EXERCISE-I (Conceptual Questions) **Build Up Your Understanding**

GRAHAM'S LAW OF DIFFUSION

1. Which pair of the gaseous species diffuse through a small jet with the same rate of diffusion at same P and T :
(1) NO, CO (2) NO, CO_2 (3) NH_3, PH_3 (4) NO, C_2H_6

2. The rate of diffusion of methane at a given temperature is twice that of a gas X. the molecular weight of X is :
(1) 64 (2) 32 (3) 4.0 (4) 8.0

3. The increasing order of effusion among the gases, H_2, O_2, NH_3 and CO_2 is :-
(1) H_2, CO_2, , NH_3, O_2 (2) H_2, NH_3, O_2, CO_2
(3) H_2, O_2, , NH_3, CO_2 (4) CO_2, O_2, NH_3, H_2

4. Gas a having molecular weight 4 diffuses thrice as fast as the gas B at a give T. The molecular weight of gas B is :
(1) 36 (2) 12 (3) 18 (4) 24

5. Four rubber tubes are respectively filled with H_2, O_2, N_2 and CO_2. The tube which will be reinflated first is :
(1) H_2 filled tube (2) O_2 filled tube (3) N_2 filled tube (4) CO_2 filled tube

6. A balloon filled with methane CH_4 is pricked with a sharp point and quickly plunged into a tank of hydrogen at the same pressure. After sometime the balloon will have :
(1) Enlarged (2) Collapsed
(3) Remained unchanged in size (4) Ethylene (C_2H_4) inside it

7. Rate of diffusion of hydrogen is :
(1) Half of He (2) 1.4 times of He
(3) Double than He (4) For times of He

8. A football bladder contains equimolar proportions of H_2 and O_2. The compostion by mass of the mixture effusing out of punctured football is in the ratio (H_2 : O_2)
(1) 1 : 4 (2) $2\sqrt{2}$: 1 (3) 1 : $2\sqrt{2}$ (4) 4 : 1

9. If the vapour densities of methane & oxygen are in the ratio 1 : 2, the ratio of rate of diffusion of O_2 & CH_4 is respectively
(1) 1 : 2 (2) 1 : 1.414 (3) 2 : 1 (4) 1.414 : 1

10. A gas X diffuses three times faster than another gas Y the ratio of their densities i.e., D_x : D_y is
(1) 1/3 (2) 1/9 (3) 1/6 (4) 1/12

11. The relative rate of diffusion of a gas (Mol wt. = 98) as compared to hydrogen will be :-
(1) 1/7 (2) 1/5 (3) 1/4 (4) 1

12. The relative rate of diffusion of a gas (molecular weight = 128) as compared to oxygen is
(1) 2 times (2) 1/4 (3) 1/8 (4) 1/2

13. Since the atomic weights of carbon, nitrogen and oxygen are 12, 14 and 16 respectively, among the following pairs of gases, the pair that will diffuse at the same rate is :
(1) Carbon dioxide and nitrous oxide (2) Carbon dioxide and nitrogen peroxide
(3) Carbon dioxide and carbon monoxide (4) Carbon dioxide and nitric oxide

14. A bottle of dry ammonia and 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 :-
(1) At the centre of the tube (2) Near the hydrogen chloride bottle
(3) Near the ammonia bottle (4) Thought out the length of the tube

15. 50 mL of a gas A diffuse through a membrane in the same time as for the diffusion of 40 mL of a gas B under identical pressure temperature conditions. If the molecular weight of A = 64, that of B would be :
(1) 100 (2) 250 (3) 200 (4) 80

16. If rate of diffusion of A is 5 times that of B, what will be the density ratio of A and B :
(1) 1/25 (2) 1/5 (3) 25 (4) 5

17. 50 mL of hydrogen diffuses through a small hole from vessel in 20 minutes time. Time taken for 40 mL of oxygen to diffuse out under similar condition will be :-
(1) 12 min (2) 64 min (3) 8 min (4) 32 min

