LEVEL # 1

GAS EQUATION AND RELATED LAWS

Q.1 The mass of CO_2 that must be mixed with 20 g. of oxygen such that 27ml. of a sample of the resulting mixture contains equal number of molecules of each gas :

(A) 13.75g (B) 27.5g (C) 41.25g (D) 55g.

Q.2 The time taken for effusion of 32ml. oxygen will be the same as the time taken for effusion under identical conditions of :

(A) 64ml of H_2 (B) 50ml of N_2 (C) 27.3ml of CO_2 (D) None of these

Q.3 Which of the following gases will have the same rate of diffusion under indentical condition?

(i) CO (ii) CO_2 (iii) N_2O (iv) N_2

(v) C_2H_4 (vi) C_3H_8

(A) CO, CO_2, C_2H_4 (B) CO_2, C_2H_4, N_2O

(C) C_3H_8, N_2O, CO_2 (D) CO, N_2, C_2H_4, C_3H_8

Q.4 A certain gas diffuses from two different vessels A and B. The Vessel A has a circular orifice while vessel B has square orifice of length equal to the radius of the orifice of vessels A. The ratio of the rates of diffusion of the gas from vessel A to that of in vessel B assuming same T & P is :

(A) π (B) $1/\pi$ (C) $1:1$ (D) $2:1$

Q.5 A mixture of hydrogen and oxygen (45ml) is sparked to form liquid water. The component not in excess reacts completely and 15ml is left over (All measurements are at the same temperature and pressure). The composition by volume in the original mixture of $H_2 : O_2$ is :

(A) 4 : 5 (B) 7 : 2 (C) either 4 : 5 or 7 : 2 (D) 2 : 1

Q.6 A balloon filled with ethylene is pricked with a sharp pointed needle and quickly placed in a tank full of hydrogen at same pressure. After a while the balloon would have :

(A) Shrunk (B) Enlarged

(C) Completely collapsed (D) Remain unchanged in the size

Q.7 What volume of chlorine at STP is required to liberate all the iodine from 200ml of 0.2 M potassium iodine solution ?

(A) 896 ml (B) 448ml (C) 224ml (D) 672ml

Q.8 For a certain gas which deviates a little from ideal behaviour, the values of T measured at different values of pressure P. The plot of $\frac{P}{p}$ on the Y axis verus P on the X axis was nonlinear and had an interception on the Y axis, which was equal to :

(A) $\frac{RT}{M}$ (B) $\frac{M}{RT}$ (C) RT (D) $\frac{RT}{V}$

where M = molar mass

Q.9 When an equimolar mixture of hydrogen and oxygen is allowed to diffuse through a small hole then the initial molar ratio of hydrogen to oxygen in the diffused is :

(A) 4 : 1 (B) 1 : 4 (C) 1 : 16 (D) 16 : 1

Q.10 Equal weights of nitrogen and carbon dioxide are introduced into an empty container. The fraction of the total pressure exerted by nitrogen is :

(A) $\frac{4}{18}$ (B) $\frac{11}{18}$ (C) $\frac{7}{11}$ (D) $\frac{4}{11}$

Q.11 0.44 g of a gas occupies at NTP 224 ml. The gas could be :

(A) O_2 (B) N_2 (C) CO_2 (D) SO_2

Q.12 A certain gas X, has a rate of diffusion $R_X = \frac{R_{CH_4}}{1.9}$ under the same conditions of temperature and pressure. If the gas belongs to the same homologous series as methane what is the molecular formula of the gas :

(A) C_4H_{10} (B) C_5H_{12} (C) C_3H_8 (D) C_6H_{14}

Q.13 A gas mixture contains N_2, NO and NO_2. The total volume of the mixture pressure at 27ºC is 100ml. If the ratio of the partial pressure $P_{N_2} : P_{NO_2}$, $P_{N_2} : P_{NO}$ = 1 : 5 what is the volume (partial) of NO in the mixture ?

(A) 83 ml (B) 60 ml (C) 53 ml (D) 80 ml

Q.14 A sealed vacuum flask of capacity 2 litres has air at a pressure of 10^{-5} torr at 27ºC the gas molecules are present in it ?

(A) -6.42×10^{20} (B) -3.21×10^{14} (C) -10^{20} (D) -6.4×10^{14}

Q.15 What is the ratio of densities of a gas (i) at 0·C and 700 mm Hg pressure and (ii) at 27ºC and 760 mm Hg ?

(A) 1 : 1.092 (B) 1.012 : 1 (C) 1.092 : 1 (D) 1 : 1.012

Q.16 The empirical formula of a gas is CH_2O. If 4.02 grams of this gas occupies 1.00 / at 0·C and 1.00 atm then its molecular formula is :

(A) $C_5H_{10}O_5$ (B) CH_2O (C) $C_3H_6O_3$ (D) $C_4H_8O_4$

Q.17 Calculate the number of moles of oxygen gas collected by displacement of water at 14ºC if atmospheric pressure is 790 torr. and the volume is 5.00 /.The vapour pressure of water at 14ºC is 12.0 torr :

(A) 4.46 (B) 0.224 (C) 0.217 (D) 0.00184

Q.18 It takes 6 times as long for a given quantity of gas A to effuse from a container than it takes for the same quantity of gas B. If the molar mass of A is 72 g mol^{-1}. What is the molar mass of B in g mol^{-1}?

