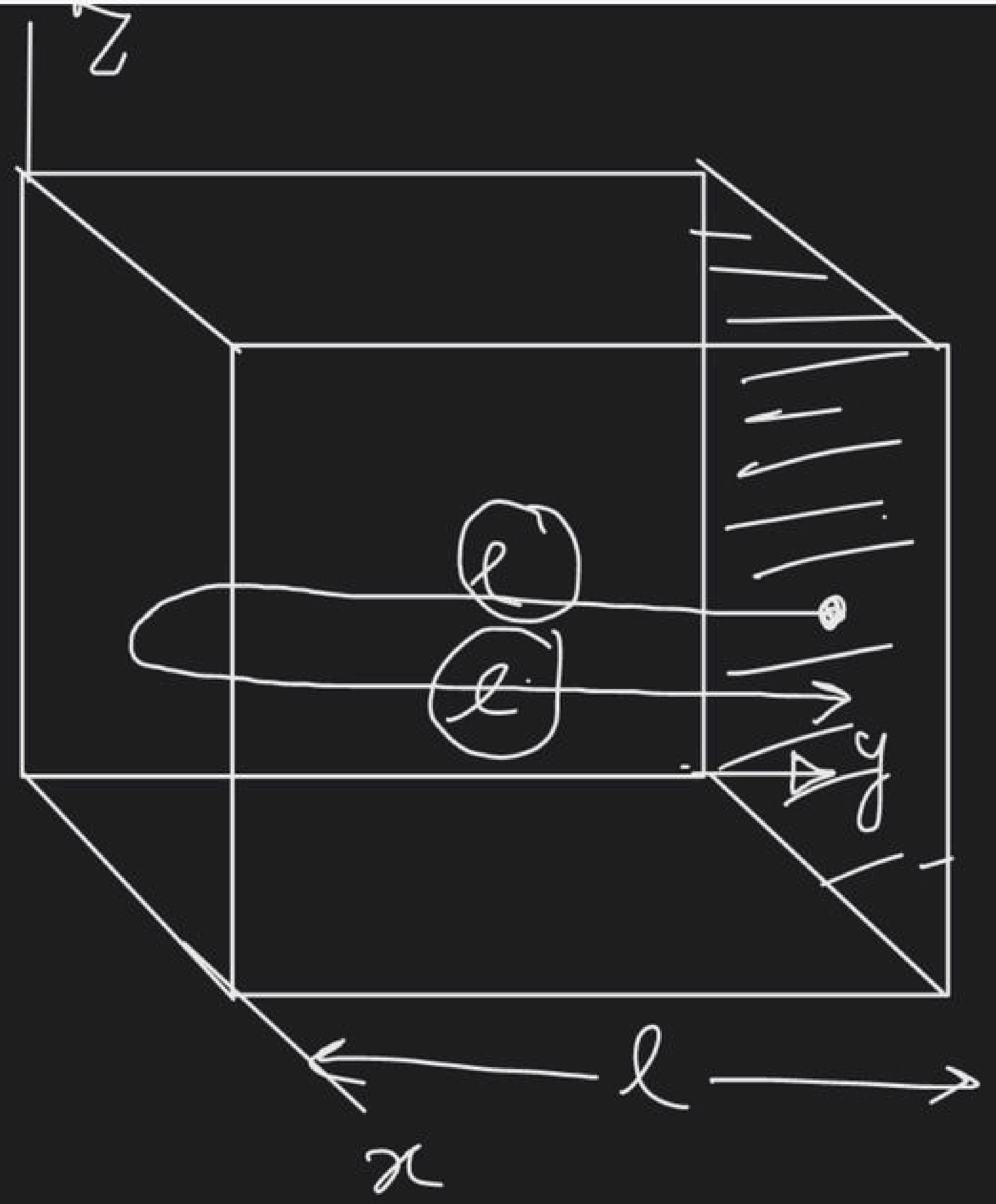


Let there N particles of mass m each moving with speed

$$u_1,\ u_2 \ \ldots\ldots\ u_N$$

$$u_1^2 = u_x^2 + \underline{\underline{u_y^2}} + u_z^2$$

momentum before collision xz wall $= m u_y$

Change in momentum due to a single $= 2 m u_y$

no. of collision/sec on xz plane $= \dfrac{u_y}{2l}$

change in momentum/sec $= 2mu_y \times \dfrac{u_y}{2l}$

force $= \dfrac{mu_y^2}{l}$

$P_y = \dfrac{mu_y^2}{l^3}$ $\quad P_x = \dfrac{mu_x^2}{l^3}$

$$P_x = \sum \frac{m}{l^3} u_x^2 \qquad P_y = \sum \frac{m}{l^3} u_y^2 \qquad P_z = \sum \frac{m}{l^3} u_z^2$$

