Additional Problems For Self Practice (APSP)

PART - I : PRACTICE TEST PAPER

This Section is not meant for classroom discussion. It is being given to promote self-study and self testing amongst the Resonance students.

Max. Marks : 120 **Max. Time : 1 Hr.**

Important Instructions

1. The test is of **1 hour** duration.
2. The Test Booklet consists of **30** questions. The maximum marks are **120.**
3. Each question is allotted **4 (four)** marks for correct response.
4. Candidates will be awarded marks as stated above in Instructions No. 3 for correct response of each question.
   ¼ (one fourth) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.
5. There is only one correct response for each question. Filling up more than one response in any question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instructions 4 above.

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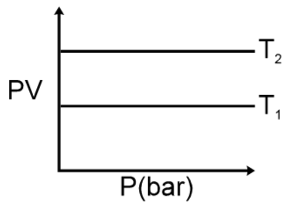
1. 2.5 L of a sample of a gas at 27°C and 1 bar pressure is compressed to a volume of 500 mL keeping the temperature constant, the percentage increase in pressure is
(1) 100 % (2) 400 % (3) 500% (4) 80%

2. For two gases, A and B with molecular weights M_A and M_B, it is observed that at a certain temperature, T, the mean velocity of A is equal to the root mean square velocity of B. Thus the mean velocity of A can be made equal to the mean velocity of B, if
(1) A is at temperature, T_1 and B at T_2, $T_1 > T_2$
(2) A is lowered to a temperature $T_2 < T$ while B is at T
(3) Both A and B are raised to a higher temperature
(4) Both A and B are lowered in temperature.

3. At what temperature, the average speed of gas molecules be double of that at temperature, 27ºC?
(1) 120ºC (2) 108ºC (3) 927ºC (4) 300ºC

4. Two glass bulbs A and B at same temperature are connected by a very small tube having a stop-corck. Bulb A has a volume of 100 cm^3 and contained the gas while bulb B was empty. On opening the stop-corck, the pressure fell down to 20%. The volume of the bulb B is :
(1) 100 cm^3 (2) 200 cm^3 (3) 250 cm^3 (4) 400 cm^3

5. The product of PV is plotted against P at two temperatures T_1 and T_2 and the 'result is shown in figure. What is correct about T_1 and T_2?



(1) $T_1 > T_2$ (2) $T_2 > T_1$ (3) $T_1 = T_2$ (4) $T_1 + T_2 = 1$

6. Match of following (where U_{rms} = root mean square speed, U_{av} = average speed, U_{mp} = most probable speed)

	List I		**List II**
(a)	U_{rms} / U_{av}	(i)	1.22
(b)	U_{av} / U_{mp}	(ii)	1.13
(c)	U_{rms} / U_{mp}	(iii)	1.08

(1) (a)-(iii), (b)-(ii), (c)-(i) (2) (a)-(i), (b)-(ii), (c)-(iii)
(3) (a)-(iii), (b)-(i), (c)-(ii) (4) (a)-(ii), (b)-(iii), (c)-(i).

7. $N_2 + 3H_2 \longrightarrow 2NH_3$. 1 mol N_2 and 4 mol H_2 are taken in 15 L flask at 27°C. After complete conversion of N_2 into NH_3, 5 L of H_2O is added. Pressure set up in the flask is :

(1) $\frac{3 \times 0.0821 \times 300}{15}$ atm (2) $\frac{2 \times 0.0821 \times 300}{10}$ atm
(3) $\frac{1 \times 0.0821 \times 300}{15}$ atm (4) $\frac{1 \times 0.0821 \times 300}{10}$ atm

8. Which of the following is not the correct set of pressure and volume at constant temperature and constant moles of gas ?

	P	V		P	V
(1)	1 atm	200 ml	(2)	760 mm	0.2 L
(3)	0.5 atm	100 L	(4)	2 atm	100 mL

9. 2 litres of moist hydrogen were collected over water at 26^0C at a total pressure of one atmosphere. On analysis, it was found that the quantity of H_2 collected was 0.0788 mole. What is the mole fraction of H_2 in the moist gas

(1) 0.989 (2) 0.897 (3) 0.953 (4) 0.967

10. When CO_2 under high pressure is released from a fire extinguisher, particles of solid CO_2 are formed, despite the low sublimation temperature (– 77ºC) of CO_2 at 1.0 atm. It is

(1) the gas does work pushing back the atmosphere using KE of molecules and thus lowering the temperature
(2) volume of the gas is decreased rapidly hence, temperature is lowered
(3) both (1) and (2)
(4) None of the above