(A) 610 (B) 2.0 (C) 12 (D) 3.5

Q.19 Consider two flask connected by a stop cock, one flask has a volume of 250 ml and contain O_2 (g) at 650 torr and the other flask has a volume of 300 ml and contains neon gas at 352 torr. If the stopcock is opened so that the two gases mix. Calculate the partial pressure of neon gas :

(A) 295 torr (B) 450 torr (C) 745 torr (D) 200 torr

Q.20 An unknown gas X has rate of diffusion measured to be 0.88 times that of PH_3 at the same conditions of T and P. The gas will be :

(A) C_2H_6 (B) CO (C) NO_2 (D) N_2O

Q.21 A gas in an open container is heated from 27ºC to 127ºC. The fraction of the original amount of gas remaining in the container will be :

(A) 3/4 (B) 1/2 (C) 1/4 (D) 1/8

Q.22 A vessels contains 1.7 g NH_3 gas and 5.1g H_2S gas. The value of effective molar mass of gas mixture at 27ºCwill be :

(A) 34 (B) 27.2 (C) 25.5 (D) 68

Q.23 A gaseous mixture prepared with 85 cc of CO and 139 cc of nitrogen measured at N.T.P would weigh:

(A) 0.28 g (B) 0.028 g (C) 0.56 g (D) 0.014 g

Q.24 A open beaker is at 27ºC and is filled with air, it is heated to 127ºC. The amount of original air that will be thrown out of the beaker will be :

(A) 12.5% (B) 25% (C) 50% (D) 75%

Q.25 The relationship between the rate of diffusion of a gas U and its molecular mass M is :

(A) $U \propto M$ (B) $U \propto \frac{1}{M}$ (C) $U \propto \frac{1}{M^2}$ (D) $U \propto \frac{1}{M^{1/2}}$

Q.26 Since the atomic masses of C, N and O are 12, 14 and 16 respectively, the pair among the following which will diffuse at the same rate is :

(A) CO_2 and N_2O (B) CO_2 and NO_2 (C) CO_2 and CO (D) N_2O and NO_2

Q.27 A closed vessel contains equal number of nitrogen and oxygen molecules at a pressure of 750 mm. If nitrogen is removed from the system then the pressure will be :

(A) 750 mm (B) 2 × 750 mm (C) $\frac{1}{2}$ × 750 mm (D) 750^2 mm

Q.28 A gas X diffuses three times as fast as gas Y. If the mol. weight of X is 64 the mol. weight of Y is

(A) 18 (B) 9 (C) 36 (D) 24

Q.29 To which of the following mixtures in Dalton's Law of partial pressure not applicable:

(A) H_2 and He (B) NH_3 and HCl (C) N_2 and H_2 (D) N_2 and O_2

Q.30 The molecular weight of O_2 and SO_2 are 32 and 64 respectively. If one litre of O_2 at 15°C and 750 mm pressure contains N molecules the number of molecules in two litres of SO_2 under the same conditions of temperature and pressure will be :

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

Q.31 How many molecules are present in one gm of hydrogen ?

(A) 6.023×10^{23} (B) 6.023×10^{22} (C) 3.0125×10^{22} (D) 3.0125×10^{23}

Q.32 The largest number of molecules is in :

(A) 54 gm of N_2O_5 (B) 28 gm of CO (C) 36 gm of H_2O (D) 36 gm of C_2H_5OH

Q.33 The number of atom in 12 g of $_6C^{12}$ is :

(A) 6 (B) 6.02×10^{23} (C) 12 (D) $12 \times 6.02 \times 10^{23}$

Q.34 The number of moles of H_2 in 0.224 litres of hydrogen at STP (273 K, 1 atm) (assuming ideal gas behaviour) is :

(A) 1 (B) 0.1 (C) 0.01 (D) 0.001

Q.35 Equal weights of methane and oxygen are mixed in an empty container at 25°C. The fraction of the total pressure exerted by oxygen is :

(A) 1/3 (B) 1/2 (C) 2/3 (D) 1/3 × 273/298

Q.36 In an experiment during the analysis of a carbon compound, 145 cc of H_2 was collected at 760 mm of Hg pressure and 27°C temperature. The weight of H_2 is nearly:

(A) 10 mg (B) 12 mg (C) 24 mg (D) 6 mg

Q.37 The vapour density of a gas is 11.2. The volume occupied by 11.2 gm of the gas at N.T.P. is :

(A) 1 litre (B) 11.2 litre (C) 22.4 litre (D) 44.8 litre

Q.38 Helium diffuses twice as fast as another gas B. If the vapour density of helium is 2, the molecular weight of B is :

(A) 4 (B) 8 (C) 16 (D) 24

Q.39 A gas is initially at 1 atm pressure. To compress it to 1/4th of its initial volume, pressure to be applied is :

(A) 1 atm (B) 2 atm (C) 4 atm (D) 1/4 atm

Q.40 A gas of volume 100 cc is kept in a vessel at pressure 10^4 P maintained at a temperature of 24°C. If the pressure is increased to 10^5P, keeping the temperature constant, then the volume of the gases becomes :

(A) 10 cc (B) 100 cc (C) 1 cc (D) 1000 cc

Q.41 A sample of gas occupies 100 ml at 27°C and 740 mm pressure. When its volume is changed to 80 ml at 740 mm pressure, the temperature of the gases will be :

(A) 21.6°C (B) 240°C (C) – 33°C (D) 89.5°C

Q.42 One litres of a gas weighs 2g at 300K and 1 atm pressure. If the pressure is made 0.75 atm. at which of the following temperature will one litre of the same gas weigh 1 gm ?
(A) 450K (B) 600K (C) 800K (D) 900K

Q.43 A sample of gas has a volume of 0.2 litre measured at 1 atm pressure and 0ºC, at the same pressure but at 273ºC, its volume will become :
(A) 0.1 lit. (B) 0.4 lit. (C) 0.6 lit. (D) 0.8 lit.

Q.44 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* ?
(A) 20ºC (B) 30ºC (C) 400K (D) 300K

Q.45 16 gm of oxygen and 3 gm of hydrogen are mixed and kept in 760 mm pressure at 0ºC. The total volume occupied by the mixture will be nearly :
(A) 22.4 *l* (B) 33.6 *l* (C) 448 litres (D) 44800 ml

Q.46 A sample of a given mass of a gas at a constant temperature occupied 95 cm^3 under a pressure of 9.962×10^4 Nm^{-2}. At the same temperature its volume at a pressure of 10.13×10^4 Nm^{-2} is :
(A) 190 cm^3 (B) 93 cm^3 (C) 46.5 cm^3 (D) 47.5 cm^3

Q.47 If two moles of an ideal gas at 546 K occupies a volume of 44.8 litres, the pressure must be:
(A) 2 atm (B) 3 atm (C) 4 atm (D) 1 atm

Q.48 300 ml of gas at 27ºC is cooled to 3ºC at constant pressure, the final volume is :
(A) 540 ml (B) 135 ml (C) 270 ml (D) 350 ml

