Topic: States of Matter 2

1. Calculate the pressure of the mixture, if at constant temperature 250 mL of N_2 at 640 mm pressure and 380 mL of O_2 at 700 mm pressure and 380 mL of O_2 at 700 mm pressure are filled in a flask of 1L capacity.
   Ans. 426 *mm*
2. 4g O_2 and 2g H_2 are filled at 0°C in a flask of 1L capacity. What would be the total pressure of the mixture?
   Ans. $= 25.18 atm$
3. H_2 and O_2 obtained by electrolysis of 40 g of H_2O are filled in a vessel of 60 L at 17°C. What are the partial pressures of H_2 and O_2 ?
   Ans. 0.8804 atm , =0.4408 atm
4. 0.60 g of gas A and 0.45 g of gas B are kept in a pot. The total pressure of the mixture is 750 mm. If the mol. wts. of A and B are 60 and 45 respectively, then find out the partial pressures of both the gases.
   Ans. =375 mm
5. 3L flask has a mixture of CH_4 and N_2 at 27°C. If the mixture mixture has 0.1 mole $_{CH4}$ and 0.2 mole $^{N}2$, ther, calculate their partial pressures and total pressure of the mixture.
   Ans. =0.821 atm , =2.463 atm
6. What will be the mole fraction of N_2 in a mixture of N_2 and O_2 if the partial pressure of O_2 is 63 cm and total pressure of the mixture is 90 cm?
   Ans. =0.3
7. A vessel has a mixture of O_2 and N_2. What will be the ratio of their partial pressures if their masses are the equal?
   Ans. = 1: 1.143
8. Equal weights of CH_4 and O_2 are mixed in an empty container of one L at 27°C, calculate the :
   (a) Fraction of total pressure exerted by O_2.
   (b) Total pressure if the weights of gases are 32 g each.
   Ans. = 73.89 atm
9. 3L of CO_2 are mixed with 4 L of O_2 and 6 L of O_2 and 6L of N_2. Prior to mixing the pressure of CO_2, O_2 and N_2 were 96, 108 and 90.6 kPa respectively. The total volume is 10 L. Find the pressure of the mixture.
   Ans. = 126.36 kPa
10. Under the same conditions of temperature and pressure, a certain volume of H_2 diffuses in 26 seconds when the same volume of CO_2 diffuses in 122 seconds. Find out the relative density of CO_2.
    Ans. =22.02
11. If the ratio between the ratio between the rates of diffusion of two gases is 4:3, then what would be the ratio in their respective mol. wt.?
    Ans. = 9:16
12. If 50 volumes of H_2 diffuse from a vessel in 85s, then under the same conditions how much time will 35 volumes of nitrous oxide take in diffusion?
    Ans. =279 s
13. The ratio of the vapour density of H_2 and O_2 is 1: 16. Which one of the gas will have higher rate of diffusion and why?
    Ans. $= \frac{4}{1}$
14. 16 mL H_2 diffuses in 30 seconds. What volume of SO_2 will diffuse in the same time under the same conditions
    Ans. $= 2.828 mL$
15. NH_3 from one end and HBr gas from the other end are allowed to enter in open tube at the same time. The length of the tube is 1 metre. At what space the white solid will be formed in the tube?
    Ans. =68.56 cm.