11. At what temperature will the total KE of 0.3 mol of He be the same as the total KE of 0.40 mol of Ar at 400 K ?

(1) 533 K (2) 400 K (3) 346 K (4) 300 K

12. Potassium hydroxide solutions are used to absorb CO_2. How many litres of CO_2 at 1.00 atm and 22ºC would be absorbed by an aqueous solution containing 15.0 g of KOH ? (Take R = $\frac{1}{12}$ ℓ atm / K/mole)

$$2KOH + CO_2 \longrightarrow K_2CO_3 + H_2O$$

(1) 3.24 L (2) 1.62 L (3) 6.48 L (4) 0.324 L

13. The volume of a gas increases by a factor of 2 while the pressure decreases by a factor of 3. Given that the number of moles is unaffected, the factor by which the temperature changes is :

(1) $\frac{3}{2}$ (2) 3 × 2 (3) $\frac{2}{3}$ (4) $\frac{1}{2} \times 3$

14. If V_0 is the volume of a given mass of gas at 273 K at constant pressure , then according to Charle's law, the volume at 10ºC will be :

(1) $10\ V_0$ (2) $\frac{2}{273}(V_0 + 10)$ (3) $V_0 + \frac{10}{273}$ (4) $\frac{283}{273}V_0$

15. When a gas is compressed at constant temperature :

(1) the speeds of the molecules increase (2) the collisions between the molecules increase
(3) the speeds of the molecules decrease (4) the collisions between the molecules decrease

16. A cylinder is filled with a gaseous mixture containing equal masses of CO and N_2. The partial pressure ratio is :

(1) $P_{N_2} = P_{CO}$ (2) $P_{CO} = 0.875\ P_{N_2}$ (3) $P_{CO} = 2\ P_{N_2}$ (4) $P_{CO} = \frac{1}{2}P_{N_2}$

17. Helium atom is two times heavier than a hydrogen molecule at 298 k, the average kinetic energy of helium is :

(1) two times that of hydrogen molecule (2) same as that of the hydrogen molecule
(3) four times that of a hydrogen molecule (4) half that of a hydrogen molecule

18. Two flasks A and B have equal volumes. A is maintained at 300 K and B at 600 K, while A contains H_2 gas, B has an equal mass of CO_2 gas. Find the ratio of total K.E. of gases in flask A to that of B.

(1) 1 : 2 (2) 11 : 1 (3) 33 : 2 (4) 55 : 7

19. A quantity of gas is collected in a graduated tube over the mercury. The volume of gas at 18 ºC is 50 ml and the level of mercury in the tube is 100 mm above the outside mercury level. The barometer reads 750 torr. Hence, volume at S.T.P. is approximately :

(1) 22 ml (2) 40 ml (3) 20 ml (4) 44 ml

20. If equal weights of oxygen and nitrogen are placed in separate containers of equal volume at the same temperature, which one of the following statements is true?
(mol wt: N_2 = 28, O_2 = 32)

(1) Both flasks contain the same number of molecules.
(2) The pressure in the nitrogen flask is greater than the one in the oxygen flask.
(3) More molecules are present in the oxygen flask.
(4) Molecules in the oxygen flask are moving faster on the average than the ones in the nitrogen flask.

21. Which of the following is NOT a postulate of the kinetic molecular theory of gases?

(1) The molecules possess a volume that is negligibly small compared to the of the container
(2) The pressure and volume of a gas are inversely related
(3) Gases consist of discrete particles that are in random motion
(4) The average kinetic energy of the molecules is directly proportional to the temperature

22. What is the total pressure exerted by the mixture of 7.0 g of N_2 , 2g of hydrogen and 8.0 g of sulphur dioxide gases in a vessel of 6 L capacity that has been kept in a reservoir at 27°C?

(1) 2.5 bar (2) 4.5 bar (3) 10 atm (4) 5.7 bar

23. At what temperature root mean square speed of N_2 gas is equal to that of propane gas at S.T.P. conditions.

(1) 173.7°C (2) 173.7 K (3) S.T.P. (4) – 40°C

24. 10 L of O_2 gas is reacted with 30 L of CO(g) at STP. The volume of each gas present at the end of the reaction are :

(1) O_2 = 10 L, CO_2 = 20 L (2) CO = 10 L, CO_2 = 20 L
(3) CO = 20 L, CO_2 = 10 L (4) CO = 15 L, CO_2 = 15 L

25. 1 mol of a gaseous aliphahatic compound $C_nH_{3n}O_m$ is completely burnt in an excess of oxygen. The contraction in volume is (assume water get condensed out)

(1) $\left(1+\frac{1}{2}n-\frac{3}{4}m\right)$ (2) $\left(1+\frac{3}{4}n-\frac{1}{4}m\right)$ (3) $\left(1-\frac{1}{2}n-\frac{3}{4}m\right)$ (4) $\left(1+\frac{3}{4}n-\frac{1}{2}m\right)$

26. One mole of a gas is defined as -

(1) The number of molecules in one litre of gas

(2) The number of molecules in one formula weight of gas

(3) The number of molecules contained in 12 grams of (12 C) isotope

(4) The number of molecules in 22.4 litres of a gas at S.T.P.

