

ASSIGNMENT

- Q.1** A gas cylinder containing cooking gas can withstand a pressure of 14.9 atm. The pressure gauge of the cylinder indicates 12 atm at 47°C. Due to sudden fire in the building, its temperature starts. At what temperature will the cylinder will explode?
- Q.2** A gas occupies 500 ml at 25°C. and 745 mm pressure. What would be its volume at S.T.P. ?
- Q.3** A gas occupies 3.00 L at 32°C. and 1 atm pressure, What volume will it occupy if the temperature is changed to 18°C. the pressure remaining unchanged ?
- Q.4** 7.00 g of a gas occupies a volume of 4.1 L at 300 K and 1 atm pressure. What is the molecular mass of the gas ?
- Q.5** A balloon blown up has a volume of 500 ml at 5°C. The balloon is distanced 7/8 of its maximum capacity.
(a) Will it burst at 30°C ?
(b) Calculate the minimum temperature above which it will burst.
- Q.6** At a constant temperature, 250 ml of argon at 760 mm pressure and 600 ml of nitrogen at 500 mm pressure are put together in a one litre flask. Calculate the final pressure.
- Q.7** H₂ gas produced by the reaction
$$\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$$
is collected over water. If 0.3 g of Zn is consumed at 27°C. in the reaction, calculate the volume of hydrogen produced. (Given: Barometric reading = 750 mm, Aqueous tension at 27°C = 25 mm. Atomic weight of Zn = 65.4).
- Q.8** When 2g of a gas A is introduced into an evacuated flask kept at 25°C, the pressure is found to be one atmosphere. If 3 g of another gas B is then added to the same flask, the total pressure becomes 1.5 atm. Assuming ideal gas behaviour, calculate the ratio of molecular weights M_A : M_B.
- Q.9** Calculate the density of SO₂ at 27°C and 1.5 atm pressure.
- Q.10** A gas at 0°C and 1 atmosphere pressure occupies 2.5 litres. What change in temperature would be necessary if the pressure is to be adjusted to 1.5 atmosphere and the gas has been transferred to 2.0 litre container.
- Q.11** A balloon of 21 cm diameter is to be filled with hydrogen gas as S.T.P. from a cylinder containing hydrogen gas at 20 atm and 300 K. The capacity of the cylinder is 2.82 litres at S.T.S. How many balloons can be filled up ?
- Q.12** What weight of AgCl would be precipitated if 10 ml of HCl gas measured at 12°C and 750 mm pressure were passed into excess of a solution of silver nitrate ?
- Q.13** An open flask at 25°C contains air. Calculate the temperature at which one filled of air measured at 25°C escapes.

- Q.14** What time will be required for a sample of ethane (C_2H_6) to diffuse through an orifice if a similar sample of butane (C_4H_{10}) required 2 minutes 23 seconds ?
- Q.15** A discharge tube of 2 litre capacity containing hydrogen gas was evacuated till the pressure inside came to 1×10^{-5} atm. If the tube is maintained at a temperature of $27^\circ C$, calculate the number of hydrogen molecules still present in the tube.
- Q.16** Atomic and molecular sizes are typically of the order of a few Angstroms. Assuming that N_2 molecule is spherical shape with radius (r) = 2×10^{-10} m, calculate
(i) the volume of a single N_2 molecule,
(ii) the percentage of empty space in one mole of N_2 gas at S.T.P.
- Q.17** Calculate the average available to a molecule is assumed in a sample of oxygen gas at N.T.P. Also calculate the average distance between neighbouring molecules if an oxygen molecule is assumed to be spherical.
- Q.18** Calculate the average, the RMS and the most probable velocities of nitrogen molecules at S.T.P.
- Q.19** Calculate the average velocity of CO_2 molecule at S.T.P.
- Q.20** Oxygen at 1 atm and $0^\circ C$ has a density of 1.4290 g L^{-1} . Calculate the RMS velocity of oxygen molecules.
- Q.21** Derive ideal gas equation for n moles of a gas. Calculate the value of R in different systems.
- Q.22** What are the postulates of kinetic molecular theory of gases ? What is kinetic gas equation and how is it helpful in Calculating the average kinetic energy of a gas molecule?
- Q.23** Pressure of 1 g of an ideal gas A at $27^\circ C$ is found to be 2 bar. When 2 g of another ideal gas B is introduced in the same flask at same temperature the pressure becomes 3 bar. What is the relationship between their molecular masses ?
- Q.24** Calculate the pressure of the gas mixture when 0.5 L of H_2 at 0.8 bar and 2.0L of oxygen at 0.7 bar is introduced in 1L vessel at $27^\circ C$?
- Q.25** How much time would it take to distribute one Avogadro number of wheat grains, if 10^{10} grains are distributed each second ?
- Q.26** A student forgot to add the reaction mixture to the round bottomed flask at $27^\circ C$ and the flames. The flask bottomed flask at $27^\circ C$ and put it on flames. The flask got heated to $477^\circ C$ Calculate the fraction of air which would have been expelled out ?
- Q.27** Pay load is defined as the difference between the mass of displaced air and the mass of the balloon. A balloon of radius 10 m and of mass 100 kg is filled with helium at 1.66 bar at $27^\circ C$. Calculate the pay load. (Density of air = 1.2 Kg m^{-3} and $R = 0.083 \text{ bar dm}^3 \text{ K}^{-1}$)
- Q.28** Calculate the total pressure in a mixture of 8 g of oxygen and 4 g of hydrogen confined in a vessel of 1 dm^3 at $27^\circ C$. ($R = 0.083 \text{ bar dm}^3 \text{ K}^{-1} \text{ mol}^{-1}$)
- Q.29** 2.9 g of a gas at $95^\circ C$ occupied the same volume as 0.184 g of hydrogen at $17^\circ C$, at the same pressure. What is the molar mass of the gas ?