Q.49 50 ml of gas A diffuses through a membrane in the same times as for the diffusion of 40 ml of a gas B under identical pressure-temperature conditions. If the molecular weight of A is 64 then molecular weight of B would be :
(A) 100 (B) 250 (C) 200 (D) 80

Q.50 Which is not true in case of an ideal gas ?
(A) It cannot be converted into a liquid
(B) There is no interaction between the molecules
(C) All the molecules of the gas move with same speed
(D) At a given temperature PV is proportional to the amount of gas

Q.51 In the gas equation PV = *n*RT the value of R depends upon :
(A) nature of gas (B) pressure of gas
(C) unit of measurement (D) temperature of gas

Q.52 The value of R in calorie/degree/mole is ;
(A) 0.0831 (B) 8.31 (C) 8.31×10^7 (D) 1.987

Q.53 The density of gas A is four times that of gas B, if the molecular weight of A is M, that of B is :
(A) 2M (B) M/2 (C) 4M (D) M/4

KINETIC THEORY OF GASES

Q.54 An ideal gas is at a pressure P and temperature T in a box which is kept in vacuum with in a large container. The wall of the box is punctured. What happens as the gas escapes through the hole ?
(A) the temperature falls (B) its temperature rises
(C) its temperature remains the same (D) unpredictable

Q.55 Which of the following statements in not true ?
(A) The ratio of the mean speed to the rms speed is independent of the temperature.
(B) The square of the mean speed of the molecules is equal to the mean squared speed at a certain temperature.
(C) Mean kinetic energy of the gas molecules at any given temperature is independent of the mean speed.
(D) The difference between rms speed and mean speed at any temperature for different gas diminishes as larger and yet larger molar masses are considered.

Q.56 The rms speed of oxygen molecules at a given temperature to that of sulphur dioxide molecule at the same temperature is in the ratio :
(A) 2 : 1 (B) 1 : $\sqrt{2}$ (C) $\sqrt{2}$: 1 (D) 1 : 1

Q.57 The mean kinetic energies of molecules of all gas are the same at
(A) The same temperature (B) Their inversion temperature only
(C) Their Boyle temperature only (D) Their critical temperature only.

Q.58 For a gaseous reaction the plot of k against 1/T gave a straight line with a slope of -8×10^3 then the energy of activation E for the reaction is :

(A) $\frac{-8 \times 10^3 \times 2.303}{R}$ (B) $\frac{-8 \times 10^3 \times R}{2.303}$ (C) $-8 \times 10^3 \times 2.303\,R$ (D) $\frac{-8 \times 10^3}{2.303 R}$

Q.59 The ratio between root mean square velocity and mean velocity is as :
(A) 1 : 1.128 (B) 1 : 1.085 (C) 1.085 : 1 (D) 1.085 : 1.128

Q.60 Calculate the number of collisions that an argon atom undergoes per second at 2.00 torr and 20·C. The average speed at these conditions is 428 ms^{-1} and the diameter of an argon atom is 360 pm. :
(A) 1.6×10^{-5} (B) 1.6×10^{-5} (C) 2.4×10^4 (D) 1.2×10^{-2}

Q.61 Calculate the kinetic energy of a hydrogen molecule travelling at 1900 meters per second :
(A) 6.04×10^{-21} J (B) 6.04×10^{-18} J (C) 1.21×10^{-20} J (D) 3.02×10^{-21} J

Q.62 Which of the following expression (s) is are true :

(A) $U_{rms} = \sqrt{\frac{3PV}{m}}$ (B) $U_{rms} = \sqrt{\frac{3RT}{m}}$ (C) $U_{rms} = \sqrt{\frac{3PV}{M}}$ (D) None of these

P = pressure of gas, V = volume of gas, *m* = mass of gas, M = molar mass of gas

Q.63 An ideal gas :
(A) Has no intermolecular attraction
(B) Molecules do not collide with each other
(C) The product of P and V is constant at a fixed temperature *i.e.* PV = constant
(D) Can be liquified with great difficulty.

Q.64 The *rms* velocity (μ), average velocity (v) and most probable velocity ($\propto$) of a gas are in the ratio :
(A) 0.82 : 0.92 : 1 (B) 1 : 0.92 : 0.82 (C) 0.92 : 0.82 : 1 (D) 1 : 0.82 : 0.92

Q.65 The temperature at which the most probable velocity of the gas molecules M is 3 times at 0ºC is :
(A) 819ºC (B) 2184ºC (C) 273ºC (D) 1365ºC

Q.66 According to the 'Kinetic theory of gases' :
(A) There are intermolecular attraction
(B) There is no intermolecular attraction
(C) The velocity of the molecule decreases for each collision
(D) Molecules have considerable volume.

Q.67 According to kinetic theory of gases, for a diatomic molecules :
(A) The pressure exerted by the gas is proportional to the mean velocity of the molecule
(B) The pressure exerted by the gas is proportional to the root mean square velocity of the molecules
(C) The root mean square velocity of the molecules is inversely proportional to the temperature
(D) By the translational kinetic energy of the molecules is proportional to the absolute temperature.

Q.68 Helium atom is two times heavier than a Hydrogen molecule. At 298 K the average kinetic energy of a Helium atom is :
(A) Two times that of a Hydrogen molecules (B) Same as that of a hydrogen molecules
(C) Four times that of a hydrogen molecules (D) Half that of a hydrogen molecules

Q.69 At constant volume for a fixed number of moles of a gas, the pressure of a gas increases with rise of temperature due to :
(A) Increase in average molecular speed (B) Increased rate of collisions amongst molecules
(C) Increase in molecular attraction (D) decrease in mean free path

Q.70 The ratio between the root mean square velocity of H_2 at 50 K and that of O_2 at 800 K is :
(A) 4 (B) 2 (C) 1 (D) 1/4

Q.71 At the same temperature and pressure, which of the following gases will have the highest kinetic energy per mole ?
(A) Hydrogen (B) Oxygen (C) Methane (D) All the same

Q.72 Pressure of a gas is due to :
(A) collisions of gas molecules
(B) the random movement of gas molecules
(C) the intermolecular forces of attraction between the gas molecules
(D) the collision of gas molecules against the walls of container

Q.73 The internal energy of 1 mole of an ideal gas is given by :
(A) 3/2RT (B) 1/2 KT (C) 1/2 RT (D) (3/2) KT