27. If two moles of an ideal gas at 546 K occupies a volume of 44.8 litres, the pressure must be -

(1) 2 atm (2) 3 atm (3) 4 atm (4) 1 atm

28. At STP the order of mean square velocity of molecules of H_2, N_2, O_2 and HBr is -

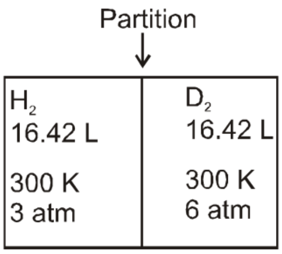
(1) $H_2 > N_2 > O_2 > HBr$ (2) $HBr > O_2 > N_2 > H_2$

(3) $HBr > H_2 > O_2 > N_2$ (4) $N_2 > O_2 > H_2 > HBr$

29. If all the oxygen atoms present in 4 mole H_2SO_4 2 mole P_4O_{10} & 2 mole NO_2 are collected for the formation of O_2 gas molecules then calculate volume of O_2 gas formed at 2 atm pressure & 273 K temperature.

(1) 224 L (2) 448 L (3) 336 L (4) 112 L

30.



If the partition is removed the average molar mass of the sample will be (Assume ideal behaviour).

(1) $\frac{5}{3}$ g/mol (2) $\frac{10}{3}$ g/mol (3) $\frac{3}{2}$ g/mol (4) 3 g/mol

Practice Test (JEE-Main Pattern)

OBJECTIVE RESPONSE SHEET (ORS)

Que.	1	2	3	4	5	6	7	8	9	10
Ans.										
Que.	11	12	13	14	15	16	17	18	19	20
Ans.										
Que.	21	22	23	24	25	26	27	28	29	30
Ans.										

PART - II : PRACTICE QUESTIONS

1. The density of gas A is twice that of B at the same temperature the molecular weight of gas B is twice that of A.The ratio of pressure of gas A and B will be :
(1) 1 : 6 (2) 1 : 1 (3) 4 : 1 (4) 1 : 4

2. An open flask containing air is heated from 300 K to 500 K. What percentage of air will be escaped to the atmosphere, if pressure is keeping constant?
(1) 80 (2) 40 (3) 60 (4) 20

3. When an ideal gas undergoes unrestrained expansion no cooling occurs because the molecule –
(1) are above inversion temperature (2) exert no attractive fore on the other
(3) do work equal to the loss in K.E. (4) collide without loss of energy

4. The volume of a gas measured at 27°C and 1 atm pressure is 10 L. To reduce the volume to 5 L at 1atm pressure the temperature required is :
(1) 75 K (2) 150 K (3) 225 K (4) 300 K

5.✍ A gaseous mixture of three gases A, B and C has a pressure of 10 atm. The total number of moles of all the gases is 10. If the partial pressure of A and B are 3.0 and 1.0 atm respectively and if C has mol. wt. of 2.0, what is the weight of C in g present in the mixture ?
(1) 6 (2) 8 (3) 12 (4) 3

6. Two vessels connected by a valve of negligible volume. One container (I) has 2.8 of N_2 at temperature T_1(K). The other container (II) is completely evacuated. The container (I) is heated to T_2 (K) while container (II) is maintained at $T_2/3$ (K). Volume of vessel (I) is half that of vessel (II). If the valve is opened then what is the weight ratio of N_2 in both vessel (W_I/W_{II}) ?
(1) 1 : 2 (2) 1 : 3 (3) 1 : 6 (4) 3 : 1

7. Two glass bulbs A and B are connected by a very small tube having a stop cock. Bulb A has a volume of 100 cm^3 and contained the gas, while bulb B was empty. On opening the stop cock, the pressure fell down to 40%. The volume of the bulb B must be :
(1) 75 cm^3 (2) 125 cm^3 (3) 150 cm^3 (4) 250 cm^3