- Q.30** A mixture of hydrogen and oxygen at 1 bar pressure contains 20% by weight of hydrogen. Calculate the pressure of hydrogen.
- Q.31** Calculate the volume occupied by 8.8 g of at 31.1°C and 1 bar pressure.
($R = 0.083 \text{ bar dm}^3 \text{ K}^{-1} \text{ mol}^{-1}$)
- Q.32** Equal volumes of two gases A and B diffuse through a porous pot in . 20 and 10 seconds respectively. If the molecular mass of A is 80, calculate the molecular mass of B.
- Q.33** 250 ml of hydrogen measured at 750 mm of Hg have to be compressed into a vessel of 50 ml capacity at a constant temperature. Calculate the pressure required to do so.
- Q.34** The mass of 500 cm³ of hydrogen gas at a pressure of 760 mm Hg and at temperature of 300 K was found to be 4.09×10^{-2} g, Calculate the molar mass of hydrogen.
- Q.35** At room temperature, ammonia gas at 1 atm pressure and HCl gas at pressure P atm are allowed to effuse through identical pin holes from opposite ends of a glass tube of 1 metre length and uniform area of cross-section. NH₄Cl is first formed at a distance of 60cm from the end through which HCl gas was sent in. Calculate the value of P.
- Q.36** A 1.00 L evacuated flask is to be filled with CO₂ gas at 300°C and a pressure of 500 mm Hg by placing a piece of dry ice, CO₂ (s) in the flask. What mass of dry ice should be used ?
- Q.37** A gas mixture of 3.0L of propane and butane on complete combustion at 27°C produced 10.0 L of CO₂. Find out the composition of the gas mixture .
- Q.38** 0.64 g of an oxide of sulphur occupies 0.224 L at 2 and 273°C Identify the compound. Also find out the mass of one molecule of the gas.
- Q.39** A mixture of nitrogen and hydrogen gas has density $0.505 \times 10^{-3} \text{ g cm}^{-3}$ at 293 K and 750 mm Hg pressure. What per cent of the mass is nitrogen ?
- Q.40** A toy balloon blown up at 5°C has a volume of 480 ml. At this stage, the balloon is expanded to 7/8 th of its maximum stretching capacity.
(i) Will the balloon burst if it is brought to a room having temperature 30°C ?
(ii) Calculate the temperature at which the balloon will burst.
- Q.41** The first order diffraction from a crystal occurred at an angle of 16.3° using X-rays of wavelength 0.154 nm. What is the distance between the set of planes causing the diffraction ?
- Q.42** What will be the wavelength of the X-rays which give a diffraction angle equal to 16.80° from a crystal, if the interplanar distance in the crystal is 0.200 nm and only first order diffraction is observed ?
- Q.43** At room temperature ammonia gas at 1 atm pressure and HCl gas at pressure P atm are allowed to diffuse through identical pin holes from opposite ends of a glass tube of 1 meter length and of uniform area of cross-section. NH₄ Cl is first formed at a distance of 60 cm from the end through which HCl gas was sent in. Calculate the value of P.
- Q.44** A spherical balloon of 21 cm diameter is to be filled with hydrogen at NTP from a cylinder containing the gas at 20 atmosphere at 27°C. If the cylinder can hold 2.82 litres of water, calculate the number of balloons that can be filled up.