Q.74 At 27ºC the ratio of rms velocities of ozone to oxygen is :
(A) r(3/5) (B) r(4/3) (C) r(2/3) (D) 0.25

Q.75 At STP the order of mean square velocity of molecules of H_2, N_2, O_2 and HBr is :
(A) $H_2 > N_2 > O_2 > HBr$ (B) $HBr > O_2 > N_2 > H_2$ (C) $HBr > H_2 > O_2 > N_2$ (D) $N_2 > O_2 > H_2 > HBr$

Q.76 At what temperature will the average speed of CH_4 molecules have the same value of O_2 at 300 K ?
(A) 1200 K (B) 150 K (C) 600 K (D) 300 K

Q.77 A closed flask contains water in all its three states, solid, liquid and vapour at 0·C. In this situation the average kinetic energy of water molecules will be :
(A) greatest in the vapour state (B) same in all the three state
(C) greatest in the solid state (D) greatest in the liquid than in the vapour state

Q.78 When an ideal gas undergoes unrestrained expansion, no cooling occurs because the molecules :
(A) are above the inversion temperature (B) exert no attractive force on each other
(C) do work equal to loss in kinetic energy (D) collide without loss of energy

Q.79 The molecular velocity of any gas is :
(A) proportional to the absolute temperature
(B) proportional to the square of absolute temperature
(C) proportional to the square root of the absolute temperature
(D) independent of the absolute temperature

Q.80 Average velocity (v) is equal to :
(A) 2.8 × *rms* velocity (u) (B) 0.9812u
(C) 0.9213u (D) 0.7567u.

VANDER WALL'S EQUATION

Q.81 The units of Vander Waal's constant 'b' is :
(A) litres atm^{-1} (B) litres $mole^{-1}$ (C) atmosphere $litre^{-1}$ (D) $litres^2$ $moles^2$

Q.82 Vander Waal's forces in molecular solids and liquids generally :
(A) Are found in only systems having permanent dipole moment
(B) Are for the most part repulsive
(C) Increase with increasing size of atoms and molecules involved
(D) Result in high melting and boiling temperatures

Q.83 The values of the Vander Waal's constant 'a' for N_2, O_2, C_2H_4 and NH_3 are 1.39, 1.32, 4.47 and 4.17 L^2. mol^{-1} respectively. The gas which can most easily be liquified is :
(A) O_2 (B) N_2 (C) NH_3 (D) C_2H_4

Q.84 The Vander Waal's equation for x moles of a real gas is given by :

(A) $\left(P+\frac{a}{V^2}\right)(V^2 - b) = xRT$ (B) $\left(P+\frac{xa}{V^2}\right)(V - xb) = xRT$

(C) $\left(P+\frac{x^2a}{V^2}\right)(V - xb) = xRT$ (D) $\left(P+\frac{xa}{V}\right)(V^2 - xb) = xRT$

Q.85 The Vander Waal's Constant for a gas X in litre atm units are 0.246 and 2.67×10^{-3} respectively. The inversion temperature in equal to :

(A) 449.44 K (B) 224.72 K (C) 112.36 K (D) 337.08 K

Q.86 The critical temperature T_c of a gas is equal to :

(A) $\frac{a}{27b^2}$ (B) 3b (C) $\frac{8a}{27bR}$ (D) $\frac{8a}{9bR}$

Q.87 In Vander Waal's equation of state for a non-ideal gas, the term that accounts for intermolecular forces is :

(A) $(V - b)$ (B) RT (C) $\left(P+\frac{a}{V^2}\right)$ (D) $(RT)^{-1}$

Q.88 A real gas most closely approaches the behaviour of an ideal gas at :

(A) 15 atmospheres and 200 K (B) 1 atm and 273 K

(C) 0.5 atm and 500 K (D) 15 atm and 500 K

Q.89 An ideal gas cannot be liquefied because :

(A) its critical temperature is always above 0ºC

(B) its molecules are relatively smaller inside

(C) it solidifies before becoming a liquid

(D) forces operative between its molecules are negligible.

Q.90 The Vander Waal's equation explains the behaviour of :

(A) ideal gases (B) real gases (C) vapours (D) non-real gases

MISCELLENEOUS

Q.91 A mixture of methane and ethane in the mole ratio X : Y has a mean molecular weight = 20. What would be the mean molecular weight if the same gases are mixed in the ratio of Y : X?

(A) 22 (B) 24 (C) 20.8 (D) 19

Q.92 A certain metal falls to liberate H_2 gas from a moderately concentrated hydrochloric acid solution. However it displaces Ag from $AgNO_3$ solution. Which among the following may be ?

(A) Mercury (B) Iron (C) Copper (D) Cadmium

Q.93 The viscosity of a liquid decreases with temperature because :

(A) Higher temperature leads to volume expansion of the liquid

(B) Higher temperature increases the repulsive intermolecular forces and makes the molecular layers slide past each other more easily

(C) Increase in thermal energy of the molecules with temperature decreases the influence of intermolecular attraction

(D) All the above are contributory factors.

Q.94 A balloon is inflated under water to a volume of 2.25 / at a pressure of 100 kPa when the water temperature is 6ºC. The volume of the balloon on the surface where the pressure is kPa and the temperature is 25ºC is :
(A) 60.2 / (B) 235 / (C) 52.8 / (D) 2.25 /

Q.95 A pressure of 0.000100 Pa is obtained using an oil diffusion pump. Calculate the number of molecules in 1.00 ml gas at this pressure at 0·C :
(A) 2.65×10^{10} (B) 7.33×10^{8} (C) 4.41×10^{-14} (D) 4.41×10^{-8}

Q.96 Consider two flask connected by a stop cock, one flask has a volume of 250 ml and contain O_2 (g) at 650 torr and the other flask has a volume of 300 ml and contains neon gas at 352 torr. If the stopcock is opened so that the two gases mix. Calculate the partial pressure of neon gas :
(A) 295 torr (B) 450 torr (C) 745 torr (D) 200 torr

Q.97 One mole of liquid water occupies 17.3 milliltres at 100ºC. Under the same conditions one mole of water vapour occupies :
(A) Less than 17.3 ml (B) 17.3 ml (C) 34.6 ml (D) 22.4 ml