8. There are 6.02×10^{22} molecules each of N_2, O_2 and H_2 which are mixed together at 760 *mm* and 273 *K*. The mass of the mixture in grams is
(1) 6.2 (2) 4.12 (3) 3.09 (4) 7

9. At 27ºC, the ratio of *rms* velocities of ozone to oxygen is
(1) $\sqrt{3/5}$ (2) $\sqrt{4/3}$ (3) $\sqrt{2/3}$ (4) 0.25

10. Calculate the compressibility factor for CO_2, if one mole of it occupies 0.4 litre at 300 K and 40 atm. Comment on the result.
(1) 0.40, CO_2 is more compressible than ideal gas (2) 0.65, CO_2 is more compressible than ideal gas
(3) 0.55, CO_2 is more compressible than ideal gas (4) 0.62, CO_2 is more compressible than ideal gas

11. The density of vapour of a substance (X) at 1 atm pressure and 500 K is 0.8 kg/m^3. The vapour effuses through a small hole at a rate of 4/5 times solver than oxygen under the same condition. What is the compressibility factor (Z) of the vapour ?
(1) 0.974 (2) 1.35 (3) 1.52 (4)1.22

12. For a real gas (mol. mass = 60) if density at critical point is 0.80 g/cm^3 and its $T_c = \frac{4 \times 10^5}{821} K$, then van der Waal's constant a (in atm L^2 mol^{-2}) is
(1) 0.3375 (2) 3.375 (3) 1.68 (4) 0.025

13. Which of the following relationship is false :

(1) Most probable velocity, $\propto = \sqrt{\frac{2RT}{M}}$ (2) PV = $\frac{1}{3}$ mnC^2_{rms}

(3) Compressibility factor Z = $\frac{PV}{nRT}$ (4) Average kinetic energy of a gas = $\frac{1}{2}$ kT

14. For every gas, there is a temperature called critical temperature

(1) above which it is not possible to liquefy a gas with the application of pressure.
(2) above which it is not possible to solidify a gas with the application of pressure.
(3) below which it is not possible to liquefy a gas with the application of pressure.
(4) below which it is not possible to solidify a gas with the application of pressure.

15. If the four tubes of a car are filled to the same pressure with N_2, O_2, H_2 and Ne separately, then which one will be filled first ?

(1) N_2 (2) O_2 (3) H_2 (4) Ne

16. At what temperature will the RMS of SO_2 be the same as that of O_2 at 303 K ?

(1) 273 K (2) 606 K (3) 303 K (4) 403 K

17. A 4.0 dm^3 flask containing N_2 at 4.0 bar was connected to a 6.0 dm^3 flask containing helium at 6.0 bar, and the gases were allowed to mix isothermally, then the total pressure of the resulting mixture will be :

(1) 10.0 bar (2) 5.2 bar (3) 1.6 bar (4) 5.0

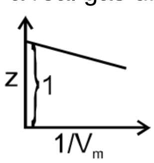
18. A 4 : 1 mixture of helium and methane is contained in a vessel at 10 bar pressure. Due to a hole in the vessel, the gas mixture leaks out. The composition of the mixture effusing out initially is :

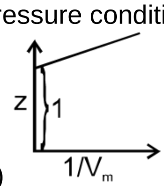
(1) 8 : 1 (2) 8 : 3 (3) 4 : 1 (4) 1 : 1

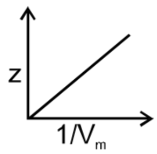
19. A vessel contains two gases A and B in the mass ratio 2 : 1 respectively. If the above gas mixture is allowed to diffuse through a hole, the molar composition of the mixture coming initially out of the hole is 1 : 4. Find the simplest whole number ratio of the moles of gases B and A present in the vessel in the beginning respectively.

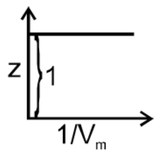
(1) 0.5 (2) 1.0 (3) 1.5 (4) 2.0 (5) 2.5

20. For a real gas under low pressure conditions, which of the following graph is correct ?

(1) 

(2) 

(3) 

(4) 

21. Use of hot air balloons in sports and meteorological obsevations is an application of

(1) Boyle's law (2) Newtonic law (3) Kelvin's law (4) Charle's law

22. Pure hydrogen sulphide is stored in a tank of 100 *litre* capacity at 20ºC and 2 *atm* pressure. The mass of the gas will be

(1) 34 *g* (2) 340 *g* (3) 282.4 *g* (4) 28.24 *g*

23. The density of a gas at 27ºC and 1 *atm* is *d*. Pressure remaining constant at which of the following temperatures will its density become 0.75 d