- Q.45** Calculate the temperature at which 28 g of N_2 will occupy volume of 10.0 litres at 2.46 atmosphere.
- Q.46** At $18^\circ C$ and 765 torr, 1.299 L of a gas weighs 2.71 g. Calculate the approximate molecular weight of the gas.
- Q.47** The volume of ozone and chlorine diffusing during the same time are 35ml and 29 ml respectively. If the molecular weight of chlorine is 71, calculate the molecular weight of ozone.
- Q.48** An iron cylinder contains helium at a pressure of 250 kPa at 300K, The cylinder can withstand a pressure of 1×10^6 Pa. The room in which cylinder is placed catches fire. Predict whether the cylinder will blow up before it melts or not. (M.P of the cylinder = 1800 K)
- Q.49** 20 dm^3 of SO_2 diffuse through a porous partition in 60 s. what volume of O_2 will diffuse under similar conditions in 30s ?
- Q.50** Calculate the total pressure in a 10 L cylinder which contains 0.4g of helium 1.6g of oxygen and 1.4 g of nitrogen at $27^\circ C$ Also calculate the partial pressure of helium gas in the cylinder. Assume ideal behaviour for gases ($R = 0.082 \text{ L atm K}^{-1} \text{ mol}^{-1}$)
- Q.51** What is density of SO_2 gas at $27^\circ C$ and 2 atmospheric pressure ? (At wts. S = 32, O = 16, $R = 0.0821 \text{ L atm K}^{-1} \text{ mol}^{-1}$)
- Q.52** Calculate the average K.E in joules of the molecules in 8 g of methane at $27^\circ C$.
- Q.53** An evacuated glass vessel weighs 50.0 g when empty 148.0 g when filled with a liquid of density 0.98 ml^{-1} and 50.5 g when filled with an ideal gas at 760mm Hg at 300 K. Determine the molecular weight of the gas.
- Q.54** Using van der Waals equation calculate the constant 'a' when two moles of a gas combined in a four litre flask exerts a pressure of 11.0 atmosphere at a temperature of 300 K. The value of 'b' is $0.05 \text{ lit mol}^{-1}$
- Q.55** A glass bulb contains 2.24 L of H_2 and 1.12 L of D_2 at S.T.P. It is connected to a fully evacuated bulb by a stopcock with a small opening. The stopcock is opened for sometime and then closed, the first bulb now contains 0.10 g of D_2 . Calculate the percentage composition by weight of the gases in the second bulb.
- Q.56** Two flasks of equal volume connected by a narrow tube of negligible volume are filled with N_2 gas. When both are immersed in boiling water the gas pressure inside the system is 0.5 atm. Calculate the pressure of the system one of the flasks is immersed in an ice-water mixture deeping the order in boiling order.
- Q.57** What is the difference in pressure between the top and bottom of a vessel 76 cm deep at $27^\circ C$ when filled with (i) water (ii) mercury ? Density of water at $27^\circ C$ is 0.990 g cm^{-3} and that of mercury is 13.50 g cm^{-3} .
- Q.58** One mole of nitrogen gas at 0.8 atm takes 38s to diffuse through a pin hole whereas one mole of an unknown compound of Xenon with fluorine at 1.6 atm takes 57 a to diffuse through the same hole. Calculate the molecule of the compound.