Q.98 If gaseous nitrogen exerts a pressure of 4.1 atm at 500 K in a vessel unknown volume then the number of molecules of nitrogen present per litre would be :
(A) 6.02×10^{23} (B) 6.02×10^{22} (C) 6.02×10^{21}
(D) insufficient data, volume should be specified

Q.99 Density of neon will be least at :
(A) STP (B) 0ºC, 2 atm (C) 273ºC, 1 atm (D) 273ºC, 2 atm

Q.100 To which of the following mixtures in Dalton's Law of partial pressure not applicable:
(A) H_2 and He (B) NH_3 and HCl (C) N_2 and H_2 (D) N_2 and O_2

Q.101 Five grams each of the following gases at 87ºC and 750 mm pressure are taken. Which of them will have the least volume ?
(A) HF (B) HCl (C) HBr (D) HI

Q.102 Equal weights of methane and oxygen are mixed in an empty container at 25ºC. The fraction of the total pressure exerted by oxygen is :
(A) 1/3 (B) 1/2 (C) 2/3 (D) 1/3 × 273/298

Q.103 If the weight of 5.6 litres of gas at NTP is 11 gm. The gas may be :
(A) PH_3 (B) $COCl_2$ (C) NO (D) N_2O

Q.104 Which is not true in case of an ideal gas ?
(A) It cannot be converted into a liquid
(B) There is no interaction between the molecules
(C) All the molecules of the gas move with same speed
(D) At a given temperature PV is proportional to the amount of gas

LEVEL # 2

Q.1 One mole of liquid water occupies 17·3 milli litres at 100ºC. Under the same conditions one mole of water vapour occupies :
(A) less than 17·3 ml (B) 17·3 ml (C) 34·6 ml
(D) 22·4 ml (E) over 30,000 ml

Q.2 Consider the following reaction
$CoCl_2$ (s) + 2HF (g) $\rightarrow$ CoF_2 (s) + 2HCl (g)
How many litres of HF (g) measured at 0·831 atm and – 18ºC are required to produce 454 grams of CoF_2 (s) ?
(A) 59·0 *l* (B) 118 *l* (C) 236 *l* (D) 16·6 *l*

Q.3 Consider the following reaction
$3H_2$ (g) + WO_3 (g) $\rightarrow$ $3H_2O$ (g) + W (s)
Calculate the number of grams of W (s) produced by reaction 425 *l* of H_2 (g) at 1·40 atm and 175ºC with 25·0 of WO_3 (g) :
(A) 29·8 g (B) 9·93 g (C) 19·9 g (D) 76·3 g

Q.4 Consider the following reaction :
$CaCO_3$ (s) + 2HCl (aq) $\rightarrow$ $CaCl_2$ (aq) + CO_2 (g) + H_2O (*l*)
A 7·96 g sample of impure carbonate reacts with HCl (aq) and produces 1·25 of CO_2 (g) at 98·7 kPa and 22ºC. Calculate the percentage purity of the $CaCO_3$ (s) sample:
(A) 36·8% (B) 31·6% (C) 63·2% (D) 27·8%

Q.5 A balloon is inflated underwater to a volume of 2·25 *l* at a pressure of 2500 kPa when the water temperature is 6ºC is :
(A) 60·2*l* (B) 235 *l* (C) 52·8 *l* (D) 2·25 *l*

Q.6 CO_2 gas and Helium are kept in a container at partial pressures p_1 and p_2 at temperature T. A small perforation is now made in the wall of the container and it is observed that both gases effuse out at the same rate (ie) same number of molecules per unit time. What is the ratio of p_1 : p_2 ?
(A) 1 : 3.33 (B) 2 : 1 (C) 3.33 : 1 (D) 1 : 2

Q.7 A gaseous hydrogen has a density 2·06 grams/litre at the same temperature and pressure at which oxygen has a density = 2·21 grams/litre. The hydrocarbon is :
(A) CH_4 (B) C_2H_2 (C) C_3H_6 (D) C_2H_6

Q.8 The critical pressure, P_C and the critical temperature, T_C of a gas are 12·77 atm and – 240ºC. What is the magnitude of the critical volume ?
(A) 0·0532 litre/mol (B) 0·064 litre/mol (C) 0·0388 litre/mol (D) 0·0796 litre/mol

Q.9 5 moles of a gas have a volume of one litre at 320 K. Calculate the value of (P_1 – P_2). P_1 is the pressure expected for the gas for ideal behaviour; P_2 is the gas pressure if the gas obeys vander waals equation. Given a = 3·59 atm litre^2 mole^{-2} and b = 0·0427 litre/mol:
(A) 54 atm (B) 44 atm (C) 62 atm (D) 34 atm

Q.10 Use the values of 'a' and 'b' given in the preceding problem and calculate the critical temperature of the gas :
(A) 333·4K (B) 303·4 K (C) 410·0 K (D) 373·4 K

Q.11 The value a of vander waal's constant for the gases O_2, N_2, NH_3 and CH_4 are 1·36, 1·39, 4·17 and 2·25 l^2 atm mol^{-1} respectively. The gas which can be most easily liquified is :
(A) O_2 (B) N_2 (C) NH_3 (D) CH_4

Q.12 The pressure-volume plot for an ideal gas at given temperature has the form of a :
(A) Straight line (B) Exponential curve
(C) Rectangular hyperbola (D) U-shaped curve.

Q.13 The average, RMS and most probable velocities of gas molecules at STP increase in the order:
(A) RMS < average velocity < most probable velocity
(B) Most probable velocity < average velocity < RMS
(C) Average velocity < RMS < most probable velocity
(D) RMS < most probable velocity > average velocity.

Q.14 The kinetic energy in Kcal of 80 gms of methane gas at 227ºC is:
(A) 15 (B) 2.5 (C) 25 (D) 7.5.

Q.15 For a real gas, PV is a constant over a small range of pressures, at :
(A) Boyle's temperature (B) Critical temperature
(C) Inversion temperature (D) Ordinary temperature.

Q.16 Joule-Thomson expansion of an ideal gas is an :
(A) Isothermal process (B) Isobaric process
(C) Isoenthalpic process (D) Ideal process.