(1) 20ºC (2) 30ºC (3) 400 *K* (4) 300 *K*

24. If P, V, M, T and R are pressure, volume, molar mass, temperature and gas constant respectively, then for an ideal gas, the density is given by

(1) $\frac{RT}{PM}$ (2) $\frac{P}{RT}$ (3) $\frac{M}{V}$ (4) $\frac{PM}{RT}$

25. Which of the following has maximum root mean square velocity at the same temperature

(1) SO_2 (2) CO_2 (3) O_2 (4) H_2

APSP Answers

PART - I

1.	(2)	**2.**	(2)	**3.**	(3)	**4.**	(4)	**5.**	(2)
6.	(1)	**7.**	(4)	**8.**	(3)	**9.**	(4)	**10.**	(1)
11.	(1)	**12.**	(1)	**13.**	(3)	**14.**	(4)	**15.**	(2)
16.	(1)	**17.**	(2)	**18.**	(2)	**19.**	(2)	**20.**	(2)
21.	(2)	**22.**	(4)	**23.**	(2)	**24.**	(2)	**25.**	(4)
26.	(4)	**27.**	(1)	**28.**	(1)	**29.**	(1)	**30.**	(2)

PART - II

1.	(3)	**2.**	(2)	**3.**	(2)	**4.**	(2)	**5.**	(3)
6.	(3)	**7.**	(3)	**8.**	(1)	**9.**	(3)	**10.**	(2)
11.	(3)	**12.**	(2)	**13.**	(4)	**14.**	(1)	**15.**	(3)
16.	(2)	**17.**	(2)	**18.**	(1)	**19.**	(4)	**20.**	(1)
21.	(4)	**22.**	(3)	**23.**	(3)	**24.**	(4)	**25.**	(4)

APSP Solutions

PART - I

1. Using $p_1V_1 = P_2V_2$ $1 \times 2.5 = 0.5 \times P_2 = 5$ bar.

$\therefore$ % increase in pressure = $\dfrac{(5-1)\text{bar}}{1\text{bar}} \times 100\% = 400\ \%$.

2. Given $\sqrt{\dfrac{8RT}{\pi M_A}} = \sqrt{\dfrac{3RT}{M_B}}$ $\Rightarrow 8M_B = 3\pi\ M_A$

& $\sqrt{\dfrac{3RT_A}{M_A}} = \sqrt{\dfrac{3RT_B}{M_B}}$ $\Rightarrow \dfrac{T_A}{M_A} = \dfrac{T_B}{M_B}$ $\Rightarrow M_B\ .\ T_A = M_A\ .\ T_B$

$\Rightarrow \dfrac{3\pi}{8} M_A\ .\ T_A = M_A\ .\ T_B$ $\Rightarrow T_B > T_A$ Hence (2)

3. $\sqrt{\dfrac{8RT}{\pi M}} = 2\sqrt{\dfrac{8 \times R \times 300}{\pi\ \ M}}$ $\Rightarrow T = 1200\ K = 927^oC$

4. $100\ P = 0.2\ P \times 100 + 0.2\ P \times V$

$\dfrac{1000}{2} = 100 + V$; $V = 400$ ml

5. $PV \propto T$

6. $\mathbf{U_{MPS}} = \sqrt{\dfrac{2RT}{M}}$; $\mathbf{U_{RMS}} = \sqrt{\dfrac{3RT}{M}}$; $\mathbf{U_{av}} = \sqrt{\dfrac{8RT}{\pi M}}$

7.

	N_2	+	$3H_2$	$\longrightarrow$	$2NH_3$
t = 0	1 mole		4 mole		0
t = t_{final}	0		1 mole		2 mole

NH_3 will absorb by water and volume will be 15 – 5 = 10 L

P = $\frac{nRT}{V} = \frac{1 \times 0.0821 \times 300}{10}$ atm

8. (1) Total moles = $\frac{1 \times 0.2}{RT}$ (2) Total moles = $\frac{1 \times 0.2}{RT}$

(3) Total moles = $\frac{0.5 \times 100}{RT}$ (4) Total moles = $\frac{2 \times 0.1}{RT}$

9. $n_{Total} = \frac{PV}{RT} = \frac{1 \times 2}{0.0821 \times 299}$ = 0.081 moles

$X_{H_2} = \frac{n_{H_2}}{n_{total}} = \frac{0.0788}{\frac{0.0821}{2} \times 299}$ = 0.967