- Q.59** The pressure exerted by 12 g of an ideal gas at temperature $t^\circ\text{C}$ in a vessel of volume V litre is one atm. When the temperature is increased by 10 degrees at the same volume, the pressure increases by 10%. Calculate the temperature t and volume V (Molecular weight of the gas = 120).
- Q.60** 34.05 mL of phosphorus vapour weight 0.0625 g at 546°C and 0.1 bar pressure. What is the molar mass of phosphorus ?
- Q.61** A student forgot to add the reaction mixture to the round bottomed flask at 27°C but put it on the flame. After a lapse of time he realized his mistake, using a pyrometer he found the temperature of the flask was 477°C . What fraction of air would have been expelled out ?
- Q.62** Calculate the temperature of 4.0 moles of a gas occupying 5dm^3 at 3.32 bar. ($R = 0.083\text{ bar dm}^3\text{ K}^{-1}\text{ mol}^{-1}$).
- Q.63** Calculate the total number of electrons present in 1.4 g of nitrogen gas.
- Q.64** How much time would it take to distribute one Avogadro number of wheat grains. if 10^{10} grains are distributed each second ?
- Q.65** Calculate the total pressure in a mixture of 8 g of oxygen and 4 g of hydrogen confined in a vessel of 1 dm^3 at 27°C . $R = 0.083\text{ bar dm}^3\text{ K}^{-1}\text{ mol}^{-1}$
- Q.66** Pay load is defined as the difference between the mass of displaced air and the mass of the balloon. Calculate the pay load when a balloon of radius 10m. mass 100Kg is filled with helium at 1.66 bar at 27°C (Density air = 1.2 kg m^{-3} and $R = 0.083\text{ bar dm}^{-3}\text{ K}^{-1}\text{ mol}^{-1}$).
- Q.67** Calculate the volume occupied by 8.8g of CO_2 at 31.1°C and 1 bar pressure. $R = 0.083\text{ bar L K}^{-1}\text{ mol}^{-1}$.
- Q.68** 2.9 g of a gas at 95°C occupied the same volume as 0.184 g of hydrogen at 17°C . at the same pressure. What is the molar mass of the gas
- Q.69** Through the two ends of a glass tube of length 200 cm hydrogen chloride gas and ammonia are allowed to enter. At what distance ammonium chloride will first appear ?
- Q.70** For 10 minutes each, at 27°C , from two identical holes nitrogen and an unknown gas are leaked into a common vessel of 3.L capacity. The resulting pressure is 4.18 bar and the mixture contains 0.4 mol of nitrogen. What is the molar mass of the unknown gas ?
- Q.71** Equal volumes of two gases A and B diffuse through a porous pot in 20 and 10 seconds respectively. If the molar mass of A is 80, find the molar mass of B.
- Q.72** Calculate the average kinetic energy of 32g methane molecules at 27°C . $R = 8.314\text{ J K}^{-1}\text{ Mol}^{-1}$.
- Q.73** A mixture of hydrogen and oxygen at one bar pressure contains 20% by weight of hydrogen. Calculate the partial pressure of hydrogen.
- Q.74** A manometer is connected to a gas containing bulb. The open arm reads 43.7cm where as the arm connected to the bulb reads 15.6 cm. If the barometric pressure is 743 mm mercury. What is the pressure of gas in bar ?

ANSWER KEY

1. 372.5 K 2. 449 ml 3. 2.86 L 4. 42 amu
5. (a) No (b) 44.7° C 6. 490 mm 7. 0.119 L 8. 1 : 3
9. 3.9 g L⁻¹ 10. 54.6°C 11. 10 12. .0605 gm
13. 99.5°C 14. 1 min 43 sec 15. 4.89×10^{17} molecules 16. (i) $3.35 \times 10^{-23} \text{ cm}^3$ (ii) 99.9098%
17. $3.72 \times 10^{-20} \text{ cm}^3$, $4.14 \times 10^{-7} \text{ cm}$ 18. $\bar{\mu} = 4.54 \times 10^4 \text{ cm s}^{-1} \mu =$
- $4.93 \times 10^4 \text{ cm s}^{-1}$, $\alpha = 4.03 \times 10^4 \text{ cm s}^{-1}$ 19. $2.42 \times 10^2 \text{ cm s}^{-1}$ 20. $4.61 \times 10^4 \text{ cm s}^{-1}$
21. $8.314 \times 10^4 \text{ Pas}$ 22. 70 g mol^{-1} 23. $M_B = 4 M_A$ 24. 1.8 bar
25. $1.908 \times 10^6 \text{ Years}$ 26. 3/5 27. 3807.59 kg 28. 56.025 bar
29. 40.0 g mol^{-1} 30. 0.8 bar 31. 5.05 dm^3 32. 20 g mol^{-1}
33. 3750 mm of Hg 34. 2.01 35. 2.2 atm 36. 0.661 g
37. propane = 66.7%, Butane = 33. 3% 38. 64, SO₂, $1.063 \times 10^{-22} \text{ g}$ 39. 90.37%
40. (i) will not burst; (ii) above 44.7°C 41. 0.274 nm. 42. 0.0584 nm.
43. 4.83 atm 44. 10 45. 299.6 K 46. 49.5 g mol^{-1}
47. 48.1 48. 1800 K 49. 14.14 dm^3 50. (R = 0.082 L atm K⁻¹mo⁻¹)
51. 5.1969 g L^{-1} 52. $6.21 \times 10^{-21} \text{ J}$ 53. 123 54. $4.49 \text{ atm L}^2 \text{ mol}^{-2}$
55. H₂ = 66.67%. D₂ = 33.33% 56. 0.433 atm. 57. (i) 0.073 atm (ii) 1 atm
58. XeF₆ 59. t = - 173°C, V = 0.82 L 60. 1247.7 g
61. 3/5 62. 50 K 63. 4.2154×10^{23} electrons 64. $1.90956 \times 10^6 \text{ year}$
65. 56.025 bar 66. 37.98 kg 67. 5.05 L 68. 40 g mol^{-1}
69. 81.12 cm four HCl end 70. 417.4 g mol^{-1} 71. 20 g mol^{-1} 72. 7382.6 J
73. 0.8 bar 74. 1.347 bar