DPP
DAILY PRACTICE PRODUCTS

Class : XIth
Date :

Solutions

Subject : PHYSICS
DPP No. : 10

Topic :- KINETIC THEORY

1 **(c)**

$v_{rms} \propto \frac{1}{\sqrt{M}} \Rightarrow \frac{v_1}{v_2} = \sqrt{\frac{M_2}{M_1}}$

$\therefore \frac{1}{\sqrt{2}} = \sqrt{\frac{M_2}{32}} \Rightarrow M_2 = 16$. Hence the gas is CH_4

2 **(a)**

No. of moles $n = \frac{m}{\text{molecular weight}} = \frac{5}{32}$

So, from ideal gas equation

$pV = nRT$

$\Rightarrow \quad pV = \frac{5}{32}RT$

3 **(a)**

According to Avogadro's hypothesis

4 **(c)**

Pressure of gas A, $P_A = \frac{125 \times 0.6}{1000} = 0.075\ atm$

Pressure of gas B, $P_B = \frac{150 \times 0.8}{100} = 0.120\ atm$

Hence, by using Dalton's law of pressure

$P_{mixture} = P_A + P_B = 0.075 + 0.120 = 0.195\ atm$

5 **(a)**

Average speed (v_{av}) of gas molecules is

$v_{\text{av}} = \sqrt{\frac{8RT}{\pi M}}$

where R is gas constant and M the molecular weight.

Given, $v_1 = v$, $M_1 = 64$, $v_2 = 4v$

$\therefore \quad \frac{v_1}{v_2} = \sqrt{\frac{M_2}{M_1}}$

$$\frac{v}{4v} = \sqrt{\frac{M_2}{64}}$$

$\Rightarrow$ $$M_2 = \frac{64}{16} = 4$$

Hence, the gas is helium (molecular mass 4).

6 **(b)**

Heat added to helium during expansion

$H = nC_V\Delta T = 8 \times \frac{3}{2}R \times 30$ $\left(C_V \text{ for monoatomic gas} = \frac{3}{2}R\right)$

$=360\ R$

$= 360 \times 8.31$ J $\qquad$ (R=8.31 J mol^{-1} – K^{-1})

$\approx$ 3000 J

7 **(c)**

In Vander Waal's equation $\left(P + \frac{a}{V_2}\right)(V - b) = RT$

a represents intermolecular attractive force and b represents volume correction

8 **(b)**

$$C_P - C_V = R \Rightarrow C_P = R + C_V = R + \frac{f}{2}R$$

$$= R + \frac{3}{2}R = \frac{5}{2}R$$

9 **(d)**

It is because of their low densities

10 **(d)**

Kinetic energy of a gas molecule

$$E = \frac{3}{2}kT$$

where k is Boltzmann's constant.

$\therefore$ $\quad E \propto T$

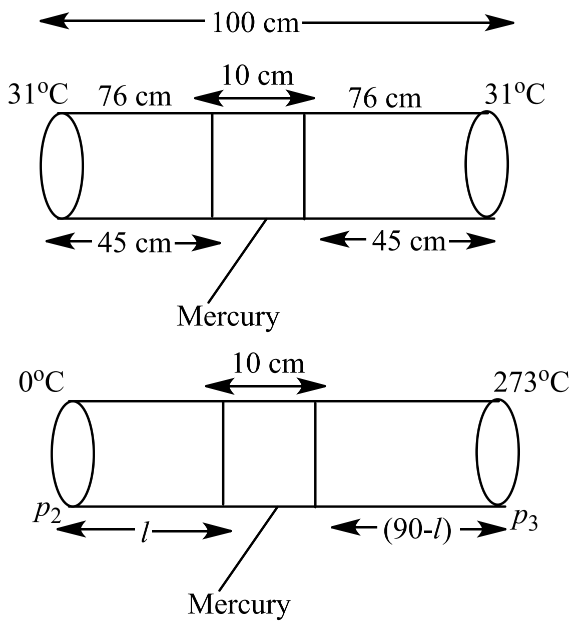
or $\quad \frac{E_1}{E_2} = \frac{T_1}{T_2}$ $\quad$ or $\quad \frac{E}{(E/2)} = \frac{300}{T_2}$

or $\quad T_2 = 150$ K

$T_2 = 150 - 273 = -123$°C

11 **(c)**

On keeping the temperature of the ends of tube at 0°C and 273°C.



