Additional Problems for Self Practice (APSP)

✍ **Marked questions are recommended for Revision.**

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

PART - I : PRACTICE TEST-1 (IIT-JEE (MAIN Pattern))

Max. Marks: 100 **Max. Time : 1 Hour**

Important Instructions:

A. General :

1. The test paper is of **1** hour duration.
2. The Test Paper consists of **25** questions and each questions carries **4** Marks. Test Paper consists of **Two** Sections.

B. Test Paper Format and its Marking Scheme:

1. Section-1 contains **20** multiple choice questions. Each question has four choices (1), (2), (3) and (4) out of which **ONE** is correct. For each question in Section-1, you will be awarded 4 marks if you give the corresponding to the correct answer and zero mark if no given answers. In all other cases, minus one **(–1)** mark will be awarded.
2. Section-2 contains **5** questions. The answer to each of the question is a **Numerical Value**. For each question in Section-2, you will be awarded 4 marks if you give the corresponding to the correct answer and zero mark if no given answers. No negative marks will be answered for incorrect answer in this section. In this section answer to each question is **NUMERICAL VALUE** with two digit integer and decimal upto two digit. If the numerical value has more than two decimal places **truncate/round-off** the value to **TWO** decimal placed.

SECTION-1

This section contains **20** multiple choice questions. Each questions has four choices (1), (2), (3) and (4) out of which Only **ONE** option is correct.

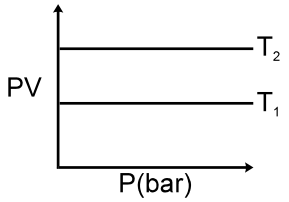
1. 2.5 L of a sample of a gas at 27°C and 1 bar pressure is compressed to a volume of 500 mL keeping the temperature constant, the percentage increase in pressure is
(1) 100 % (2) 400 % (3) 500% (4) 80%

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 cannot 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) Temperatures of both A and B are raised.
(4) Temperatures of both A and B are lowered.

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. 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

8. 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

9. 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

10. 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) $\frac{1}{2}$ × 3

11. 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

12. 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) $P_{CO} = \frac{1}{2} P_{N_2}$

13. 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

14. 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

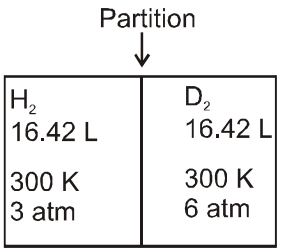
15. If equal weights of oxygen and nitrogen are placed in separate containers of equal volume at the same temperature, which one of the following statements is true? (Mol wt: $N_2 = 28$, $O_2 = 32$)
(1) Both flasks contain the same number of molecules.
(2) The pressure in the nitrogen flask is greater 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.

16. 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

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

18. 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) $N_2 > O_2 > H_2 > HBr$

19. If all the oxygen atoms present in 4 mole H_2SO_4, 2 mole P_4O_{10} & 2mole 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

20. 

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

SECTION-2

This section contains **5** questions. Each question, when worked out will result in **Numerical Value**.

21. 2 litres of moist hydrogen were collected over water at 26ºC 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 percentage of H_2 in the moist gas.

22. 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 (in ml) of gas at S.T.P. is :

23. What is the total pressure (in atm) exerted by the mixture of 70 g of N_2, 20 g of hydrogen and 80 g of sulphur dioxide gases in a vessel of 6 L capacity that has been kept in a reservoir at 27°C?

24. 10 L of O_2 gas is reacted with 30 L of CO (g) at STP. Sum total of volume of CO_2 & CO (in Ltr) present at end of reaction.

25. If twenty moles of an ideal gas at 546 K occupies a volume of 44.8 litres, the pressure (in atm) must be-

Practice Test-1 (IIT-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					
Ans.										

PART - II : JEE (MAIN) / AIEEE OFFLINE PROBLEMS (PREVIOUS YEARS)

1. According to kinetic theory of gases in an ideal gas between two successive collisions a gas molecule travels: **[AIEEE 2003, 3/225]**

(1) In a straight line path (2) With an accelerated velocity

(3) In a circular path (4) In a wavy path

2. What volume of hydrogen gas, at 273 K and 1 atm pressure will be consumed in obtaining 21.6 g of elemental boron (atomic mass = 10.8) from the reduction of boron trichloride by hydrogen? **[AIEEE 2003, 3/225]**

(1) 89.6 L (2) 67.2 L (3) 44.8 L (4) 22.4 L

3. As the temperature is raised from 20°C to 40°C, the average kinetic energy of neon atoms changes by a factor : **[AIEEE 2004, 3/225]**

(1) 2 (2) $\sqrt{\frac{313}{293}}$ (3) $\frac{313}{293}$ (4) $\frac{1}{2}$

5. Which one of the following statements is not true about the effect of an increase in temperature on the distribution of molecular speeds in a gas ? **[AIEEE 2005, 3/225]**

(1) The area under the distribution curve remains the same as under the lower temperature

(2) The distribution becomes broader

(3) The fraction of the molecules with the most probable speed increases

(4) The most probable speed increases

6. Equal masses of methane and oxygen are mixed in an empty container at 25°C. The fraction of the total pressure exerted by oxygen is **[AIEEE 2007, 3/120]**

(1) 1/3 (2) 1/2 (3) 2/3 (4) $\frac{1}{3} \times \frac{273}{298}$

7. When r, P and M represent rate of diffusion, pressure and molecular mass, respectively, then the ratio of the rates of diffusion (r_A/r_B) of two gases A and B, is given as: **[AIEEE 2011, 4/120]**

(1) $(P_A/P_B)\,(M_B/M_A)^{1/2}$ (2) $(P_A/P_B)^{1/2}\,(M_B/M_A)$ (3) $(P_A/P_B)\,(M_A/M_B)^{1/2}$ (4) $(P_A/P_B)^{1/2}\,(M_A/M_B)$

8. The molecular velocity of any gas is: **[AIEEE 2011, 4/120]**

(1) inversely proportional to absolute temperature.

(2) directly proportional to square of temperature.