10. K.E. $\propto$ Temperature

11. $\left[\frac{3}{2}nRT\right]_{He} = \frac{3}{2}nRT$

0.3 T = 0.4 × 400

T = 533 K

12. V = $\frac{15}{56} \times \frac{1}{2} \times \frac{0.0821 \times 295}{1}$ = 3.24 L

13. PV = nRT

$\frac{P}{3} \times 2V = nRT$

$T' = \frac{2}{3}T$

14. $\frac{V_1}{T_1} = \frac{V_2}{T_2}$

$\frac{V_0}{273} = \frac{V_2}{283} \quad \Rightarrow \quad V_2 = \frac{283}{273}V_0$

15. Frequency of collision will increase.

16. $\frac{P_{N2}}{P_{CO}} = \frac{X_{N2}}{X_{CO}} = \frac{n_{N2}}{n_{co}} = \frac{x \times 28}{28 \times x} = 1$ $P_{N2} = P_{co}$

Where x_{n2}, x_{co} is mole fraction of N_2 & CO and x is wt. of N_2 & CO taken.

17. Average K.E. = $\frac{3}{2}$RT and T is constant 298 K

$\therefore$ K.E. is same for all gases at same Temperature.

18. $\frac{n_A T_A}{n_B T_B} = \frac{m}{2} \times \frac{44}{m} \times \frac{300}{600}$

19. Net pressure of gas = P_{gas}

P_{gas} ($P_{xʃl}$) = 650 mm.

$\frac{P_1V_1}{T_1} = \left(\frac{P_2V_2}{T_2}\right)_{STP}$

$\frac{650 \times 50}{291} = \frac{760 \times V_2}{273}$

$V_2 = 40.11$ ml

$P_1 = 9$ atm $\quad P_2 = 6$ atm

$V_1 = 5\ell \quad V_2 = 10\ \ell$

20. $n_{N_2} > n_{O_2}$ where 'n' is no of moles of gases.

$\Rightarrow \quad P_{N_2} > P_{O_2}$ because $P_{gas} \alpha$ n.

22. No. of moles of $N_2 = \frac{7}{28} = \frac{1}{4}$

No. of moles of H_2 = 1 Mole

Total moles = $\frac{1}{4} + 1 + \frac{1}{8}$

No. of moles of $SO_2 = \frac{1}{8}$ moles

$= \frac{1}{8}(2 + 8 + 1) = \frac{11}{8}$

$P = \frac{nRT}{V} = \frac{11}{8} \times \frac{0.0821 \times 300}{6} = 5.64 \approx 5.7$ atm.

23. Let Temp (T) where V_{rms} of N_2 = V_{rms} of C_3H_8 at STP

$= \sqrt{\frac{3RT_1}{M_{N2}}} = \sqrt{\frac{3RT_2}{M_{C_3H_8}}} = \sqrt{\frac{3 \times 8.314 \times 273}{44 \times 10^{-3}}} = \sqrt{\frac{3RT_1}{M_{N2}}} = 393.38$

$T_1 = 173.72$ K

24. $2CO \quad + \quad O_2 \longrightarrow 2CO_2$

30/22.4 $\quad$ 10/22.4

O_2 is limiting reagent

10/22.4 $\quad$ 0 $\quad$ 20/22.4

$\therefore$ at the end of reaction CO_2 = 20 L

CO = 10 L

25. $C_nH_{3n}O_m + yO_2 \longrightarrow nCo_2(g) + \frac{3n}{2} H_2O(\ell)$

Contraction in volume = Contraction in moles of gas = $1 + \frac{3n}{4} - \frac{m}{2}$

$\Rightarrow \quad \frac{3n}{4} - \frac{m}{2} \times \frac{1}{2} = y \qquad \Rightarrow \quad n + \frac{3n}{4} - \frac{m}{2} = y$

26. No. of molecules in 22.4 L at STP
is 6.02×10^{23} = 1 mole of gas.

27. $P = \frac{nRT}{V} = \frac{2 \times 0.0821 \times 546}{44.8} = 2$ atm

28. $V_{rms} \propto \frac{1}{\sqrt{M}}$ 'M' is Molecular wt.

order of M.wt. = $H_2 < N_2 < O_2 <$ HBr

$\therefore$ order of $V_{rms} = H_2 > N_2 > O_2 >$ HBr.