Q.17 Equal volumes of SO_2 and He at a temperature T and pressure P are allowed to effuse through a hole. The rate of effusion of helium is :
(A) Equal to the rate of effusion of SO_2 (B) Four times the rate of effusion of SO_2
(C) Half of the rate of effusion of SO_2 (D) Twice the rate of effusion of SO_2.

Q.18 If certain mass of gas is expanded at constant temperature :
(A) The pressure of the gas decreases
(B) The kinetic energy of the gas molecules increases
(C) The kinetic energy of the molecules decreases
(D) The number of molecules of the gas increases.

Q.19 The ratio, $\frac{\text{rms velocity of } SO_2}{\text{rms velocity of He}}$, of sulphur dioxide and helium gases at 30·C is equal:
(A) 4 (B) 0.25 (C) 0.10 (D) 8.

Q.20 A certain volume of argon gas (Mol. wt. = 40) requires 45 *s* to effuse through a hole at a certain pressure and temperature. The same volume of another gas of unknown molecular weight requires 60 *s* to pass through the same hole under the same conditions of temperature and pressure. the molecular weight of the gas is:

(A) 53 (B) 35 (C) 71 (D) 120.

Q.21 Three gases A, B and C have values of van der waal's constants, a (in units of litre^2 mol^{-2} atm) of 1.38, 6.70 and 4.00 respectively. The ease of liquification of these gases decreases in the order :

(A) B > A > C (B) B > C > A (C) B > A > C (D) C > A > B.

Q.22 Which of the following contains the greatest number of nitrogen atoms ?

(A) 500 ml of 2.0 M NH_3 (B) One mole of NH_4Cl

(C) 6.02×10^{23} molecules of NO_2 gas (D) 22.4 litres of N_2 gas at 0ºC and 1atm.

Q.23 The critical temperature and critical pressure of a gas obeying van der Waal's equation are 30ºC and 73 atm respectively. Its van der Waal's constant, *b* (in litres mol^{-1}) is, therefore :

(A) 0.500 (B) 0.060 (C) 0.265 (D) 0.128.

Q.24 The average kinetic energy of two moles of CO_2 at a certain temperature is 1800 cal. The temperature of the gas is :

(A) 300 K (B) 150 K (C) 200 K (D) 400 K.

Q.25 The relative ratio of U*rms* : U*n* : U*mp* at a given temperature is :

(A) $\sqrt{3} : \sqrt{\frac{56}{22}} : \sqrt{2}$ (B) $\sqrt{\frac{56}{22}} : \sqrt{2} : \sqrt{3}$

(C) $\sqrt{3} : \sqrt{2} : \sqrt{\frac{56}{22}}$ (D) $\sqrt{2} : \sqrt{\frac{56}{22}} : \sqrt{3}$

Q.26 At a given temperature if *r* (X) = 3*r* (Y) and M (Y), where *r* and M stand for density and molar mass of the gases X and Y, then the ratio of their pressures would be:

(A) $\frac{p(X)}{p(Y)} = \frac{1}{2}$ (B) $\frac{p(X)}{p(Y)} = 4$ (C) $\frac{p(X)}{p(Y)} = 6$ (D) $\frac{p(X)}{p(Y)} = \frac{1}{6}$

Q.27 The pressure of the atmosphere 100 miles above the earth is about 2×10^{-6} mm of Hg and temperature is – 18ºC. How many molecules are there in 1 ml of a gas at this altitude ?

(A) $2{\cdot}07 \times 10^{11}$ molecules (B) $1{\cdot}02 \times 10^{11}$ molecules

(C) $0{\cdot}05 \times 10^{10}$ molecules (D) $7{\cdot}58 \times 10^{10}$ molecules

Q.28 With increasing temperature the difference between most probable speed of molecules of a gas rms velocity and average velocity will :

(A) decrease (B) increase

(C) reamins the same (D) not predictable

Q.29 If the pressure of a gas is reduced 1/2 and the absolute temperature is doubled the volume of gas will :

(A) Double (B) Increases four times

(C) Remain unchanged (D) Become 1/4 th

Q.30 0·2 of CO_2 occupies 280 ml at a certain temperature and pressure. Under the same conditions 0·1 of an unknown gas occupies 220 ml. The unknown gas may be :

(A) Cl_2 (B) NO (C) CO (D) N_2

Q.31 An open flask contains air at 27ºC and one atm. pressure. The flask is heated to 127ºC at the same pressure. The fraction of original air remaining in the flask will be :

(A) 1/5 (B) 2/5 (C) 1/2 (D) 3/4

Q.32 Under what conditions does a real gas behave most normally as ideal gas ?

(A) At low pressure and low temperature (B) At low pressure and high temperature

(C) At high pressure and low temperature (D) At high pressure and high temperature

Q.33 When a vapour at atmospheric pressure was gradually heated from 25ºC. its colour was found to deepen at first and then to fade as the temperature was raised above 160ºC. At 600ºC the vapour was almost colourless, but its colour deepens when pressure was raised at this temperature. The above observations the consistent with the vapour being :

(A) pure bromine

(B) mixture of hydrogen and bromine

(C) mixture of nitrogen dioxide and nitrogen tetraoxide

(D) pure nitrogen dioxide

Q.34 A vessel contains 1·7 NH_3 gas and 5·1 H_2S gas. The value of effective molar mass of gas mixture at 27ºC will be :

(A) 34 (B) 27.2 (C) 25.5 (D) 68

Q.35 One mol of N_2O_4 is heated in a sealed tube upto a certain temperature. When the N_2O_4 is half dissociated into NO_2, the ratio of partial pressures of N_2O_4 : NO_2 is:

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

Q.36 The density of argon will be highest at :

(A) 0ºC, 2atm (B) 273ºC, atm (C) 500K, 2 atm (D) STP

Q.37 In LPG cylinder a very small amount of sulphur compound is mixed to detect any leakage. It is use of the phenomenon of :

(A) Osmosis (B) Boiling (C) Dilution (D) Diffusion

Q.38 A vessel has nitrogen gas and water vapour at a total pressure of 1 atm. The partial pressure of water vapour is 0·3 atm. When the contents of this vessel are transferred to another vessel having one-third the capacity of the original vessel, completely at the same temperature. The total pressure of the system in the new vessel is :

(A) 2·4 atm. (B) 1 atm. (C) 3·33 atm (D) 093 atm.