(3) directly proportional to square root of temperature.

(4) inversely proportional to the square root of temperature.

9. A gaseous hydrocarbon gives upon combustion 0.72 g of water and 3.08 g. of CO_2. The empirical formula of the hydrocarbon is : **[JEE(Main) 2013, 4/120]**

(1) C_2H_4 (2) C_3H_4 (3) C_6H_5 (4) C_7H_8

10. For gaseous state, if most probable speed is denoted by C*, average speed by and mean square speed by C, then for a large number of molecules the ratios of these speeds are :

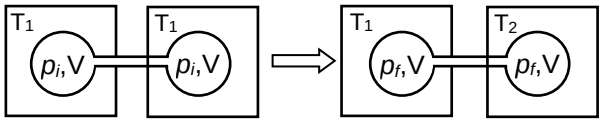
[JEE(Main) 2013, 4/120]

(1) C* : $\bar{C}$: C = 1.225 : 1.128 : 1 (2) C* : $\bar{C}$: C = 1.128 : 1.225 : 1

(3) C* : $\bar{C}$: C = 1 : 1.128 : 1.225 (4) C* : $\bar{C}$: C = 1 : 1.225 : 1.128

11. Two closed bulbs of equal volume (V) containing an ideal gas initially at pressure p_i and temperature T_1 are connected through a narrow tube of negligible volume as shown in the figure below. The temperature of one of the bulbs is then raised to T_2. The final pressure p_f is:

[JEE(Main) 2016, 4/120]



(1) $2p_i\left(\frac{T_1}{T_1+T_2}\right)$ (2) $2p_i\left(\frac{T_2}{T_1+T_2}\right)$ (3) $2p_i\left(\frac{T_1T_2}{T_1+T_2}\right)$ (4) $p_i\left(\frac{T_1T_2}{T_1+T_2}\right)$

12. The ratio of mass percent of C and H of an organic compound ($C_XH_YO_Z$) is 6 : 1. If one molecule of the above compound ($C_XH_YO_Z$) contains half as much oxygen as required to burn one molecule of compound C_XH_Y completely to CO_2 and H_2O.The empirical formula of compound $C_XH_YO_Z$ is :

[JEE(Main) 2018, 4/120]

(1) $C_3H_4O_2$ (2) $C_2H_4O_3$ (3) $C_3H_6O_3$ (4) C_2H_4O

PART - III : NATIONAL STANDARD EXAMINATION IN CHEMISTRY (NSEC) STAGE-I

Ideal Gases

1. The rate of diffusion of a gas of molecular weight M is given by the relation : **[NSEC-2000]**

(A) rate $\propto \sqrt{\text{density of gas}}$ (B) rate $\propto \frac{1}{\sqrt{M}}$

(C) rate $\propto$ M (D) rate is independent of density of gas.

2. The kinetic energy of one gram mole of any gas depends on : **[NSEC-2000]**

(A) absolute temperature of the gas. (B) nature of the gas molecules.

(C) pressure of the gas (D) volume of the gas

3. A flask of gaseous CCl_4 was weighed at measured temperature and pressure. The flask was then flushed and filled with O_2 at same temperature and pressure. The weight of the CCl_4 vapour will be : **[NSEC-2000]**

(A) five times as heavy as O_2 (B) one fifth heavy as compared to O_2

(C) same as that of O_2 (D) twice as heavy as the O_2

4. For an ideal gas, which of the following graphs, will not be a straight line when all the other variables are held constant ? **[NSEC-2000]**

(A) P Vs T (B) V Vs T (C) P Vs 1/V (D) n Vs T

5. A gas cylinder was found unattended in a public place. The investigating team took the cylinder and collected samples from it. The density of the gas was found to be 2.380 g L^{-1} at 15ºC and 736 mm Hg pressure. Hence the molar mass of the gas is : **[NSEC-2003]**

(A) 83 (B) 71 (C) 32 (D) 58

6. Considering air as a 4:1 mixture of nitrogen and oxygen, the mass of air in a hall with dimensions 5 m × 5 m × 5 m at STP is approximately **[NSEC-2003]**

(A) 160 g (B) 160 kg (C) 16 g (D) 1.60 kg.

7. R.M.S. velocity of sulphur trioxide is found to be equal to the most probable velocity of another gas at the same temperature. Hence, the molecular weight of the gas is : **[NSEC-2004]**

(A) 46 (B) 64 (C) 53 (D) 80.

8. What is the total pressure inside a 2L vessel containing 1g of He, 14g of CO and 10g of NO at 27°C ? **[NSEC-2007]**

(A) 0.25 atm (B) 13.2 atm (C) 1.24 atm (D) 21.6 atm

9. The root mean square velocity of SO_2 is equal to that of oxygen at 27°C when the temperature is : **[NSEC-2008]**

(A) 327°C (B) 127°C (C) 227°C (D) 600°C

10. The temperature of a sample of sulfur dioxide is increased from 27°C to 327°C. The average kinetic energy of the gas molecules **[NSEC-2008]**

(A) is doubled (B) increases by the factor 327/27
(C) is halved (D) remains same

11. A gas shows positive joule-thomson effect below : **[NSEC-2008]**

(A) Critical temperature (B) Boyle temperature
(C) Transition temperature (D) Inversion temperature

12. A container having volume V contains an ideal gas at 1 atm pressure. It is connected to another evaculated container having volume 0.5 dm^3 through a tube having negligible volume. After some time the first container is found to have pressure 570 mm of Hg. If temperature is constant, V is : **[NSEC-2010]**

(A) 1.0 dm^3 (B) 1.5 dm^3 (C) 2.0 dm^3 (D) 2.5 dm^3

13. A beaker is heated from 27°C to 127°C, the percentage of air originally present in beaker that is expelled is: **[NSEC-2011]**

(A) 50% (B) 25% (C) 33% (D) 40%

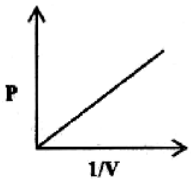
14. The vapour density of gas A is four times that of B. If the molecular mass of B is M then molecular mass of A is: **[NSEC-2012]**

