DPP
DAILY PRACTICE PROBLEMS

CLASS: XIth | **SUBJECT : PHYSICS**
Date : | **DPP No. : 8**

Topic :- KINETIC THEORY

1 **(c)**

$V \propto T \Rightarrow \frac{V_1}{V_2} = \frac{T_1}{T_2} \Rightarrow \frac{V}{2V} = \frac{(273+27)}{T_2} = \frac{300}{T_2}$

$\Rightarrow T_2 = 600K = 327°C$

2 **(a)**

$C_P - C_V = R = 2.\frac{cal}{g-mol-K}$

Which is correct for option (a) and (b). Further the ratio $\frac{C_P}{C_V}(=\gamma)$ should be equal to some standard value corresponding to that of either, mono, di, or triatomic gases. From this point of view option (a) is correct because $\left(\frac{C_P}{C_V}\right)_{mono} = \frac{5}{3}$

3 **(a)**

$v_{rms} = \sqrt{\frac{3RT}{M}} \Rightarrow T \propto M$ [$\because v_{rms}, R \rightarrow$ constant]

$\frac{T_{H_2}}{T_{O_2}} = \frac{M_{H_2}}{M_{O_2}} = \frac{T_{H_2}}{(273+47)} = \frac{2}{32} \Rightarrow T_{H_2} = 20K$

4 **(c)**

Molecules of ideal gas behaves like perfectly elastic rigid sphere

5 **(d)**

$PV = mrT \Rightarrow P \propto m$ [$\because V, r, T \rightarrow$ constant]

$\Rightarrow \frac{m_1}{m_2} = \frac{P_1}{P_2} \Rightarrow \frac{10}{m_2} = \frac{10^7}{2.5 \times 10^6} \Rightarrow m_2 = 2.5\ kg.$

Hence mass of the gas taken out of the cylinder

$= 10 - 2.5 = 7.5kg$

7 **(b)**

$(\Delta Q)_P = \mu C_P \Delta T$ and $(\Delta Q)_V = \mu C_V \Delta T$

$\Rightarrow \frac{(\Delta Q)_V}{(\Delta Q)_P} = \frac{C_V}{C_P} = \frac{\frac{3}{2}R}{\frac{5}{2}R} = 3/5$

$\left[\because (C_V)_{mono} = \frac{3}{2}R, (C_P)_{mono} = \frac{5}{2}R\right]$

$\Rightarrow (\Delta Q)_V = \frac{3}{5} \times (\Delta Q)_P = \frac{3}{5} \times 210 = 126\, J$

8 **(d)**

Root mean square velocity of gas molecules

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

or $$v_{\text{rms}} \propto \frac{1}{\sqrt{M}}$$

or $$\frac{v_{O3}}{v_{O2}} = \sqrt{\frac{M_{O2}}{M_{O3}}}$$

Here, $M_{O2} = 32$, $M_{O3} = 48$

$\therefore$ $$\frac{v_{O3}}{v_{O2}} = \sqrt{\frac{32}{48}} = \frac{\sqrt{2}}{\sqrt{3}}$$

9 **(d)**

$v_{rms} = \sqrt{\frac{3RT}{M}} \Rightarrow v_{rms} \propto \frac{1}{\sqrt{M}}$

10 **(c)**

For mono atomic gas, C_V is constant $\left(\frac{3}{2}R\right)$. It doesn't vary with temperature

11 **(a)**

$PV = \mu RT = \frac{m}{M}RT$

$\Rightarrow \frac{PV}{T} \propto \frac{1}{M}$ $[\because M =$ molecule mass$]$

From graph $\left(\frac{PV}{T}\right)_A < \left(\frac{PV}{T}\right)_B < \left(\frac{PV}{T}\right)_C$

$\Rightarrow M_A > M_B > M_C$

12 **(d)**

$\frac{\Delta Q}{\Delta t} = KA\left(\frac{\Delta T}{\Delta x}\right) = K\pi r^2\left(\frac{\Delta T}{l}\right) \propto \frac{r^2}{l}$

As $\frac{r^2}{l}$ is maximum for (d), it is the correct choice.

13 **(a)**

Internal energy of the gas remains constant, hence

$$T_2 = T$$

Using $$p_1V_1 = p_2V_2$$

$$p.\frac{V}{2} = p_2V_2$$

$$p_2 = \frac{p}{2}$$

14 **(d)**

The square root of $\overline{v}^2$ is called the root mean square velocity (rms) speed of the molecules.

$$v_{\text{rms}} = \sqrt{\overline{v}^2} = \sqrt{\frac{v_1^2 + v_2^2 + v_3^3 + v_4^4}{4}}$$
$$= \sqrt{\frac{(1)^2 + (2)^2 + (3)^2 + (4)^2}{4}}$$
$$= \sqrt{\frac{1+4+9+16}{4}} = \sqrt{\frac{30}{4}} = \sqrt{\frac{15}{2}}\,\text{kms}^{-1}$$

15 **(b)**

Using Newton's law of cooling,

$$\log\frac{\theta_2 - \theta_0}{\theta_1 - \theta_0} = -Kt$$

$$\text{Log}\frac{40 - \theta_0}{50 - \theta_0} = -K \times 5 \quad .....(i)$$

$$\text{Log}\frac{33.33 - \theta_0}{40 - \theta_0} = -K \times 5 \quad .....(ii)$$

From Eqs.(i) and (ii),

$$\frac{40 - \theta_0}{50 - \theta_0} = \frac{33.33 - \theta_0}{40 - \theta_0}$$

On solving, we get

$\theta_0 = 19.95°\text{C} \approx 20°\text{C}$

17 **(c)**

1. The dotted line in the diagram shows that there is no derivation in the value of $\frac{pV}{nT}$ for different temperature T_1 and T_2 for increasing pressure so, this gas behaves ideally. Hence, dotted line corresponds to 'ideal' gas behavior.

2. At high temperature, the derivation of the gas is less and at low temperature the derivation of gas is more. In the graph, derivation for T_2 is greater than for T_1. Thus,

$$T_1 > T_2$$

3. Since, the two curves intersect at dotted line so, the value of $\frac{pV}{nT}$ at that point on the y-axis is same for all gases.

18 **(d)**

Since $v_{rms} \propto \sqrt{T}$. Also mean square velocity $\overline{v^2} = v_{rms}^2$

19 **(b)**

$$v_{rms} \propto \frac{1}{\sqrt{M}} \Rightarrow V_H > V_N > V_O \;\; [\because M_H < M_N < M_O]$$

20 **(b)**

$P_f = 2p + \overline{p}$

Saturated vapour pressure will not change if temperature remains constant.

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	C	A	A	C	D	B	B	D	D	C

Q.	11	12	13	14	15	16	17	18	19	20
A.	A	D	A	D	B	A	C	D	B	B