Gaseous State

Q.1. The pressure exerted by 12 g of an ideal gas at temperature t° C in a vesselof volume V litre is one atm. When the temperature is decreased by 10° at the same volume, the pressure decreases by 10%. The temperature t is given by :

(A) 103 K

(B) 173 K

(C) 273 K

(D) 100 K.

Q.2. An iron cylinder contains helium at a pressure of 200 kPa at 300 K. The cylinder can withstand a pressure of 1000 kPa. If the room in which the cylinder is kept catches fire. Whether the cylinder will blow up before it melts or not, if the melting point of the cylinder is 1800 K at :

(A) after the cylinder melts

(B) before the cylinder melts

(C) at its melting point

(D) none of these.

Q.3. An LPG cylinder weighs 14.8 kg when empty. When full, it weighs 29.0 kg and shows a pressure of 2.5 atm. In the course of use at 27° C, the weight of full cylinder is reduced to 20.5 kg. If LPG is n-butane with normal boiling point 0° C. The final pressure inside the cylinder is given by :

(A) 1.2 atm

(B) 1.4 atm

(C) 1.0 atm

(D) 1.5 atm

Q.4. A spherical balloon of 21 cm diameter is to be filled up with hydrogen gas atNTP from a cylinder containing the gas at 20 atm at 27° C. The cylinder can hold 2.82 litre of water at NTP. The number of balloon that can be filled up is :

(A) 10

(B) 8

(C) 5

(D) 2.

Q.5. A balloon of diameter 20 m weighs 100 kg. It is filled with He at 1.0 atm and 27° C. Density of air is 1.2 kg m^{-1}, R = 0.82 dm^3 atm $K^{-1}mol^{-1}$. The pay-load of the balloon will be :

(A) 42467 kg

(B) 4246700 g

(C) 4246.7 kg

(D) 424670 g.

Q.6. An open vessel at 27° C is heated until $3/5^{th}$ of the air in it is expelled. If the volume of the vessel is assumed to be constant, the temperature at which vessel was heated is :

(A) 477 K

(B) 477° C

(C) 750° C

(D) 750

Q.7. An open vessel at 27° C is heated until half of the air in it is expelled. If the volume of the vessel is assumed to be constant, the temperature at which vessel was heated is :

(A) 600 K

(B) 477° C

(C) 327° C

(D) 750 K.

Q.8. Two glass bulbs of equal volumes are connected by a narrow tube and filled with a gas at 0°C and pressure of 76 cm of Hg. One of the bulb is then placed in a water bath maintained at 62° C. If the volume of the connecting tube is negligible, the new value of the pressure inside the bulbs is :

(A) 75 cm of Hg

(B) 80 cm of Hg

(C) 83.75 cm of Hg

(D) none of these.

Q.9.A 10 litre cylinder contains 0.4 g of helium, 1.6 g of oxygen and 1.4 g of nitrogen at 27º C. Assume ideal behavior of gases. Given R = 0.082 litre atom $K^{-1}mol^{-1}$. The partial pressure of helium gas in the cylinder is :

(A) 0.123 atm

(B) 0.132 atm

(C) 0.231 atm

(D) 0.246 atm.

Q.10. An empty glass vessel weighs 50 g and 148 g when filled with a liquid of density 0.98 g mL^{-1} and 50.5 g when filled with an ideal gas at 760 mm Hg 300 K. The molecular weight of the gas is :

(A) 124

(B) 122

(C) 123

(D) 125**.**

Q.11.A column of Hg of 10 cm in length is contained in the middle of a narrow 1 m long tube closed at both ends. Both the halves of the tube contains air at a pressure of 76 cm of Hg. The distance of the column of Hg displaced if the tube is held vertical is :

(A) 1 cm

(B) 2 cm

(C) 3 cm

(D) 4 cm.