(A) M (B) 4M (C) M/4 (D) 2M

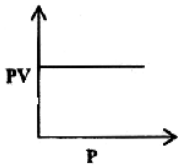
15. A gas shows positive Joule-Thomson Effect below its **[NSEC-2013]**

(A) Boyle Temperature (B) Critical Temperature
(C) Inversion Temperature (D) Transition Temperature

16. The graph that **wrongly** represents the Boyle's law of an ideal gas is **[NSEC-2014]**



(I)



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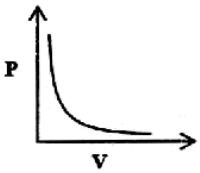
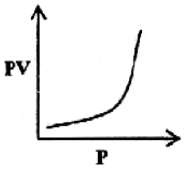


(III)



(IV)

(A) II (B) I (C) IV (D) III

17. In an experiment, it was found that for a gas at constant temperature, PV = C. The value of C depends on **[NSEC-2015]**
(A) atmospheric pressure (B) quantity of gas
(C) molecular weight of gas (D) volume of chamber

18. The quantity that does not change for a sample of a gas in a sealed rigid container when it is cooled from 120°C to 90°C at constant volume is **[NSEC-2015]**
(A) average energy of the molecule (B) pressure of the gas
(C) density of the gas (D) average speed of the molecules

19. Equal masses of ethane and hydrogen gas are present in a container at 25ºC. The fraction of the total pressure exerted by ethane gas is : **[NSEC-2016]**
(A) 1/2 (B) 1/16 (C) 15/16 (D) 1/8

20. The volume of nitrogen evolved on complete reaction of 9 g of ethylamine with a mixture of $NaNO_2$ and HCl at 273ºC and 1 atm pressure is : **[NSEC-2016]**
(A) 11.2 dm^3 (B) 5.6 cm^3 (C) 4.48 dm^3 (D) 22.4 cm^3

21. Which of the following will not give a straight line plot for an ideal gas ? **[NSEC-2017]**
(A) V vs T (B) T vs P (C) V vs I/P (D) V vs I/T

22. When a sample of gas kept at 20ºC and 4.0 atm is heated to 40ºC at constant volume **[NSEC-2017]**
(A) average speed of the gas molecules will decrease.
(B) number of collisions between the gas molecules per second will remain the same.
(C) average kinetic energy of the gas will increase.
(D) pressure of the gas will become 8 atm.

23. The pressure inside two gas cylinders of volume 25 m^3 and 50 m^3 are 10 kPa and 20 kPa respectively. The cylinders are kept at the same temperature and separated by a valve. What is the pressure in the combined system when the vale is opened? **[NSEC-2018]**
(A) 30 kPa (B) 15 kPa (C) 16.7 kPa (D) 2.5 kPa

24. Density of CO_2 gas at 0ºC and 2.00 atm pressure can be expressed as **[NSEC-2018]**
(A) 2 g m^{-3} (B) 4 g m^{-3} (C) 4×10^3 kg m^{-3} (D) 8 g L^{-1}

Real Gases

25. The critical volume of a gas when expressed in terms of Van der Waals constants 'a' and 'b' takes the form: **[NSEC-2000]**
(A) 3a (B) $a/27b^2$ (C) 8a/27Rb (D) 3b

26. Real gases approach ideal behaviour at : **[NSEC-2001]**
(A) high temperatures and high pressure
(B) high temperatures and low pressures
(C) low temperatures and low pressures
(D) critical point

27. A gas will approach ideal behaviour at **[NSEC-2004]**
(A) low temperature and low pressure
(B) low temperature and high pressure
(C) high temperature and low pressure
(D) high temperature and high pressure.

28. The van der waal`s equation for real gases is $\left(P + a\left(\frac{n}{V}\right)^2\right)(V - nb) = nRT$.

In the above equation, the terms a $(n/V)^2$ and (–nb) respectively represents the corrections for: **[NSEC-2004]**

(A) intermolecular attractive forces and inelastic collision
(B) intermolecular repulsive force and high temperatures
(C) intermolecular attractive forces and molecular volumes
(D) deviations in the temperature and pressure.

29. In the van der Waals equation of state for a real gas, the term that accounts for intermolecular attraction is **[NSEC-2005]**

(A) $(P + a/V^2)$ (B) $(V - b)$ (C) RT (D) $1/(V - b)$.

30. A gas shows positive joule-thomson effect below : **[NSEC-2008]**

(A) Critical temperature (B) Boyle temperature
(C) Transition temperature (D) Inversion temperature

31. Under high pressure conitions, van der waal's equation for a real gas reduces to : **[NSEC-2008]**

(A) PV = RT (B) PV + a/V = RT
(C) PV – Pb = RT (D) $(P + a/V^2)(V - b) = RT$

32. In the Vander waal equation of state for a non ideal gas the term that accounts for intermolecular force is **[NSEC-2012]**

(A) (V – b) (B) RT (C) $(P + \frac{a}{v^2})$ (D) 1/RT

33. Real gases behave ideally at **[NSEC-2014]**

(A) low pressure and low temperature (B) high pressure and low temperature
(C) low pressure and high temperature (D) high pressure and high temperature

34. The van der Waals equation for one mole of a real gas can be written as $(P + a/V^2)(V - b) = RT$. For the gases H_2, NH_3, and CH_4, the value of 'a' (bar L^{-2} mol^{-2}) are 0.2453, 4.170 and 2.253 respectively.
Which of the following can be inferred from the 'a' values ? **[NSEC-2017]**

(A) NH_3 can be most easily liquified
(B) H_2 can be most easily liquified
(C) value of 'a' for CH_4 is less than that of NH_3 because it has the lower molar mass
(D) intermolecular forces are the strongest in hydrogen

35. The pressure inside two gas cylinders of volume 25 m^3 and 50 m^3 are 10 kPa and 20 kPa respectively. The cylinders are kept at the same temperature and separated by a valve. What is the pressure in the combined system when the vale is opened? **[NSEC-2018]**