$$P_x = P_y = P_z = P$$

$$P = \frac{P_x + P_y + P_z}{3}$$

$$P = \frac{1}{3} \frac{m}{l^3} \sum \left(u_x^2 + u_y^2 + u_z^2 \right)$$

$$= \frac{1}{3} \frac{m}{l^3} \sum u^2$$

$$PV = \frac{1}{3} m \sum u^2$$

$$PV = \frac{1}{3} m N \left(\frac{u_1^2 + u_2^2 - - - - u_N^2}{N} \right)$$

$$= \frac{1}{3} m N \, U_{rms}^2$$

$$= \frac{1}{3} m N_A \frac{N}{N_A} U_{rms}^2$$

$$PV = \frac{1}{3} n M U_{rms}^2$$

by Maxwell

$$U_{rms} = \sqrt{\frac{3RT}{M}}$$

$$PV = \frac{1}{\cancel{3}} n \cancel{M} \frac{\cancel{3}RT}{\cancel{M}}$$

$$\boxed{PV = nRT}$$

$$KE = \frac{1}{2}mu^2$$

$$KE_{avg} = \frac{1}{2}m \frac{u_1^2 + u_2^2 - - u_N^2}{N}$$

of 1 molecule

$$= \frac{1}{2}m\, U_{rms}^2$$

$$KE_{avg} = \frac{1}{2}m N_A V_{rms}^2$$

1 mol

$$= \frac{1}{2}M\, U_{rms}^2$$

$$KE_{avg} = \frac{1}{2} M \frac{3RT}{M}$$

of 1 mole

$$\boxed{KE_{avg} = \frac{3}{2} RT}$$

of 1 mol

$\underline{O_2}$ $n = 1$

$\underline{N_2}$ $n = 1$

$\underline{T = 300}$

$$KE_{avg} = \frac{3}{2}\left(\frac{R}{N_A}\right) T$$

of 1 molecule

$$= \frac{3}{2} k T$$

Boltzman Const

JEE Main

1, 2, 3, 4, 7, 8, 10, 13, 14, 16, 18, 19, 20, 21

NCERT

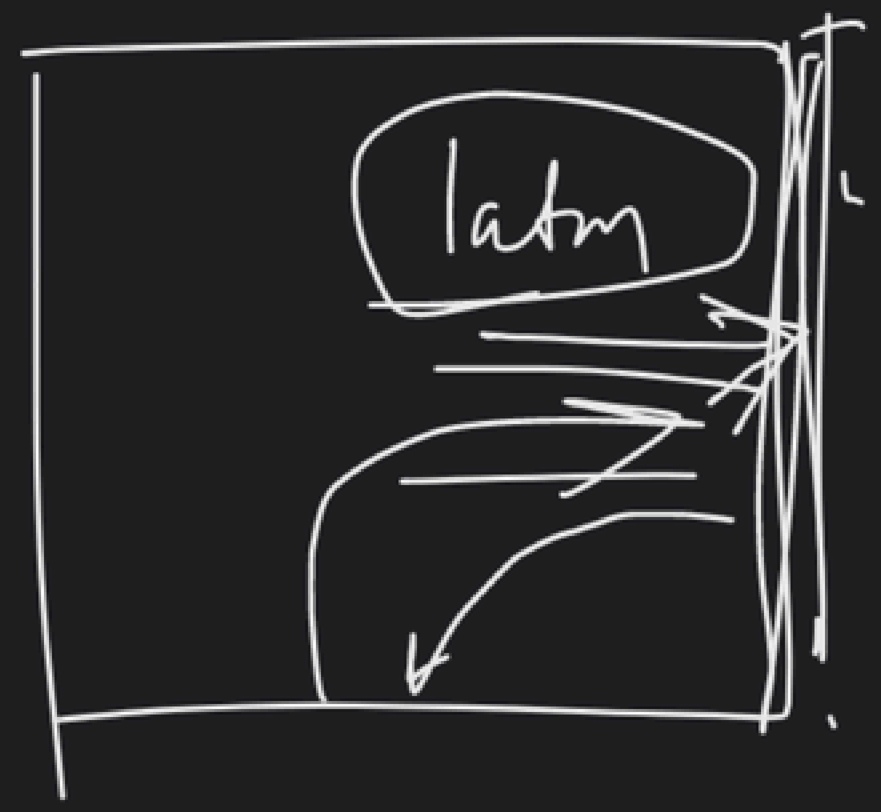
Notes

$$U_{avg} = \frac{u_1 + u_2 - - - - u_N}{N}$$

$$GM \text{ of speed} = (u_1 \times u_2 \times u_3 - - u_N)^{1/N}$$

$$U_{rms} = \left(\frac{u_1^2 + u_2^2 - - - u_N^2}{N}\right)^{1/2}$$

root mean square speed


latm