16. Calculate the relative rates of diffusion for $^{235}UF_6$ and $^{238}UF_6$ in gaseous form.
    Ans. =1.0043

17. The pressure in a vessel that contained pure O_2 dropped from 2000 torr to 1500 torr in 55 min as O_2 leaked through a small hole into vacuum. When the same vessel was filled with another gas, the pressure dropped 2000 torr to 1500 torr in 85 min. What is the mol. wt. of second gas?
Ans. = 76.4
18. Calculate the average and total kinetic energy of 8g of CH_4 at 27°C?
Ans. $6.21\times10^{-21}\,JK^{-1}\,mol^{-1}6$
19. Calculate u_{rms}, u_{av} and u_{mp} and u_{mp} of oxygen at 27°C.
Ans. $=1683.6K$
20. At what temperature will hydrogen molecules have the same u_{rms} as nitrogen molecules at 27°C?
Ans. $=21.428K$
21. The temperature of a gas is -60°C, to what temperature should it be heated so that (*a*) the average translation K.E. of the molecule be doubled. (b) the u_{rms} of the molecules be doubled.
Ans. =153°C, =579°C
22. Calculate $u_{rms,}\,u_{mp}$ of (~) O_2 at STP (b) O_2 of its density 0.0081 g (*mL*) at 1 atm.
Ans. $=1.79\times10^4\ cm\ s^{-1}$
23. The average velocity of gas molecules is 400 m/sec. Calculate its u_{mp} at this temperature.
Ans. $=354.4\,ms^{-1}$
24. Using van der Waals' equation calculate the constant 'a' when 2 moles of a gas confined in a 4L flask exerts a pressure of 11.0 atmosphere at 300K. The value of 'b' is 0.05 L mol^{-1}.
Ans. $=6.52\,atm\ L^2mol^{-2}$
25. The van der Waal's constants for a gas are : 'a' = 0.350 $Nm^4\ mol^{-2}$ and 'b' = $0.045\times10^{-3}\ m^3\ mol^{-1}$. Calculate the critical constants of the gas.
Ans. =277 K
26. The compressibility factor for one mole of a van der Waal's gas at 0°C and 100 atm pressure is found to be 0.5. Assuming the volume of gas molecule is negligible calculate the van der Waals' constant 'a'.
Ans. $=1.256\,atm\ L^2\ mol^{-2}$.
27. Calculate the weight of CO_2 (compressibility factor Z= 0.65) occupying 0.6L at 50 atm at 27°C.
Ans. =82.45 g
28. Write the density formula of Boyle's law.
Ans. $\frac{p_1}{d_1}=\frac{p_2}{d_2}$
29. Draw the graph of log P v/s log V at constant temperature for a given mass of a gas and indicate different positions.
30. Draw the plot of V v/s T and show that volume of any mass of a gas will become zero at -273°C.
31. A weather balloon expands slowly and slowly as it goes to higher heights in the environment. Why?
32. Which of the following has rate of diffusion equal to that of CO_2?
N_2, SO_2, O_2, N_2O
Ans. N_2O
33. Compare the rates of diffusion of CH_4 and SO_2.
34. Why is Dalton's law of partial pressure NOT applicable to a mixture of $NH_3(g)$ and $HCl(g)$ kept in the same container?
35. n_A and n_B moles of non reacting gases are filled in a chamber. If P is their total pressure. How are the pressure P_A of gas A and total pressure. How are the pressure P related to each other in terms of n_A and n_B?
36. N_1 and N_2 are the number of moles of two gases of molar masses M_1 and M_2 respectively initially taken at pressure P_1 and P_2. If n_1 and n_2 moles of these gases diffuse in the same time, what is the ratio $n_1 : n_2$ in terms of N_1 and N_2?
37. Two gases A and B of molar masses M_A and M_B respectively diffuse for time t_A and t_B respectively. How are the ratio of the diffused masses $w_A : w_B$ related to the molar masses if $t_A = t_B$?

38. Define:
(a) Root mean square speed (b) Average speed (c) Most probable speed

39. What are van der Waal's constant 'a' and 'b' related to ?

40. Write van der Waals' equation for real gas.
How is van der Waals' equation written at
(a) high pressure
(b) moderate low pressure

41. Define
(a) Critical temperature
(b) Critical pressure
(c) Critical volume

42. Define with units:
Surface tension and viscosity of a liquid.

43. Use of unhygienic water may cause jaundice. How the pressure of jaundice can confirmed using surface tension of urine of the patient?

******