(A) 30 kPa (B) 15 kPa (C) 16.7 kPa (D) 2.5 kPa

36. Density of CO_2 gas at 0ºC and 2.00 atm pressure can be expressed as **[NSEC-2018]**

(A) 2 g m^{-3} (B) 4 g m^{-3} (C) 4×10^3 kg m^{-3} (D) 8 g L^{-1}

37. A helium cylinder in which the volume of gas = 2.24 L at STP (1 atm, 273 K) developed a leak and when the leak was plugged the pressure in the cylinder was seen to have dropped to 550 mm of Hg. The number of moles of He gas that had escaped due to this lead is **[NSEC-2019]**

(A) 0.028 (B) 0.072 (C) 0.972 (D) 0.099

PART - IV : PRACTICE TEST-2 (IIT-JEE (ADVANCED Pattern))

Max. Time : 1 Hr. **Max. Marks : 66**

Important Instructions

A. General :

1. The test is of 1 hour duration.
2. The Test Booklet consists of 22 questions. The maximum marks are 66.

B. Question Paper Format

3. Each part consists of five sections.
4. Section 1 contains 7 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONE is correct.
5. Section 2 contains 5 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONE OR MORE THAN ONE are correct.
6. Section 3 contains 6 questions. The answer to each of the questions is a numerical value, ranging from 0 to 9 (both inclusive).
7. Section 4 contains 1 paragraphs each describing theory, experiment and data etc. 3 questions relate to paragraph. Each question pertaining to a partcular passage should have only one correct answer among the four given choices (A), (B), (C) and (D).
8. Section 5 contains 1 multiple choice questions. Question has two lists (list-1 : P, Q, R and S; List-2 : 1, 2, 3 and 4). The options for the correct match are provided as (A), (B), (C) and (D) out of which ONLY ONE is correct.

C. Marking Scheme

9. For each question in Section 1, 4 and 5 you will be awarded 3 marks if you darken the bubble corresponding to the correct answer and zero mark if no bubble is darkened. In all other cases, minus one (–1) mark will be awarded.
10. For each question in Section 2, you will be awarded 3 marks. If you darken all the bubble(s) corresponding to the correct answer(s) and zero mark. If no bubbles are darkened. No negative marks will be answered for incorrect answer in this section.
11. For each question in Section 3, you will be awarded 3 marks if you darken only the bubble corresponding to the correct answer and zero mark if no bubble is darkened. No negative marks will be awarded for incorrect answer in this section.

SECTION-1 : (Only One option correct Type)

This section contains 8 multiple choice questions. Each questions has four choices (A), (B), (C) and (D) out of which Only ONE option is correct.

1. 10 moles of an ideal gas present in 8.21 litre closed container. The intercept on y-axis and slope of curve plotted between P/T vs T are :
(A) 0.01, 0 (B) 0.1, 1 (C) 0.1, 0 (D) 10, 1

2. 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 :
(A) 1 : 6 (B) 1 : 1 (C) 4 : 1 (D) 1 : 4

3. 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?
(A) 80 (B) 40 (C) 60 (D) 20

4. 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 ?
(A) 6 (B) 8 (C) 12 (D) 3

5. Two vessels connected by a valve of negligible volume. One container (I) has 2.8 g 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})?
(A) 1 : 2 (B) 1 : 3 (C) 1 : 6 (D) 3 : 1

6. Correct expression for density of an ideal gas mixture of two gases 1 and 2, where m_1 and m_2 are masses and n_1 and n_2 are moles and M_1 and M_2 are molar masses.

(A) $d = \frac{(m_1+m_2)}{(M_1+M_2)}$ (B) $d = \frac{(m_1+m_2)}{(n_1+n_2)}\frac{P}{RT}$ (C) $d = \frac{(n_1+n_2)}{(m_1+m_2)} \times \frac{P}{RT}$ (D) None of these

7. A balloon filled with ethyne is pricked with a sharp point and quickly dropped in a tank of H_2 gas under identical conditions. After a while the balloon will :

(A) Shrink (B) Enlarge
(C) Completely collapse (D) Remain unchanged in size

8. 10 ml of gaseous hydrcarbon is exploded with 100 ml O_2. The residual gas on cooling is found to measure 95 ml of which 20 ml is abosrbed by KOH and the reminder by alkaline pyrogallol. The formula of the hydrocarbon is :

(A) CH_4 (B) C_2H_6 (C) C_2H_4 (D) C_2H_2

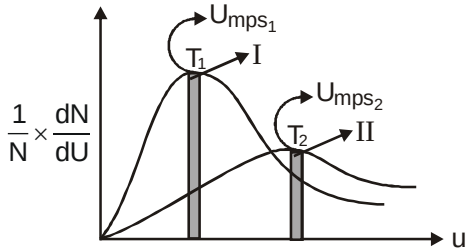
Section-2 : (One or More than one options correct Type)

This section contains 5 multipole choice questions. Each questions has four choices (A), (B), (C) and (D) out of which ONE or MORE THAN ONE are correct.

9. The Ne atom has 10 times the mass of H_2. Which of the following statements are true?

(A) Ten moles of H_2 would have the same volume as 1 mole of Ne.
(B) One mole of Ne exerts the same pressure as one mole of H_2 at STP
(C) A H_2 molecule travels 10 times faster than an Ne atom.
(D) At STP, one litre of Ne has 10 times the density of 1 litre of H_2.

10. Following represent the Maxwell distribution curve for an ideal gas at two temperature T_1 and T_2. Which of the following option(s) are true ?



(A) Total area under the two curves is independent of moles of gas
(B) U_{mps} decreases as temperature decreases
(C) $T_1 > T_2$ and hence higher the temperature, sharper the curve
(D) The fraction of molecules having speed = U_{mps} decreases as temperature increases

11. If for two gases of molecular weights M_A and M_B at temperature T_A and T_B, respectively, $T_AM_B = T_BM_A$, then which property has the same magnitude for both the gases ?