Q.39 The value of Vander Waal's constant 'a' is maximum is for :
(A) helium (B) nitrogen (C) O_2 (D) CH_4

Q.40 The corrected Van der Waal's equation for a real gas is :

(A) $\left(P+\frac{n^2a}{V^2}\right)(V - nb) = nRT$ (B) $\left(P-\frac{n^2}{V^2}\right)(V - nb) = nRT$

(C) $\left(P-\frac{n^2a}{(V^2-nb)^2}\right)(V - nb) = nRT$ (D) $\left(P-\frac{n^2a}{(V-nb)^2}\right)(V - nb) = nRT$

Q.41 For two gases, A and B with molecular weight XA and XB, it is observed that at a certain temperature, T, the mean velocity of A is equal to the root mean squared velocity of B. Thus then mean velocity of A can be made equal to the mean velocity of B, if
(A) A is at temperature $T_2 < T_1 > T$
(B) A is lowered to a temperature $T_2 < T$ while B is at T
(C) Both A and B are raised to a higher temperature
(D) Both A and B are lowered in temperature

Q.42 Producer gas is a mixture of :
(A) $CO + N_2$ (B) $CO_2 + H_2$ (C) $CO + H_2$ (D) $CO_2 + N_2$

Q.43 Dry ice is :
(A) Solid ice without water (B) Solid SO_2
(C) Solid CO_2 (D) Solid C_6H_6

LEVEL # 3

Q.1 Equal masses of methane and oxygen are mixed in an empty container at 25°C. The fraction of total pressure exerted by oxygen is : **[IIT-1981]**

(A) 1/3 (B) 1/2 (C) 2/3 (D) 1/3 x 273/298

Q.2 The temperature at which real gases obey the ideal gas laws over a wide range of pressure is called: **[IIT-1981]**

(A) Critical temperature (B) Boyle temperature

(C) Inversion temperature (D) Reduce temperature

Q.3 The ratio of root mean square velocity to average velocity of gas molecules at a particular temperature is : **[IIT-1981]**

(A) 1·086 : 1 (B) 1 : 1·086 (C) 2 : 1·086 (D) 1·086 : 2

Q.4 Equal masses of methane and hydrogen are mixed in an empty container at 25°C. The fraction of the total pressure exerted by hydrogen is : **[IIT-1984]**

(A) 1/2 (B) 8/9 (C) 1/9 (D) 16/17

Q.5 The total KE of an ideal monoatomic gas at 27ºC is : **[IIT-1984]**

(A) 900 cal. (B) 1600 cal. (C) 300 cal. (D) None

Q.6 When an ideal gas undergoes unrestrained expansion no cooling occurs because the molecules : **[IIT-1984]**

(A) Are above the inversion temperature (B) Exert no attractive forces on each other

(C) Do work equal to loss in kinetic energy (D) Collide without loss of energy

Q.7 Rate of diffusion of a gas is : **[IIT-1985]**

(A) Directly proportional to its density

(B) Directly proportional to its molecular mass

(C) Directly proportional to the square root of its molecular mass

(D) Inversely proportional to the root of its molecular mass.

Q.8 The average velocity of an ideal gas molecule at 27°C is 0·3 m/sec. The average velocity at 927°C will be : **[IIT-1986]**

(A) 0·6 m/sec (B) 0·3 m/sec (C) 0·9 m/sec (D) 3·0 m/sec

Q.9 If a gas expands at constant temperature : **[IIT-1986]**

(A) The pressure decreases

(B) The kinetic energy of molecules remain the same

(C) The kinetic energy of molecules decreases

(D) The number of molecules of the gas increases

Q.10 A bottle of dry ammonia and a bottle of dry hydrogen chloride connected through a long tube are opened simultaneously at both ends, the white ammonium chloride ring first formed will be : **[IIT-1988]**

(A) At the centre of the tube (B) Near the hydrogen chloride bottle
(C) Near the Ammonia bottle (D) Through out the length of the tube

Q.11 In Vander Waal's of state for a non ideal gas the term that accounts for intermolecular force is : **[IIT-1988]**

(A) $(V - b)$ (B) RT (C) $\left(p + \frac{a}{V^2}\right)$ (D) $(RT)^{-1}$

Q.12 The values of Vander Waal's constant '*a*' for the gases O_2, N_2, NH_3 and CH_4 are 1·360, 1·390, 4·170 and 2·253 L atm mol^{-2} respectively. The gas which can most easily be liquified is : **[IIT-1989]**

(A) O_2 (B) N_2 (C) NH_3 (D) CH_4

Q.13 The density of Neon will be highest at : **[IIT-1990]**

(A) STP (B) 0ºC, 2 atm (C) 273ºC, 1 atm (D) 273ºC, 2 atm.

Q.14 The rate of diffusion of methane at a given temp. is twice that of a gas X. The molecular weight of X is : **[IIT-1990]**

(A) 64·0 (B) 32·0 (C) 4·0 (D) 8·0

Q.15 The compressibility of a gas is less than unity at STP. Therefore : **[IIT-1991]**

(A) $V_m > 22{\cdot}4$ litres (B) $V_m < 22{\cdot}4$ litres (C) $Vm = 22{\cdot}4$ litres (D) $V_m = 44{\cdot}8$ litres

Q.16 According to kinetic theory of gases, for a diatomic molecule **[IIT-1991]**

(A) The pressure exerted by the gas is proportional to the mean velocity of the molecule
(B) The pressure exerted by the gas is proportional to the root mean square velocity of the molecule
(C) The root mean square velocity of the molecule is inversely proportional to the temperature
(D) The mean translational kinetic energy of the molecule is proportional to the absolute temperature

Q.17 Consider an ideal gas contained in a vessel. If the intermolecular interaction suddenly begins to act, which of the following will happen ? **[REE-1991]**

(A) The pressure decreases (B) The pressure increases
(C) The pressure remains unchanged (D) The gas collapses.

Q.18 At constant volume, for a fixed number of moles of a gas the pressure of the gas increase with rise of temperature due to : **[IIT-1992]**

(A) Increase in average molecular speed (B) Increase rate of collisions amongs molecules
(C) Increase in molecular attraction (D) Decrease in mean free path.