18. The densities of two gases are in the ratio of 1 : 16. The ratio of their rates of diffusion is :
(1) 16 : 1 (2) 4 : 1 (3) 1 : 4 (4) 1 : 16

19. The rate of diffusion of a gas having molecular weight just double of nitrogen gas is 56 mL per sec the ratio of diffusion of nitrogen gas will be :
(1) 79.19 mL/sec (2) 112 mL/sec (3) 56 mL/sec (4) 90 mL/sec

20. If the four tubes of a car are filled to the same pressure with N_2, O_2, $H_2$and CO_2 separately then which one will be filled first:
(1) N_2 (2) O_2 (3) H_2 (4) CO_2

21. Under identical conditions of temperature and pressure the ratio of the rates of effusion of O_2 and CO_2 gases is given by :
(1) $\frac{\text{rate of effusion of oxygen}}{\text{rate of effusion of } CO_2} = 0.87$ (2) $\frac{\text{rate of effusion of oxygen}}{\text{rate of effusion of } CO_2} = 1.17$
(3) $\frac{\text{rate of effusion of oxygen}}{\text{rate of effusion of } CO_2} = 8.7$ (4) $\frac{\text{rate of effusion of oxygen}}{\text{rate of effusion of } CO_2} = 0.17$

DEVIATION FROM IDEAL GAS BEHAVIOUR

22. When does a real gas show behavior same as ideal gas :
(1) At low temperature and low pressure (2) At high temperature and high pressure
(3) At low temperature and high pressure (4) At high temperature and low pressure

23. In van der Waal's equation of state of the gas law, the constant 'b' is a measure of :

(1) Intermolecular repulsions (2) Intermolecular attraction
(3) Volume occupied by the molecules (4) Intermolecular collisions per unit volume

24. The term that accounts for intermolecular force in van der Waal's equation for non ideal gas is :
(1) RT (2) V – b
(3) $\left(P - \frac{a}{V^2}\right)$ (4) $[RT]^{-1}$

25. Pressure of real gas is less than the pressure of ideal gas because :
(1) No. of collisions increase (2) Difinite shape of molecule
(3) Inter molecular forces (4) K.E. of molecule increases

26. Which gas can be easily liquefied ?
Given 'a' for $NH_3 = 4.17$, $CO_2 = 3.59$, $SO_2 = 6.71$, $Cl_2 = 6.49$
(1) NH_3 (2) Cl_2 (3) SO_2 (4) CO_2

27. At relatively high pressure, van der waal's equation reduces to :
(1) PV = RT (2) $PV = RT + \frac{a}{V}$
(3) PV = RT + Pb (4) $PV = RT - \frac{a}{V^2}$

28. A real gas most closely approaches the behaviour of an ideal gas at :
(1) 15 atm and 200 K (2) 1 atm and 273 K
(3) 0.5 atm and 500 K (4) 15 atm and 500 K

29. The compressibility factor of an ideal gas is :
(1) 0 (2) 1 (3) 2 (4) 4

30. The compressibility of a gas is less than unity at STP therefore :
(1) $V_m < 22.4$ lit (2) $V_m > 22.4$ lit
(3) $V_m = 22.4$ lit (4) $V_m = 44.8$ lit

31. The values of van der 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^2 atm mol^{-2} respectively. The gas which can most easily be liquefied is :
(1) O_2 (2) N_2 (3) NH_3 (4) CH_4

ANSWER KEY

EXERCISE-I (Conceptual Questions)

1.	(4)	**2.**	(1)	**3.**	(4)	**4.**	(1)	**5.**	(1)	**6.**	(1)	**7.**	(2)
8.	(1)	**9.**	(2)	**10.**	(2)	**11.**	(1)	**12.**	(4)	**13.**	(1)	**14.**	(2)
15.	(1)	**16.**	(1)	**17.**	(2)	**18.**	(2)	**19.**	(1)	**20.**	(3)	**21.**	(2)
22.	(4)	**23.**	(3)	**24.**	(3)	**25.**	(4)	**26.**	(3)	**27.**	(3)	**28.**	(3)
29.	(2)	**30.**	(2)	**31.**	(3)								