(A) PV if mass of gases taken are same (B) Pressure
(C) KE per mole (D) V_{rms}

12. Two non reacting gas A & B having mole ratio of 3 : 5 in a container exerts a pressure of 8 atm. If B is removed what would be pressure of 'A' only. If A is removed what would be pressure of 'B' only, temperature remaining constant.

(A) 3 atm (B) 4 atm (C) 5 atm (D) None of these

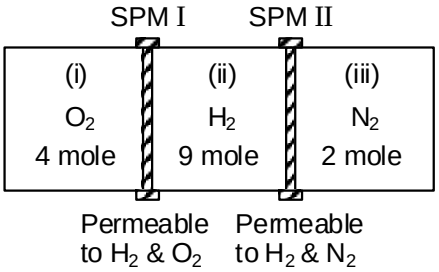
13. Which of the following does not shows explicitly the relationship between Boyle's law and Charles' law ?

(A) $\frac{P_1}{P_2} = \frac{T_1}{T_2}$ (B) PV = K (C) $\frac{P_2}{P_1} = \frac{V_1}{V_2}$ (D) $\frac{V_2}{V_1} = \frac{P_1}{P_2} \times \frac{T_2}{T_1}$

Section-3 : (Numerical Value Questions)

This section contains 6 questions. Each question, when worked out will result in a numerical value from 0 to 9 (both inclusive)

14. A container is divided into 3 identical parts by fixed semipermeable membrane as shown below.



In compartment (i) 4 moles of O_2 are taken
In compartment (ii) 9 moles of H_2 are taken
In compartment (iii) 2 moles of N_2 are taken
Calculate the ratio of total pressure in the three compartments after a sufficient long time. Assume temperature constant throughout. If ratio is a : b : c (simplest ratio) then express your answer as a + b + c.

15. The density of a gas filled in an electric lamp is 0.75 kg/m^3. When lamp is switched on, the pressure in it increases from 4 Pa to 25 Pa, then what is increase in u_{rms} in m/sec.

16. Gaseous decomposition of A follows Ist order kinetics ($\frac{-d[A]}{dt}$ = k[A]). Pure A(g) is taken in a sealed flask where decomposition occurs as

$$A(g) \longrightarrow 2B(g) + C(g)$$

After 10 sec., a leak was developed in the flask. On analysis of the effused gaseous mixture (Obeying Graham's law) coming out initially, moles of B(g) were found to be double of A. What is rate constant k in sec^{-1}.

Given : Molecular weight of A = 16, Molecular weight of B = 4, Molecular weight of C = 8.

[ℓn 3 = 1.1; ℓn 2 = 0.7]

Write your answer by multiplying it with 100.

17. 0.75 mole of solid X_4 and 2 mole of O_2 are heated to completely react in a closed rigid container to form 1 mol of only one gaseous compound (no reactant left behind). Find the ratio of final pressure at 327ºC to the initial pressure at 27ºC in the flask. Fill your answer as x, where ratio is x : 1.

SECTION-4 : Comprehension Type (Only One options correct)

This section contains 1 paragraphs, each describing theory, experiments, data etc. 3 questions relate to the paragraph. Each question has only one correct answer among the four given options (A), (B), (C) and (D)

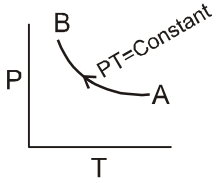
Paragraph for Questions 18 to 20

When a sample of an ideal gas is changed from an initial state to a final state, various curves can be plotted for the process like P–V curve, V–T curve, P–T curve etc.

For example, P–V curve for a fixed amount of an ideal gas at constant temperature is a rectangular hyperbola, V–T curve for a fixed amount of an ideal gas at constant pressure is a straight line and P–T curve for a fixed amount of an ideal gas at constant volume is again a straight line. However, the shapes may vary if the constant parameters are also changed.

Now, answer the following questions :

18. Which of the following statements is correct regarding a fixed amount of ideal gas undergoing the following process :

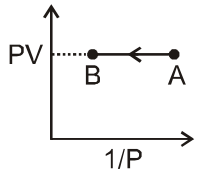


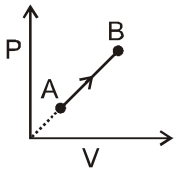
(A) Root mean square (RMS) speed of gas molecules increases during the process A $\rightarrow$ B.
(B) Density of the gas increases during the process A $\rightarrow$ B.
(C) Such a graph is not possible.
(D) If $P_B = 4P_A$, then $V_A = 4V_B$ (where P_A, V_A, P_B & V_B represent pressure and volume values at states A and B).

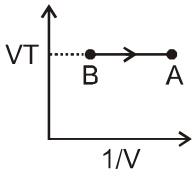
19. Two moles of an ideal gas is changed from its initial state (16 atm, 6L) to final state (4 atm, 15L) in such a way that this change can be represented by a straight line in P–V curve. The maximum temperature attained by the gas during the above change is : (Take R = $\frac{1}{12}$ L atm K^{-1} mol^{-1})

(A) 324 K (B) 648 K (C) 1296 K (D) 972 K

20. Which of the following graphs is not possible for a fixed amount of ideal gas upon moving from initial state A to final state B :

(A) 

(B) 

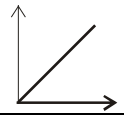
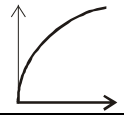
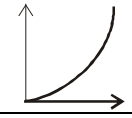
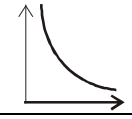
(C) 

(D) None of these

SECTION-5 : Matching List Type (Only One options correct)

This section contains 1 questions, each having two matching lists. Choices for the correct combination of elements from List-I and List-II are given as options (A), (B), (C) and (D) out of which one is correct

21. Match each **List-I** with an appropriate pair from **List-II** and select the correct answer using the code given below the lists.

	List-I		**List-II**
P.	$\frac{1}{V^2}$ vs. P for ideal gas at constant T and n.	1.	
Q.	V vs. $\frac{1}{T}$ for ideal gas at constant P and n	2.	
R.	PT vs. T^2 for ideal gas at constant V and n.	3.	
S.	V vs. $\frac{1}{P^2}$ for ideal gas at constant T and n.	4.	

