DPP
DAILY PRACTICE PROBLEMS

CLASS : XIth
Date :

Solutions

SUBJECT : PHYSICS
DPP No. : 4

Topic :- KINETIC THEORY

1 **(a)**

A monoatomic gas molecule has only three translational degrees of freedom

2 **(b)**

$$\gamma_{\text{mix}} = \frac{\frac{\mu_1\gamma_1}{\gamma_1 - 1} + \frac{\mu_2\gamma_2}{\gamma_2 - 1}}{\frac{\mu_1}{\gamma_1 - 1} + \frac{\mu_2}{\gamma_2 - 1}} = \frac{\frac{3 \times 1.3}{(1.3-1)} + \frac{2 \times 1.4}{(1.4-1)}}{\frac{3}{(1.3-1)} + \frac{2}{(1.4-1)}} = 1.33$$

3 **(b)**

At critical temperature the horizontal portion in P - V curve almost vanishes as at temperature T_2. Hence the correct answer will be (b)

4 **(a)**

$$v_{rms} \propto \frac{1}{\sqrt{M}} \Rightarrow \frac{(v_{rms})_{H_2}}{(v_{rms})_{He}} = \sqrt{\frac{M_{He}}{M_{H_2}}} = \sqrt{\frac{4}{2}} = \frac{\sqrt{2}}{1}$$

5 **(a)**

When electric spark is passed, hydrogen reads with oxygen to form water (H_2O). Each gram of hydrogen reacts with eight grams of oxygen. Thus 96 gm of oxygen will be totally consumed together with 12 gm of hydrogen. The gas left in the vessel will be 2 gm of hydrogen $i.e.$

Number of moles $\mu = \frac{2}{2} = 1$

Using $PV = \mu RT \Rightarrow P \propto \mu \Rightarrow \frac{P_2}{P_1} = \frac{\mu_2}{\mu_1}$

($\mu_1 =$ Initial number of moles $= 7 + 3 = 10$ and $\mu_2 =$ Final number of moles $= 1$)

$$\Rightarrow \frac{P_2}{1} = \frac{1}{10} \Rightarrow P_2 = 0.1\ atm$$

6 **(a)**

$$v_{rms} = \sqrt{\frac{3RT}{M}} \Rightarrow \frac{v_2}{v_1} = \sqrt{\frac{T_2}{T_1}} = \sqrt{\frac{(273+90)}{(273+27)}} = 1.1$$

% increase $= \left(\frac{v_2}{v_1} - 1\right) \times 100 = 0.1 \times 100 = 10\%$

7 **(c)**

Ideal gas equation is given by

$$pV = nRT \quad \text{...(i)}$$

For oxygen, $p = 1$ atm, $V = 1$ L, $n = n_{O2}$

Therefore, Eq. (i) becomes

$\therefore \quad 1 \times 1 = n_{O2}RT$

$\Rightarrow \quad n_{O2} = \frac{1}{RT}$

For nitrogen $p = 0.5$ atm, $V = 2$ L, $n = n_N$

$\therefore \quad 0.5 \times 2 = n_{N2}RT$

$\Rightarrow \quad n_{N2} = \frac{1}{RT}$

For mixture of gas

$$p_{\text{mix}}V_{\text{mix}} = n_{\text{mix}}RT$$

Here, $n_{\text{mix}} = n_{O2} + n_{N2}$

$\therefore \quad \frac{p_{\text{mix}}V_{\text{mix}}}{RT} = \frac{1}{RT} + \frac{1}{RT}$

$\Rightarrow \quad p_{\text{mix}}V_{\text{mix}} = 2 \quad (V_{\text{mix}} = 1)$

8 **(d)**

Let T_0 be the initial temperature of the black body

$\therefore \lambda_0 T_0 = b$ (Wien's law)

Power radiated, $P_0 = CT_0^4$, where, C is constant.

If T is new temperature of black body, then

$\frac{3\lambda_0}{4}T = b = \lambda_0 T_0$ or $T = \frac{4}{3}T_0$

Power radiated, $P = CT^4 = CT_0^4\left(\frac{4}{3}\right)^4$

$P = P_0 \times \frac{256}{81}$ or $\frac{P}{P_0} = \frac{256}{81}$

9 **(c)**

$PV = \frac{m}{M}RT \Rightarrow V \propto mT \Rightarrow \frac{V_1}{V_2} = \frac{m_1}{m_2} \cdot \frac{T_1}{T_2}$

$= \frac{2V}{V} = \frac{m}{m_2} \times \frac{100}{200} \Rightarrow m_2 = \frac{m}{4}$

10 **(c)**

At constant temperature $PV =$ constant $\Rightarrow P \propto \frac{1}{V}$

11 **(a)**

$v_{rms} \propto \frac{1}{\sqrt{M}} \Rightarrow (v_{rms})_1 < (v_{rms})_2 < (v_{rms})_3$ also in mixture temperature of each gas will be same, hence kinetic energy also remains same

12 **(b)**

$$\frac{E_1}{E_2} = \frac{T_1}{T_2} = \frac{300}{450} = \frac{2}{3}$$

13 **(a)**

$$PV = \mu RT = \frac{m}{M} RT \Rightarrow P = \frac{d}{M} RT \left[\text{Density } d = \frac{m}{V}\right]$$

$$\Rightarrow \frac{P}{dT} = \text{constant or } \frac{P_1}{d_1 T_1} = \frac{P_2}{d_2 T_2}$$

14 **(d)**

$$P \propto T \Rightarrow \frac{P_2}{P_1} = \frac{T_2}{T_1} = \frac{(273+100)}{(273+0)} = \frac{373}{273}$$

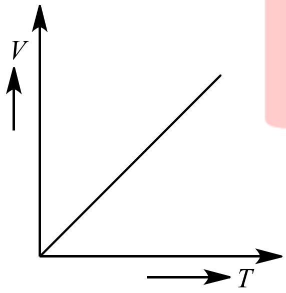
$$\Rightarrow P_2 = \frac{760 \times 373}{273} = 1038 mm$$

15 **(c)**

Since temperature is constant, so v_{rms} remains same

16 **(c)**

At constant pressure, the volume of a given mass of a gas is directly proportional to its absolute temperature (T).



ie., $\frac{V}{T}$=constant

This is another form of Charles' law. Hence, variation of volume with temperature is as shown.

Hence, correct graph will be (C).

17 **(d)**

Argon is a monoatomic gas so it has only translational energy

19 **(c)**

According to the Dalton's law of partial pressure, the total pressure will be $P_1 + P_2 + P_3$

20 **(d)**

Kinetic energy $\propto$ Temperature

$$\Rightarrow \frac{E_1}{E_2} = \frac{T_1}{T_2} \Rightarrow \frac{E_1}{E_2} = \frac{(273+27)}{(273+927)} = \frac{300}{1200} = \frac{1}{4}$$

$$\Rightarrow E_2 = 4E_1$$

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