Applying ideal gas equation

$$\frac{p_1V_1}{T_1}=\frac{p_2V_2}{T_2}=\frac{p_3V_3}{T_3}$$

$$\frac{76\times 45}{(273+31)}=\frac{p_2\times l}{(273+0)}=\frac{p_3(90-l)}{273+273}$$

$$\underset{\text{I}}{\frac{76\times 45}{304}}=\underset{\text{II}}{\frac{p_2\times l}{273}}=\underset{\text{III}}{\frac{p_3(90-l)}{546}}$$

From II and III

$$\frac{p_2\times l}{273}=\frac{p_3(90-l)}{546}$$

(Mercury column is at rest, so pressure difference $p_2-p_3=0 \Rightarrow p_2=p_3$)

$\therefore \quad \dfrac{p_2\times l}{273}=\dfrac{p_2(90-l)}{546}$

$\Rightarrow \quad 2l=90-l \Rightarrow l=30$ cm

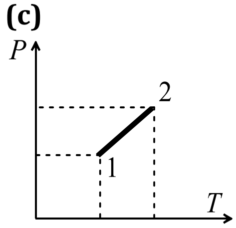
From I and II

$$\frac{76\times 45}{304}=\frac{p_2\times 30}{273}$$

$\Rightarrow \quad p_2=\dfrac{76\times 45\times 273}{30\times 304}$

$$p_2=102.4$$

12 **(c)**



$PV=\mu RT$

$\Rightarrow V \propto \frac{T}{P}$ ($\because \mu$ and R are fixed)

Since, T increases rapidly and P increases slowly thus volume of the gas increases

13 **(b)**

$$v_{av} \propto \frac{1}{\sqrt{M}} \Rightarrow \frac{v_{He}}{v_H} = \sqrt{\frac{M_H}{M_{He}}} = \sqrt{\frac{1}{4}} = \frac{1}{2} \Rightarrow v_{He} = \frac{v_H}{2}$$

14 **(b)**

$$v_{rms} = \sqrt{\frac{3RT}{M}} = \sqrt{\frac{3 \times 8.3 \times 300}{28 \times 10^{-3}}} = 517 m/s$$

15 **(d)**

Thermal equilibrium implies that the temperature of gases is same. Hence Boyle's law is applicable *i.e*

$P_a V_a = P_b V_b$

16 **(d)**

$$C_V = \frac{5}{2} R \text{ and } C_p = \frac{7}{2} R$$

$$\therefore \qquad \gamma = \frac{C_p}{C_V} = \frac{7}{5}$$

17 **(c)**

Moist and hot air being lighter rises up and leaves the room throught the ventilator near the roof and fresh air rushes into the room throught the doors.

18 **(d)**

Root means square velocity of molecule in left part

$$v_{rms} = \sqrt{\frac{3KT}{m_L}}$$

Mean or average speed of molecule in right part

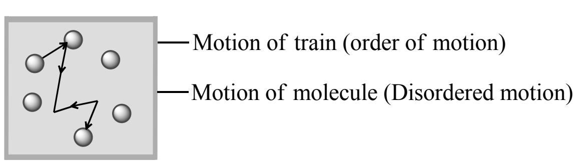
$$v_{av} = \sqrt{\frac{8}{\pi} \frac{KT}{m_R}}$$

According to problem $\sqrt{\frac{3KT}{m_L}} = \sqrt{\frac{8}{\pi} \frac{KT}{m_R}}$

$$\Rightarrow \frac{3}{m_L} = \frac{8}{\pi \, m_R} \Rightarrow \frac{m_L}{m_R} = \frac{3\pi}{8}$$

19 **(c)**

Temperature of the gas is concerned only with it's disordered motion. It is no way concerned with it's ordered motion



20 **(c)**

$$\gamma_{\max} = \frac{\dfrac{\mu_1\gamma_1}{\gamma_1 - 1} + \dfrac{\mu_2\gamma_2}{\gamma_2 - 1}}{\dfrac{\mu_1}{\gamma_1 - 1} + \dfrac{\mu_2}{\gamma_2 - 1}}$$

$$= \frac{\dfrac{1 \times \frac{5}{3}}{\left[\frac{5}{3} - 1\right]} + \dfrac{1 \times \frac{7}{5}}{\left[\frac{7}{5} - 1\right]}}{\left[\dfrac{1}{\frac{5}{3} - 1}\right] + \left[\dfrac{1}{\frac{7}{5} - 1}\right]} = \frac{3}{2} = 1.5$$

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	C	A	A	C	A	B	C	B	D	D
Q.	11	12	13	14	15	16	17	18	19	20
A.	C	C	B	B	D	D	C	D	C	C