Code:

	P	Q	R	S		P	Q	R	S
(A)	3	4	1	2	(B)	1	2	4	3
(C)	3	1	2	4	(D)	2	3	1	4

Practice Test-2 (IIT-JEE (ADVANCED 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									
Ans.										

APSP Answers

PART - I

1.	(2)	**2.**	(1)	**3.**	(3)	**4.**	(4)	**5.**	(2)
6.	(1)	**7.**	(1)	**8.**	(1)	**9.**	(1)	**10.**	(3)
11.	(2)	**12.**	(1)	**13.**	(2)	**14.**	(2)	**15.**	(2)
16.	(2)	**17.**	(4)	**18.**	(1)	**19.**	(1)	**20.**	(2)
21.	96.70	**22.**	40.11	**23.**	56.44	**24.**	30	**25.**	20.01

PART - II

1.	(1)	**2.**	(2)	**3.**	(3)	**5.**	(3)	**6.**	(1)
7.	(1)	**8.**	(3)	**9.**	(4)	**10.**	(3)	**11.**	(2)
12.	(2)								

PART – III

1.	(B)	**2.**	(A)	**3.**	(A)	**4.**	(D)	**5.**	(D)
6.	(B)	**7.**	(C)	**8.**	(B)	**9.**	(A)	**10.**	(A)
11.	(D)	**12.**	(B)	**13.**	(B)	**14.**	(B)	**15.**	(C)
16.	(C)	**17.**	(B)	**18.**	(C)	**19.**	(B)	**20.**	(C)
21.	(D)	**22.**	(C)	**23.**	(C)	**24.**	**All options are incorrect.**		
25.	(D)	**26.**	(B)	**27.**	(C)	**28.**	(C)	**29.**	(A)
30.	(D)	**31.**	(C)	**32.**	(C)	**33.**	(C)	**34.**	(A)
35.	(C)	**36.**	(All options are incorrect)			**37.**	(A)		

PART – IV

1.	(C)	**2.**	(C)	**3.**	(B)	**4.**	(C)	**5.**	(C)
6.	(B)	**7.**	(B)	**8.**	(D)	**9.**	(BD)	**10.**	(ABD)
11.	(AD)	**12.**	(AC)	**13.**	(ABC)	**14.**	15	**15.**	6
16.	4	**17.**	1	**18.**	(B)	**19.**	(B)	**20.**	(D)
21.	(A)								

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 = $\frac{(5-1)\text{bar}}{1\text{bar}} \times 100\% = 400\ \%$.

2. Given

$$\sqrt{\frac{8RT}{\pi M_A}} = \sqrt{\frac{3RT}{M_B}}$$

$$\Rightarrow \quad 8M_B = 3\pi M_A$$

$$\& \quad \sqrt{\frac{3RT_A}{M_A}} = \sqrt{\frac{3RT_B}{M_B}} \qquad \Rightarrow \qquad \frac{T_A}{M_A} = \frac{T_B}{M_B}$$

$$\Rightarrow \quad M_B.T_A = M_A.T_B$$

$$\Rightarrow \quad \frac{3\pi}{8} M_A.T_A = M_A.T_B \qquad \Rightarrow \qquad T_B > T_A$$

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

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

$\frac{1000}{2} = 100 + V$

$V = 400$ mL.

5. $PV \propto T$.

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

7. K.E. $\propto$ Temperature

8. $\left[\frac{3}{2}nRT\right]_{He} = \frac{3}{2}nRT$; $0.3\ T = 0.4 \times 400$; $T = 533\ K$

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

10. $PV = nRT$

$\frac{P}{3} \times 2V = nRT$; $T' = \frac{2}{3}T$

11. Frequency of collision will increase.

12. $\frac{P_{N_2}}{P_{CO}} = \frac{X_{N_2}}{X_{CO}}$ $\frac{n_{N_2}}{n_{co}} = \frac{x \times 28}{28 \times x} = 1$ $P_{N_2} = P_{co}$

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

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

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

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

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

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

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

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

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

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

Order of M.wt. = $H_2 < N_2 < O_2 < HBr$ $\Rightarrow$ $\therefore$ Order of $V_{rms} = H_2 > N_2 > O_2 > HBr$.

19. 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 $\Rightarrow$ $\therefore$ at 2 atm = $\frac{1}{2}$ × 22.4 × 20 = 224 L

20. 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 = $\frac{2 \times 2 + 4 \times 4}{4 + 2} = \frac{10}{3}$

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

$\% X_{H_2} = \frac{n_{H_2}}{n_{total}} = \frac{0.0788}{\frac{0.0821}{2} \times 299} \times 100 = 96.70$

22. Net pressure of gas = P_{gas}

P_{gas} = 650 mm.

$\frac{P_1V_1}{T_1} = \left(\frac{P_2V_2}{T_2}\right)_{STP}$ $\Rightarrow$ $\frac{650 \times 50}{291} = \frac{760 \times V_2}{273}$ $\Rightarrow$ $V_2 = 40.11$ ml

23. No. of moles of $N_2 = \frac{70}{28} = 2.5$ Mole

$\Rightarrow$ No. of moles of $H_2 = \frac{20}{2} = 10$ Mole

No. of moles of $SO_2 = \frac{80}{64} = 1.25$ Mole

$\Rightarrow$ Total moles = 13.75

$P = \frac{nRT}{V} = \frac{0.0821 \times 300 \times 13.75}{6} = 56.44$

24.

$$\underset{30/22.4}{2CO} + \underset{10/22.4}{O_2} \longrightarrow 2CO_2$$

O_2 is limiting reagent $\quad 10/22.4 \quad 0 \quad 20/22.4$

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

$CO = 10$ L

25. $P = \frac{nRT}{V} = \frac{20 \times 0.0821 \times 546}{44.8} = 20.01$ atm.

