PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 29

Total Marks : 36

Max. Time : 40 min.

Topic : Gaseous State

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.3,7	(3 marks, 3 min.)	[12, 12]
Multiple choice objective ('–1' negative marking) Q.1,4	(4 marks, 4 min.)	[8, 8]
Subjective Questions ('–1' negative marking) Q.4,5,6,8	(4 marks, 5 min.)	[16, 20]

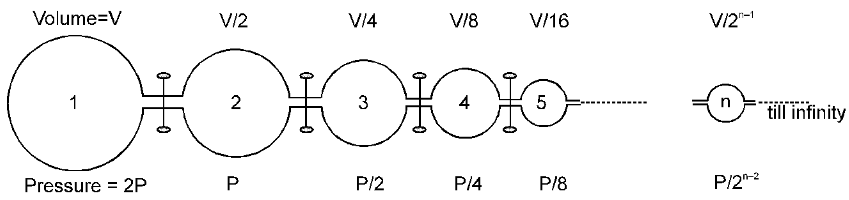
1. Equal masses of Sulphur dioxide and Oxygen gases are mixed in an empty container at 25°C. The fraction of the total pressure exerted by sulphur dioxide is :

(A) 1/3 (B) 1/2 (C) 2/3 (D) $\frac{1}{3} \times \frac{273}{298}$

2. A mixture of helium and methane gases at 1.4 bar pressure contains 20% by mole of helium. Partial pressure of helium will be :

(A) 0.7 bar (B) 0.28 bar (C) 0.56 bar (D) 0.8 bar

3.



Infinite number of flasks are connected to one another as shown above. The volumes and pressures in each flask vary as shown. The stopcocks are initially closed. The common pressure, when all the stopcocks are opened, is : (Assume constant temperature)

(A) P (B) $\frac{1}{2}$P (C) $\frac{P}{4}$ (D) $\frac{4}{3}$P

4. The density of a mixture of O_2 and N_2 gases at NTP is 1.3 g litre^{-1}. Calculate partial pressure of O_2.

5. Two gases A and B having molecular weights 60 and 40 respectively are enclosed in a vessel. The weight of A is 0.6 g and that of B is 0.2 g . The total pressure of the mixture is 750 mm. Calculate the partial pressure of the two gases.

6. A spherical balloon of mass 100 Kg and diameter 21 m is filled with He gas at 168° C and 5 atm pressure.If the density of air is $\frac{14}{11}$ g/L, find the value of payload of the balloon (in Kg). Take R = $\frac{1}{12}$ L atm K^{-1} mol^{-1}

7. A mixture of He and SO_2 at one bar pressure contains 20% by weight of He. Partial pressure of He will be:

(A) 0.2 bar (B) 0.4 bar (C) 0.6 bar (D) 0.8 bar

8. A 11 litre flask contains 20g of Neon and an unknown weight of Hydrogen. The gas density is found to be 2g/litre at 0^{0}C. Determine the average molecular weight of the gas mixture.

Answer Key

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1.	(A)	**2.**	(B)	**3.**	(D)	**4.**	0.28 atm
5.	p_A = 500 mm, p_B = 250 mm.	**6.**	3434Kg	**7.**	(D)	**8.**	11 amu.

Hints & Solutions

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1. Let the mass of SO_2 and oxygen be m g. Mole fraction of SO_2, X_{SO_2}

$$= \frac{\frac{m}{64}}{\frac{m}{64}+\frac{m}{32}} = \frac{m}{32}\times\frac{32}{3m} = \frac{1}{3}$$

Let the total pressure be P.

∴ Partial pressure of SO_2, $P_{SO_2} = P \times X_{SO_2}$ $P \times \frac{1}{3} = \frac{1}{3}$ P.

3. $n_T = n_1 + n_2 + n_3 + \ldots\ldots\ldots\ldots\ldots\ldots$

$$\frac{P_T.V_T}{RT} = \frac{P_1V_1}{RT} + \frac{P_2V_2}{RT} + \ldots\ldots\ldots\ldots\ldots\ldots = \Sigma P_iV_i$$

$$P_TV_T = \Sigma P_iV_i$$

$$= 2PV + \frac{P.V}{2} + \frac{P}{2}.\frac{P}{4} + \frac{P}{4}.\frac{V}{8} + \ldots\ldots\ldots\ldots\ldots\ldots$$

$$= 2PV\,[\,1 + \frac{1}{4} + \frac{1}{16} + \frac{1}{64} + \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$

$$P_T V_T = 2PV \frac{1}{1-\frac{1}{4}} = 2PV.\frac{4}{3}$$

$$V_T = V_1 + V_2 + V_3 + \ldots\ldots\ldots\ldots\ldots$$

$$= V + \frac{V}{2} + \frac{V}{4} + \frac{V}{8} \ldots\ldots\ldots$$

$$= V\left[1+\frac{1}{2}+\ldots\ldots\ldots\ldots\right] = V\frac{1}{1-\frac{1}{2}} = 2V$$

$$\therefore \quad P_T . 2V = 2PV.\frac{4}{3}$$

$$P_T = \frac{4}{3}P$$

4. 0.28 atm

5. Mole of A = $\frac{0.60}{60}$ = 0.01 ; Mole of B = $\frac{0.20}{40}$ = 0.005 ; Total mole = 0.015

Total pressure = 750 mm ; Partial pressure of A = $\frac{\text{mole of A}}{\text{total moles}}$ x total pressure

= $\frac{0.01}{0.015}$ x 750 = 500 mm ; Partial pressure of B = $\frac{0.005}{0.015}$ x 750 = 250 mm

6. $M_{balloon} + M_{gas} + M_{payload} = M_{air\ displaced}$

$$100 + \frac{\frac{4}{3}\times\frac{22}{7}\times\left(\frac{21}{2}\right)^3\times 1000\times 5}{\frac{1}{12}\times 441}\times\frac{4}{1000} + M_{payload} = \frac{4}{3}\times\frac{22}{7}\times\left(\frac{21}{2}\right)^3\times\frac{14}{11}$$

on solving , $M_{payload}$ = 3434 kg

7. (D) Weight of H_2 = 20 g in 100 g mixture ; Weight of O_2 = 80 g

$\therefore$ Moles of $H_2 = \frac{20}{2} = 10$; $\therefore$ Moles of $O_2 = \frac{80}{32} = \frac{5}{2}$

$\therefore$ Total moles = $10 + \frac{5}{2} = \frac{25}{2}$

$\therefore$ $P'_{H_2} = P_T$ x mole fraction of H_2 = 1 x $\frac{10}{25/2}$ = 0.8 bar

8. $\frac{20+w_{H_2}}{11} = 2 \quad \Rightarrow \quad w_{H_2} = 2$ g.

$$M_{avg} = \frac{20+2}{\frac{20}{20}+\frac{2}{2}} = 11.$$