29. moles of O_2 in 4 mole (H_2SO_4) = 4 × 2

moles of O_2 in 2 mole (P_4O_{10}) = 10

moles of O_2 in 2 mole (NO_2) = 2

$\therefore$ total moles of O_2 = 20 mole

$\because$ volume of 20 mole at 1 atm = 22.4 × 20 L

$\therefore$ at 2 atm = $\frac{1}{2} \times 22.4 \times 20$ = 224 L

30. mole of H_2 = $\frac{3 \times 16.42}{0.0821 \times 300}$ = 2 ; mole of D_2 = $\frac{6 \times 16.42}{0.0821 \times 300}$ = 4

average molecular weight = $\frac{2 \times 2 + 4 \times 4}{4 + 2}$ = $\frac{10}{3}$

PART - II

1. $d_A = 2d_B$; $3M_A = M_B$; $PM = dRT$

$= \frac{P_A}{P_B} \times \frac{M_A}{M_B} = \frac{d_A}{d_B} \times \frac{RT}{RT}$

$= \frac{P_A}{P_B} \times \frac{1}{2} = 2$

$\frac{P_A}{P_B} = \frac{4}{1}$

2. $V_1 = V$, $T_1 = 300$ K, $T_2 = 500$ K, $V_2 = ?$

At constant pressure $V_1T_2 = V_2T_1$

$\therefore$ $V_2 = \frac{P_1T_2}{T_1} = \frac{V \times 500}{300} = \frac{5V}{3}$

$\therefore$ Volume of air escaped = final volume – initial volume

$= \frac{5V}{3} - V \frac{2V}{3}$

$\therefore$ % of air escaped = $\frac{2V/3}{5V/3} \times 100 = 40\%$

3. Attraction forces between ideal gas molecule are zero.

4. According to gas laws

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

$P_1 = 1$ atm, $V_1 = 10$ L, $T_1 = 27 + 273 = 300$ K

$P_2 = 1$ atm, $V_2 = 5$L, $T_2 = ?$

Putting the values we have

$\frac{1 \times 10}{300} = \frac{1 \times 5}{T_2}$

$T_2 = 30 \times 5 = 150$ K

5. Pressure of Total mixture = 10 atm

$P_A + P_B + P_C = 10$

$3 + 1 + P_C = 10$ $\Rightarrow$ $P_C = 6$ atm

Total moles of mixture = 10

$n_A + n_B + n_C = 10$

$\frac{P_A}{P_B} = \frac{n_A}{n_B} = \frac{3}{1}$ $\Rightarrow$ $\frac{P_B}{P_C} = \frac{n_B}{n_C} = \frac{1}{6}$

Let $n_A = K$ $\Rightarrow$ $n_B = \frac{K}{3}$ $n_C = \frac{1}{6}$ $n_B = 2K$

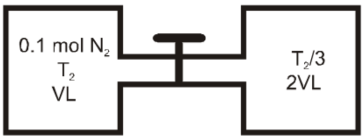
$\Rightarrow \quad K + \frac{K}{3} + 2K = 10 \quad \Rightarrow \quad \frac{K}{3} = \frac{n_C}{6} \quad \Rightarrow \quad n_C = 2K$

$\Rightarrow \quad K\left(\frac{10}{3}\right) = 10 \quad K = 3, \quad \Rightarrow \quad n_A = 3$

$n_B = 1$

$n_C = 6$ weight of 'C' in mixture = 2 × 6 = 12 .

6.



Let x moe of N_2 present into vessel II and P is final pressure of N_2

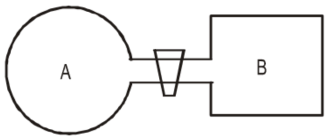
$P(2V) = xR(T_2/3)$ and $P(V) = (0.1 - x)RT_2$

$\Rightarrow \quad 2 = \frac{x}{3(0.1 - x)} \quad \Rightarrow \quad x = 0.6/7$ mole,

$\frac{0.6}{7} \times 2.8 \Rightarrow 2.4$ g N_2

II has 2.4 g N_2 and I has 0.4 g of N_2 ; $\frac{W_I}{W_{II}} = \frac{0.4}{2.4} \Rightarrow 1 : 6$

7.