PART – II

1. It is one of the assumption of kinetic theory of gas.

2.

$$\underset{2 \text{ mol}}{2BCl_3} + \underset{3 \text{ mol}}{3H_2} \longrightarrow \underset{2 \text{ mol}}{2B} + 6HCl$$

21.6 g B = 2 mol B = 3 mol H_2

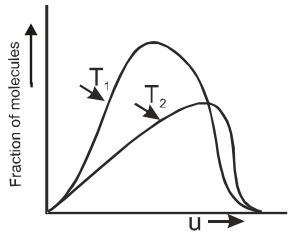
PV =nRT

$\therefore$ $V = \frac{nRT}{P} = \frac{3 \times 0.0821 \times 273}{1} = 67.2$ L

3. K.E. $= \frac{3}{2}RT$

$E_1 = \frac{3}{2}R\,293$ and $E_2 = \frac{3}{2}R\,313 \Rightarrow E_2 = \frac{313}{293} \times E_1$

5. Distribution of molecules (N) with velocity (μ) at two temperature T_1 and T_2 ($T_2 > T_1$) is show below:



At both temperatures, distribution of molecules with increase in velocity first increases, reaches a maximum value and then decreases.

6. Let the mass of methane and oxygen be m gm. Mole fraction of oxygen X_{O_2}

$$= \frac{\frac{m}{32}}{\frac{m}{32}+\frac{m}{16}} = \frac{m}{32}\times\frac{32}{3m} = \frac{1}{3}$$ Let the total pressure be P.

$\therefore$ Partial pressure of O_2, $P_{O_2} = P \times X_{O_2}$ $P \times \frac{1}{3} = \frac{1}{3}P$.

7. $r \propto \frac{p}{\sqrt{M}}$ $\Rightarrow$ $\frac{r_A}{r_B} = \frac{p_A}{p_B}\sqrt{\frac{M_B}{M_A}}$

8. $v = \sqrt{\frac{8RT}{\pi M}}$ $\Rightarrow$ $v \propto \sqrt{T}$

9. 18g H_2O contains 2g H

$\therefore$ 0.72 g H_2O contains 0.08 gH.

44 g CO_2 contains 12g C

$\therefore$ 3.08 g CO_2 contains 0.84 g C

$\therefore$ C : H = $\frac{0.84}{12} : \frac{0.08}{1}$ = 0.07 : 0.08 = 7 : 8

$\therefore$ Empirical formula = C_7H_8

10. C* = most probable speed = $\sqrt{\frac{2RT}{M}}$

$\bar{C}$ = average speed = $\sqrt{\frac{8RT}{\pi M}}$

C = Mean square speed corrected as rms = $\sqrt{\frac{3RT}{M}}$

$C^* < \bar{C} < C$

$C^* : \bar{C} : C = 1 : \sqrt{\frac{4}{\pi}} : \sqrt{\frac{3}{2}}$ = 1 : 1.128 : 1.225

Note : As no option correspond to mean square speed, it is understood as misprint. It should be root means square speed. So, ans is (3)

11. Initial moles = final moles

$$\frac{P_i \times V}{RT_1} + \frac{P_i \times V}{RT_1} = \frac{P_f \times V}{RT_2} + \frac{P_f \times V}{RT_1}$$

$$\Rightarrow \quad \frac{P_i}{T_1} + \frac{P_i}{T_1} = \frac{P_f}{T_2} + \frac{P_f}{T_1}$$

$$\frac{2P_i}{T_1} = P_f\left[\frac{1}{T_2} + \frac{1}{T_1}\right] \quad \Rightarrow \quad \frac{2P_i}{T_1} = P_f\left[\frac{T_1 + T_2}{T_1T_2}\right]$$

$$\Rightarrow \quad P_f = 2P_i \times \left(\frac{T_2}{T_1 + T_2}\right)$$

12. Element C : H

Mass ratio 6 : 1

Mole Ratio 6/12 : 1 $\Rightarrow$ = 1 : 2

So C_XH_Y have empirical formula : CH_2

for Burning a CH_2 unit ; oxygen required is $\frac{3}{2}$ mol

$CH_2 + \frac{3}{2} O_2 \longrightarrow CO_2 + H_2O$

Empirical formula is $2 \times (CH_2O_{3/2}) \Rightarrow C_2H_4O_3$

PART – IV

1. Intercept on y-axis = $\log_{10} \frac{nR}{V} = \log_{10} \frac{10 \times 0.821}{8.21} = -10$

$\frac{P}{T}$ v/s curve $\frac{P}{T} = \frac{nR}{V}$

Intercept = $\frac{nR}{V} = \frac{10 \times 0.821}{8.21} = 0.1$, slope = 0

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

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

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

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

3. $V_1 = V$, $T_1 = 300$ 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 = $\frac{2V/3}{5V/3} \times 100 = 40\%$

4. Pressure of Total mixture = 10 atm

$P_A + P_B + P_C = 10$

$3 + 1 + P_C = 10 \quad \Rightarrow \quad P_C = 6$ 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 $n_A = K$ $\Rightarrow$ $n_B = \frac{K}{3}$ $n_C = \frac{1}{6}$ $n_B = 2K$

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

$\Rightarrow$ $n_C = 2K$

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

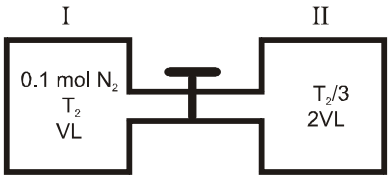
$\Rightarrow$ $n_A = 3$

$n_B = 1$

$n_C = 6$

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

5.



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 $P(V) = (0.1 - x)RT_2$

$\Rightarrow$ $2 = \frac{x}{3(0.1-x)}$

$\Rightarrow$ x = 0.6/7 mole,

$\frac{0.6}{7} \times 28 \Rightarrow 2.4$ 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. H_2 gas is greater than diffuses into balloon because rate of diffusion of H_2 is greater than the rate of diffusion of ethyne. Hence, it is enlarged.

8. Volume of CO_2 = 20 ml (absorbed gas by KOH)

Volume of air unreacted = 95 – 20 = 75 (gas abosrbed by pyrogallol)

$\therefore$ O_2 reacted = 100 + 75 = 25 ml

$\because$ 10 ml hydrocarbon libarates 20 ml CO_2.