Q.19 Equal weights of ethane and hydrogen are mixed in an empty container at 25ºC. Thus fraction of the total pressure exerted by hydrogen is : **[IIT-1993]**

(A) 1 : 2 (B) 1 : 1 (C) 1 : 16 (D) 15 : 16.

Q.20 In a closed room of 1000 m^3, a perfume bottle is opened up. The room develops smell. This is due to which property of gases ? **[IIT-1994]**

(A) Viscosity (B) Diffusion (C) Density (D) None

Q.21 An ideal gas expands according to the law P^2V = constant on expansion the temp of the gas- **[REE-1994]**

(A) Will rise

(B) Will drop

(C) Will remain constant

(D) Can not be determined becans the external pressure is not known

Q.22 Which of the following statements are true- **[REE-1995]**

(A) A real gas would behave like an ideal gas at high tem. and low pressure

(B) A real gas always earth more pressure on the enclosure than an ideal gas under equivalent conditions.

(C) A ideal gas would never condense in to liquid state.

(D) The temp. of a real gas dropswhen it expands.

Q.23 Which of the following gas molecules has the longest mean free path : **[IIT-1995]**

(A) H_2 (B) N_2 (C) O_2 (D) Cl_2

Q.24 The ratio between the root mean square velocity of H_2 at 50 K and that of O_2 at 800 K is: **[IIT-1996]**

(A) 4 (B) 2 (C) 1 (D) 1/4

Q.25 X ml of H_2 gas effuses through a hole in a container in 5 seconds the time taken for the effusion of the same volume of the gas specified below under identical conditions is : **[IIT-1996]**

(A) 10 seconds : He (B) 20 seconds : O_2

(C) 25 seconds : CO (D) 55 seconds : CO_2

Q.26 The critical temperature of water is higher than that of O_2 because the H_2O molecules has: **[IIT-1997]**

(A) Fewer electrons than O_2 (B) Two covalent bonds

(C) V-shape (D) Dipole moment

Q.27 The compressibility factor for an ideal gas is : **[IIT-1997]**

(A) 1·5 (B) 1·0 (C) 2·0 (D) ∞

Q.28 According to Graham's law at a given temperature the ratio of the rates of diffusion r_A/r_B of gases A and B is given by : **[IIT-1998]**

(A) $(P_A/P_B)\ (M_A/M_B)^{1/2}$ (B) $(M_A/M_B)\ (P_A/P_B)^{1/2}$

(C) $(P_A/P_B)\ (M_B/M_A)^{1/2}$ (D) $(M_A/M_B)\ (P_B/P_A)^{1/2}$

Q.29 A gas will approach ideal behaviour at : **[IIT-1999]**

(A) Low temperature and low pressure (B) Low temperature and high pressure

(C) High temperature and low pressure (D) High temperature and high pressure

Q.30 At a temp. T K, the pressure of 4.0 gm argon in a bulb is P. The bulb is put in a bath having temp. higher by 50 K than the first one 0.8 gm of argon gas had to be removed to maintain original pressure. The temp. T is equal to- **[REE-1999]**

(A) 510 K (B) 200 K (C) 700 K (D) 73 K

Q.31 The root mean square velocity of an ideal gas at constant pressure varies with density (D) as : **[IIT-2001]**

(A) D^2 (B) D (C) $\sqrt{D}$ (D) $1/\sqrt{D}$

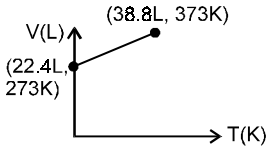
Q.32 At 100ºC and 1 atm, if the density of liquid water is 1.0 gm cm^{-3} and that of water vapour is 0.0006 gm cm^{-3} then the volume occupied by water molecules in 1 litre of steam at that temperature is : **[IIT-2000]**

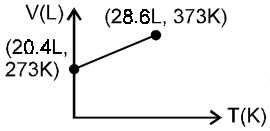
(A) 6 cm^3 (B) 60 cm^3 (C) 0.6 cm^3 (D) 0.06 cm^3

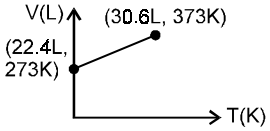
Q.33 The *rms* velocity of hydrogen is $\sqrt{7}$ times the *rms* velocity of nitrogen. If T is the temperature of the gas : **[IIT-2000]**

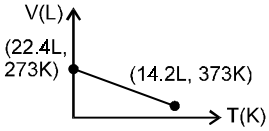
(A) $T(H_2) = T(N_2)$ (B) $T(H_2) > T(N_2)$ (C) $T(H_2) < T(N_2)$ (D) $T(H_2) = \sqrt{7}\ T(N_2)$.

Q.34 Which of the following volume M-temperature (T) plots respresents the behaviour of one mole of an ideal gas at one atmospheric pressure. **[IIT-2002]**

(A) 

(B) 

(C) 

(D) 

Q.35 When the temperature is increased, surface tension of water **[IIT-2002]**

(A) increases (B) decreases

(C) remains constant (D) shows irregular behaviour

Q.36 Positive deviation from ideal behaviour takes place becuase of **[IIT-2003]**

(A) molecular interaction between atoms and PV/nRT > 1

(B) molecular interaction between atoms and PV/nRT < 1

(C) finite size of the atoms and PV/nRT > 1

(D) finite size of the atoms and PV/nRT < 1

Q.37 For a monoatomic gas kinetic energy = E. The relation with rms velocity is **[IIT-2004]**

(A) $u = \left(\frac{2E}{m}\right)^{1/2}$ (B) $u = \left(\frac{3E}{2m}\right)^{1/2}$ (C) $u = \left(\frac{E}{2m}\right)^{1/2}$ (D) $u = \left(\frac{E}{3m}\right)^{1/2}$

Q.38 ΔH_{vap} = 30 kJ/mole and ΔS_{vap} = 75 J mol^{-1} K^{-1}. Find temperature of vapour, at one atmosphere **[IIT-2004]**

(A) 400 K (B) 350 K (C) 298 K (D) 250 K

Q.39 2 mol of an ideal gas expanded isothermally and reversibly from 1 litre to 10 litres at 300 K. What is the enthalpy change ? **[IIT-2004]**

(A) 4.98 k.J (B) 11.47 k.J (C) –11.47 k.J (D) 0 k.J