Q.12. A thin tube of uniform cross-section sealed at both ends lies horizontally. The middle

5 cm contains Hg and the two equal ends contains air at the same pressure P. When the tube is held at an angle 60º with the vertical, the length of the air column above and below the mercury are 46 cm and 44.5 cm respectively. The system is kept at 30º C. The pressure P in cm of Hg is :

(A) 76 cm

(B) 75.4 cm

(C) 75 cm

(D) none of the above

Q.13. A vertical hollow cylinder of height 152 cm is fitted with movable piston of negligible mass and thickness. The lower half of the cylinder contains an ideal gas and the upper half is filled with mercury. The cylinder is initially at 300 K. When the temperature of the cylinder is raised half of the mercury comes out of the cylinder. Assuming the thermal expansion of mercury to be negligible, the temperature is :

(A) 300.5 K

(B) 333.5 K

(C) 336.5

(D) 337.5

Q.14. One mole of N_2 at 0.8 atm takes 38 second to diffuse through a pinhole, whereas one mole of an unknown compound of xenon with fluorine at 1.6 atm takes 57 second to diffuse through the same hole. The molecular formula of the compound is :

(A) XeF

(B) XeF_6

(C) Xe_2F_3

(D) XeF_3.

Q.15. The compound of the equilibrium mixture ($Cl_2 \leftrightarrow 2Cl$), which is attained at 1200º C, is determined by measuring the rate of effusion through a pin hole. It is observed that at 1.80 mm Hg pressure, the mixture effuses 1.16 times as fast as krypton effuses under the same conditions. Atomic weight of Kr being 84, the fraction of chlorine molecules dissociated into atoms is :

(A) 10.7 %

(B) 11.7 %

(C) 12.7 %

(D) 13.7 %.

Q.16.A mixture containing 1.12 litre of D_2 and 2.24 litre of H_2 at NTP is taken inside a bulb through a stop cock with a small opening. The second bulb is fully evacuated. The stop cock is opened for a certain time and then closed. The first bulb is now found to contain 0.10 g of D_2. The % by weight of the gases D_2 and H_2 respectively in second bulb are :

(A) 40%, 60%

(B) 30%, 70%

(C) 41.67%, 58.33%

(D) none of the above.

Q.17. At 27° C, H_2 is leaked through a tiny hole into a vessel for 20 minutes. Another unknown gas at the same temperature and pressure as that of H_2 is leaked through the same hole for 20 minutes. After the effusion of the gases, the mixture exerts a pressure of 6 atm. The H_2 content of the mixture is 0.7 mole. If volume of container is 3 litre, the molecular weight of the unknown gas is :

(A) 510

(B) 1020

(C) 1010

(D) 920.

Q.18. A 4: 1 mixture of He and CH_4 is contained in a vessel at 20 bar pressure.Due to a hole in the vessel, the gas mixture leaks out. The composition of mixture effusing out initially is :

(A) 1: 4

(B) 4: 1

(C) 1: 8

(D) 8: 1.

Q.19. The average speed at T_1 K and the most probable speed at T_2 K of CO_2 gas is 9×10^4 cm sec^{-1}. The value of T_1 and T_2 are:

(A) 1684.0 K, 2143.37 K

(B) 1684.37 K, 2143.0 K

(C) 2443.0 K, 1268 K

(D) none of these.

Q.20. The average velocity of gas molecules is 400 m/sec. Its rms velocity in

m/sec at the same temperature is:

(A) 430

(B) 432

(C) 434

(D) 436.

Q.21. A glass bulb of 1 litre capacity contains 2×10^{21} molecules of nitrogen exerting pressure of 7.57×10^3 Nm^{-2}. The root mean square speed and the most probable speed when u_{MP} : u_{rms} being 0.82, are :

(A) 494.22, 405.26

(B) 490.22, 405.26

(C) 494.22, 400.26

(D) none of these.

Q.22. If volume occupied by CO_2 molecules is negligible, then the pressure exerted by one mole of CO_2 gas at 273 K, where a = 3.592 atm litre^2 mol^{-2}, is :

(A) less than 34 atm

(B) equal to 34 atm

(C) more than 34 atm

(D) none of the above.

Q.23. The compressibility factor for 1 mole of a van der Waals' gas at 0° C and 100 atmosphere pressure is found to be 0.5. Assuming that the volume of gas molecule is negligible the van der Waals' constant is :

(A) 3.592

(B) 3.125

(C) 1.125

(D) 1.253.

Q.24. One way of writing the equation of state for real gases is PV = RT [1 + B / V + ---- where B is a constant. An approximate expression for B in terms of van der Waals' constant a and b is:

(A) b + a / RT

(B) b – a / RT

(C) ab / RT

(D) none of the above.

Q.25. A graph is plotted between PV_m along y-axis and P along x-axis, where V_m is the molar volume of a real gas. The intercept made by the graph along y-axis is :

(A) nRT

(B) VRT

(C) RT

(D) P.