$\therefore$ 2 atoms of 'C' are present in the compound.

$\therefore$ $C_2H_x + yO_2 \longrightarrow 2CO_2 + H_2O$

initial	10 ml	25 ml		
final	0	0	20	10 ml

volume of water vapours = (25 – 20) × 2 = 10 ml

$\because$ 10 ml hydrocarbon gives 10 ml water vapours.

$\therefore$ No. of Hydrogen atoms in compounds are 2.

$\therefore$ Compound will be C_2H_2.

10. (A) $\therefore$ area under the curve gives fraction of molecules and total area is constant.

(B) U_{mps} decreases with decrease in temperature.

(C) T_2 is higher temperature

(D) As seen from graph ; $\therefore$ A, B, D

11. When $\frac{T_A}{M_A} = \frac{T_B}{M_B}$ or $T_AM_B = T_BM_A$

$(PV)_A = nRT$ or $\frac{W_A}{M_A} RT_A$ and $(PV)_B = \frac{W_B}{M_B} RT_B$

$\therefore$ When $W_A = W_B$

$(PV)_A = (PV)_B$

$$U_{rms} = \sqrt{\frac{3RT}{M}}$$

$\therefore$ $U_A = \sqrt{\frac{3RT_A}{M_A}}$; $U_B = \sqrt{\frac{3RT_B}{M_B}}$ $\therefore$ $U_A = U_B$ $\left(\frac{T_A}{M_A} = \frac{T_B}{M_B}\right)$

12. $P_T = X_AP°_A + X_BP°_B$

$8 = \frac{3}{8} P_A + \frac{5}{8} P_B$

$\frac{P_A}{P_B} = \frac{3}{5}$ $\therefore$ $P_A = 3$ atm; $P_B = 5$ atm

14. After a very long time

$\Rightarrow$ P_{H_2} will be same in all the compartments

$\Rightarrow$ P_{O_2} will be same in (i) & (ii) compartment

$\Rightarrow$ P_{N_2} will be same in (ii) & (iii) comportment

Compartment	(i)	(ii)	(iii)
	$O_2 = 2$ mole	$H_2 = 3$ mole	$H_2 = 3$ mole
	$H_2 = 3$ mole	$O_2 = 2$ mole	$N_2 = 1$ mole
		$N_2 = 1$ mole	

Ratio of Pressure = Ratio of moles = 5 : 6 : 4 ($\because$ V & T is same)

a + b + c = 5 + 6 + 4 = 15.

15. $u_{rms} = \sqrt{\frac{3RT}{M}} = \sqrt{\frac{3P}{d}}$ $d = \frac{PM}{RT}$ $\Rightarrow$ $\Delta u_{rms} = \sqrt{\frac{3}{d}}(\sqrt{P_2} - \sqrt{P_1}) = 2 \times 3 = 6$ m/sec.

16. $A(g) \longrightarrow 2B(g) + C(g)$

$1-\alpha \qquad 2\alpha \qquad \alpha$

$$\frac{r_B}{r_A} = \frac{2}{1} = \frac{2\alpha}{1-\alpha} \times \sqrt{\frac{16}{4}}$$

$$\Rightarrow \qquad \alpha = \frac{1}{3}$$

$$\Rightarrow \qquad K = \frac{1}{10}\, ln\, \frac{3}{2} = \frac{0.4}{10} = 0.04\ sec^{-1}$$

17. Mole atoms of X = 0.75 × 4 = 3

Mole atoms of O = 2 × 2 = 4

Hence the product is X_3O_4 (g)

Initial moles of gaseous reactants, $n_1 = 2$ (oxygen only)

Final moles of gaseous product, $n_2 = 1$ (X_3O_4)

Hence, $\frac{P_2}{P_1} = \frac{n_2T_2}{n_1T_1} = \frac{1\times 600}{2\times 300} = 1$ or $P_2 : P_1 : 1 : 1$

18. (A) Temperature decreases during process A to B, so RMS speed decreases (V_{RMS})

(B) $d_{gas} = \frac{PM}{RT}$. Upon moving from A to B, P increases and temperature decreases. So, density of gas increases.

(C) This graph is possible if during the process : $P \propto \frac{1}{V^{1/2}}$.

$\because$ PT = Constant $\therefore$ $P\left(\frac{PV}{nR}\right)$ = Constant $\therefore$ P^2V = Constant or $PV^{1/2}$ = Constant

(D) If $P_B = 4P_A$, then $V_A = 16V_B$ (according to P^2V = Constant for process)

19. Equation of straight line:

$$(y - y_1) = \left(\frac{y_2 - y_1}{x_2 - x_1}\right)(x - x_1)$$

$$\Rightarrow \qquad (P - 16) = \left(\frac{4-16}{15-6}\right)(V - 6)$$

$$3P + 4V = 72$$

$$T_{max} = \frac{(PV)_{max}}{nR}$$

For $(PV)_{max}$, $3P = \frac{72}{2}$ and $4V = \frac{72}{2}$

$$P = 12,\ V = 9$$

$$\Rightarrow \qquad T_{max} = \frac{12\times 9}{1\times(1/12)} = 648K.$$

20. (A) This graph is possible if temperature of gas is kept constant and pressure is increased from A to B.

(B) This graph is possible if temperature of gas is increased continuously during the process A to B.

(C) This graph is possible if during the process: $P \propto \frac{1}{V^2}$

$\because$ VT = constant

$\therefore$ $V\left(\frac{PV}{nR}\right)$ = Constant or PV^2 = constant.

21. $y = \frac{1}{V^2}$ or $\sqrt{y} = \frac{1}{V}$

$P = x$ and $P = \frac{\text{constant}}{V}$

(A) $x = (k)\sqrt{y} \Rightarrow y = k^1x^2$

(B) $V = kT$; $y = V$ & $\frac{1}{T} = x \therefore y = \frac{k}{x}$

(C) $P = kT$; $PT = kT^2$ or $y = kx$

(D) $v = \frac{c}{p} \Rightarrow y = c\sqrt{x}$; $y^2 = cx$