DPP
DAILY PRACTICE PROBLEMS

CLASS : XIth
Date :

Solutions

SUBJECT : PHYSICS
DPP No. : 5

Topic :- KINETIC THEORY

1 **(d)**

$$\frac{V_{rmsHe}}{V_{rmsAr}} = \frac{\sqrt{\frac{3RT}{m_{He}}}}{\sqrt{\frac{3RT}{m_{Ar}}}} = \sqrt{\frac{m_{Ar}}{m_{He}}} = \sqrt{\frac{40}{4}} = \sqrt{10} \approx 3.16$$

2 **(c)**

We know that $C_P - C_V = \frac{R}{J}$

$$\Rightarrow J = \frac{R}{C_P - C_V}$$

$$C_P - C_V = 1.98 \frac{cal}{g - mol - K}$$

$$R = 8.32 \frac{J}{g - mol - K}$$

$$\therefore J = \frac{8.32}{1.98} = 4.20 J/cal$$

3 **(c)**

S.I. unit of R is $J/mol - K$

4 **(a)**

According to Boyle's law $PV =$ constant

5 **(a)**

$$v_{\text{rms}} \propto \sqrt{\frac{3RT}{M}}$$

$$\Rightarrow \quad T \propto v_{\text{rms}}^2$$

$$\Rightarrow \quad \frac{T_2}{T_1} = \left[\frac{v_2}{v_1}\right]^2 = \frac{1}{4} \Rightarrow T_2 = \frac{T_1}{4} = \frac{273 + 327}{4}$$

$$= 150 \text{ K} = -123°\text{C}$$

6 **(a)**

The total pressure exerted by a mixture of non-reacting gases occupying a vessel

is equal to the sum of the individual pressure which each gas exert if it alone occupied the same volume at a given temperature.
For two gases,

$$p = p_1 + p_2 = p + p = 2p$$

7 **(b)**
According to ideal gas equation $PV = nRT$
$PV = \frac{m}{M}RT, P = \frac{\rho}{M}RT$ or $\frac{\rho}{P} = \frac{M}{RT}$ or $\frac{\rho}{P} \propto \frac{1}{T}$
Here, $\frac{\rho}{P}$ represent the slope of graph
Hence $T_2 > T_1$

8 **(c)**

$$PV = \mu RT = \frac{m}{M}RT \Rightarrow P \propto mT$$

$$\Rightarrow \frac{P_2}{P_1} = \frac{m_2 T_2}{m_1 T_1} = \frac{1}{2} \times \frac{(273 + 27 + 50)}{(273 + 27)} = \frac{7}{12}$$

$$\Rightarrow P_2 = \frac{7}{12}P_1 = \frac{7}{12} \times 20 = 11.67 atm. \approx 11.7 atm$$

9 **(a)**
Since $c_{rms} << V_e$, hence molecules do not escape out

11 **(b)**
In case of given graph, V and T are related as $V = aT - b$, where a and b are constants.
From ideal gas equation, $PV = \mu RT$
We find $P = \frac{\mu RT}{aT - b} = \frac{\mu R}{a - b/T}$
Sinec $T_2 > T_1$, therefore $P_2 < P_1$

12 **(c)**
Gas equation for N molecules $PV = NkT$

$$\Rightarrow N = \frac{PV}{kT} = \frac{1.2 \times 10^{-10} \times 13.6 \times 10^3 \times 10 \times 10^{-4}}{1.38 \times 10^{-23} \times 300}$$

$$= 3.86 \times 10^{11}$$

13 **(c)**
$E \propto T$

14 **(a)**

$$v_{rms} \propto \sqrt{T}, \frac{v_2}{v_1} = \sqrt{\frac{T_2}{T_1}} \Rightarrow v_2 = \sqrt{\frac{(273 + 927)}{(273 + 27)}} v_1 \Rightarrow v_2 = 2v_1$$

15 **(c)**
For ideal gas, on free expansion there is no change in temperature. Hence $C_a = C_b$

16 **(b)**

$v_{rms} > v_{av} > v_{mp}$

17 **(a)**

According to Boyle's law, $pV = k$ (a constant)

Or $p\frac{m}{p} = k$ or $p = \frac{pm}{k}$

Or $p = \frac{p}{k}$ (where, $\frac{k}{m} = k$ a constant)

So, $\rho_1 = \frac{p_1}{k}$ and $V_1 \frac{p_1}{k} = \frac{m_1}{p_1} = \frac{m_1}{p_1/k} = \frac{km_1}{\rho_1}$

Similarly , $V_2 = \frac{km_2}{p_2}$

Total volume = $V_1 + V_2 = k\left(\frac{m_1}{p_1} + \frac{m_2}{p_2}\right)$

Let p be the common pressure and ρ be the common density of mixture. Then

$$\rho = \frac{m_1 + m_2}{V_1 + V_2} = \frac{m_1 + m_2}{k\left(\frac{m_1}{P_1} + \frac{m_2}{P_2}\right)}$$

$$\therefore\ p = k\rho = \frac{m_1 + m_2}{\frac{m_1}{P_1} + \frac{m_2}{P_2}} = \frac{P_1 P_2 (m_1 + m_2)}{(m_1 P_2 + m_2 P_1)}$$

18 **(c)**

$v_{rms} = \sqrt{\frac{3RT}{M}}$. According to problem T will become $2T$ and M will becomes $M/2$ so the value of v_{rms} will increase by $\sqrt{4} = 2$times, *i.e.*, new root mean square velocity will be 2 v

19 **(a)**

Here, $\frac{K_1}{K_2} = \frac{1}{2}, \frac{r_1}{r_2} = \frac{1}{2}$

$$\therefore\ \frac{A_1}{A_2} = \frac{1}{4}$$

$$\frac{dx_1}{dx_2} = \frac{1}{2}, \frac{dQ_2}{dt} = 4 \text{ cals}^{-1},\ \frac{dQ_1}{dt} = \ ?$$

$$\frac{dQ_2/dt}{dQ_1/dt} = \frac{K_2 A_2 dT/dx_2}{K_1 A_1 dT/dx_1} = \frac{K_2}{K_1}\frac{A_2}{A_1}\frac{dx_1}{dx_2}$$

$= 2 \times 4 \times \frac{1}{2} = 4$

$$\frac{dQ_1}{dt} = \frac{dQ_2/dt}{4} = \frac{4}{4} = 1 \text{ cals}^{-1}$$

20 **(b)**

At lower pressure we can assume that given gas behaves as ideal gas so $\frac{PV}{RT} =$ constant but when pressure increases, the decrease in volume will not take place in same proportion so $\frac{PV}{RT}$ will increase

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