$V_A = 100$ ml $\quad V_B = V$ ml

$P_A V_A = P_A' V'$ Where $V' = V_A + V_B = (V_A + V)$ ml

$P_A\, 100 = \frac{2}{5} P_A \times V' \qquad P_A = \frac{P_A \times 40}{100} = \frac{2}{5} P_A$

$250 = V' \quad \Rightarrow \quad V_A + V = 250$ ml

$V = 150$ ml

8. 6.02×10^{22} molecules of each N2, O2 and H2

$= \frac{6.02 \times 10^{22}}{6.02 \times 10^{23}}$ *moles* of each

Weight of mixture = weight of 0.1 *mole* N2 + weight of 0.1 *mole* H2 + weight of 0.1 mole of O2

$= (28 \times 0.1) + (2 \times 0.1) + (32 \times 0.1) = 6.2gm$

9. $\frac{U_{O_3}}{U_{O_2}} = \sqrt{\frac{M_{O_2}}{M_{O_3}}} = \sqrt{\frac{32}{48}} = \sqrt{\frac{2}{3}}$

10. $Z = \frac{(PV)_{real}}{(PV)_{ideal}}$

11. $\frac{r_x}{r_{O_2}} = \sqrt{\frac{M_{O_2}}{M_x}} = \left(\frac{4}{5}\right)^2 = \frac{32}{M_x} = 50$

$d_x = 0.80$ kg/m^3.

$V_m = \frac{1000}{800} \times 50 = 62.5$ L ; $\quad Z = \frac{PV_m}{RT} = \frac{1 \times 62.5}{0.0821 \times 500} = 1.52$

12. $V_c = \frac{60}{0.80}$ **= 75 cm³ mol⁻¹ ;** $b = \frac{V_c}{3}$ = 25 cm³ mol⁻¹ = 0.025 L mol⁻¹

$\therefore \quad T_c = \frac{8a}{27\ Rb}$; $\frac{4 \times 10^5}{821} = \frac{8 \times a}{27 \times 0.0821 \times 0.025}$ $\Rightarrow$ a = 3.375

13. Average kinetic energy of a gas/ molecule = $\frac{3}{2}$KT.

14. Critical temperature is a temperature above which it is not possible to liquefy a gas with the applicatoin of pressure.

15. Lower the density of the gas, faster it will be filled. As H_2 has lowest density, it will be filled first.

16. u = $\sqrt{\frac{3RT}{M}}$

When $u_{SO_2} = u_{O_2}$, then $\frac{T_{SO_2}}{M_{SO_2}} = \frac{T_{O_2}}{M_{O_2}}$ or $\frac{T_{SO_2}}{64} = \frac{303}{32}$ $\Rightarrow$ T_{SO_2} = 606 K.

17. At constant temperature,

$P_1 V_1 + P_2 V_2 = P_3 (V_1 + V_2)$

(4.0 bar) (4.0 dm³) + (6.0 bar) (6.0 dm³) = P_3 (4.0 + 6.0 dm³)

or $P_3 = \frac{16+36}{10} = \frac{52}{10}$ = 5.2 bar.

18. Pressure of helium = 8 bar

Pressure of CH_4 = 2 bar $\frac{r_{He}}{r_{CH_4}} = \frac{P_1}{P_2}\sqrt{\frac{M_{CH_4}}{M_{He}}} = \frac{8}{2}\sqrt{\frac{16}{4}} = \frac{8}{1}$ = 8 : 1

19. $\frac{r_A}{r_B} = \frac{n_A}{n_B} \times \sqrt{\frac{M_B}{M_A}}$

$\therefore \frac{(\text{Moles of A coming out initially})/\Delta t}{(\text{Moles of B coming out initially})/\Delta t} = \left(\frac{\frac{2x}{M_A}}{\frac{1x}{M_B}}\right) \times \sqrt{\frac{M_B}{M_A}}$ $\therefore$ Ratio of moles $= \frac{n_B}{n_A} = \frac{1}{2} \times \frac{4}{1} = 2$

20. At low pressure vander waal's equation for a real gas is given as

$Z = 1 - \frac{a}{RTV}$

intercept = 1 ; slop = –ve

22. $n = \frac{PV}{RT} = \frac{m}{M}$; $m = \frac{MPV}{RT} = \frac{34 \times 2 \times 100}{0.082 \times 293} = 282.4 gm$

23. At constant pressure

$V \propto nT \propto \frac{m}{M}T$; $\frac{V_1}{V_2} = \frac{m_1 T_1}{m_2 T_2} \therefore \frac{T_1}{T_2} = \frac{V_1}{m_1} \times \frac{m_2}{V_2} = \frac{d_2}{d_1} \Rightarrow \frac{300^o K}{T_2} = \frac{0.75d}{d}$ $T_2 = \frac{300}{0.75} = 400^o K$

24. PV = nRT

$P\frac{M}{d}$ = nRT $\left(\because\ V = \frac{M}{d}\right)$; d = $\frac{PM}{RT}$

25. $V_{rms} = \sqrt{\frac{3RT}{M}} \therefore V_{rms} \propto \frac{1}{\sqrt{M}}$ at same T

because H_2 has least molecular weight so its r.m.s. velocity should be maximum.