CHAPTER 1

Solutions

Expressing Concentration of Solutions

1. In one molal solution that contains 0.5 mole of a solute, there is *(2022)*

a. 1000 g of solvent
b. 500 mL of solvent
c. 500 g of solvent
d. 100 mL of solvent

2. Which of the following is dependent on temperature? *(2017-Delhi)*

a. Weight percentage
b. Molality
c. Molarity
d. Mole fraction

3. What is the mole fraction of the solute in a 1.00 m aqueous solution? *(2015 Re)*

a. 0.0177
b. 0.177
c. 1.770
d. 0.0354

4. How many grams of concentrated nitric acid solution should be used to prepare 250 mL of 2.0 M HNO_3? The concentrated acid is 70% HNO_3. *(2013)*

a. 70.0 g conc. HNO_3
b. 54.0 g conc. HNO_3
c. 45.0 g conc. HNO_3
d. 90.0 g conc. HNO_3

Vapour Pressure of Liquid Solutions

5. Which one is not correct mathematical equation for Dalton's Law of partial pressure? Here p = total pressure of gaseous mixture *(2022)*

a. $p_i = x_i p_i^o$, where x_i = mole fraction of i^{th} gas in gaseous mixture
p_i^o = pressure of i^{th} gas in pure state

b. $p = p_1 + p_2 + p_3$

c. $p = n_1 \frac{RT}{V} + n_2 \frac{RT}{V} + n_3 \frac{RT}{V}$

d. $p_i = x_i p$, where p_i = partial pressure of i^{th} gas
x_i = mole fraction of i^{th} gas in gaseous mixture

6. The correct option for the value of vapour pressure of a solution at 45°C with benzene to octane in molar ratio 3 : 2 is: *(2021)*

[At 45°C vapour pressure of benzene is 280 mm Hg and that of octane is 420 mm Hg. Assume Ideal gas]

a. 168 mm of Hg
b. 336 mm of Hg
c. 350 mm of Hg
d. 160 mm of Hg

7. Which of the following statements about the composition of the vapour over an ideal 1 : 1 molar mixture of benzene and toluene is correct? Assume that the temperature is at 25°C.

(Given, vapour pressure data at 25°C, benzene = 12.8 kPa, toluene = 3.85 kPa) *(2016-I)*

a. The vapour will contain equal amounts of benzene and toluene
b. Not enough information is given to make a prediction
c. The vapour will contain a higher percentage of benzene
d. The vapour will contain a higher percentage of toluene

Ideal and Non-Ideal Solutions

8. The mixture which shows positive deviation from Raoult's law is: *(2020)*

a. Benzene + Toluene
b. Acetone + Chloroform
c. Chloroethane + Bromoethane
d. Ethanol + Acetone

9. For an ideal solution, the correct option is : *(2019)*

a. Δ_{mix} S = 0 at constant T and P
b. Δ_{mix} V ≠ 0 at constant T and P
c. Δ_{mix} H = 0 at constant T and P
d. Δ_{mix} G = 0 at constant T and P

10. The mixture that forms maximum boiling azeotrope is: *(2019)*

a. Water + Nitric acid
b. Ethanol + Water
c. Acetone + Carbon disulphide
d. Heptane + Octane

11. Which one of the following is incorrect for ideal solution? *(2016 - II)*

a. $\Delta P = P_{obs} - P_{calculated\ by\ Raoult's\ law} = 0$
b. $\Delta G_{mix} = 0$
c. $\Delta H_{mix} = 0$
d. $\Delta U_{mix} = 0$

12. Which one is not equal to zero for an ideal solution? *(2015)*

a. ΔS_{mix} b. ΔV_{mix}
c. $\Delta P = P_{observed} - P_{Raoult}$ d. ΔH_{mix}

Colligative Properties and Determination of Molar Mass

13. The following solutions were prepared by dissolving 10 g of glucose ($C_6H_{12}O_6$) in 250 ml of water (P_1), 10 g of urea (CH_4N_2O) in 250 ml of water (P_2) and 10 g of sucrose ($C_{12}H_{22}O_{11}$) in 250 ml of water (P_3). The right option for the decreasing order of osmotic pressure of these solutions is: *(2021)*

a. $P_1 > P_2 > P_3$ b. $P_2 > P_3 > P_1$
c. $P_3 > P_1 > P_2$ d. $P_2 > P_1 > P_3$

14. If 8 g of a non-electrolyte solute is dissolved in 114 g of n-octane to reduce its vapour pressure to 80%, the molar mass (in g mol^{-1}) of the solute is
[Given that molar mass of n-octane is 114 g mol^{-1}] *(2020-Covid)*

a. 60 b. 80
c. 20 d. 40

15. Isotonic solutions have same *(2020-Covid)*

a. Freezing temperature b. Osmotic pressure
c. Boiling temperature d. Vapour pressure

16. If molality of the dilute solution is doubled, the value of molal depression constant (K_f) will be: *(2017-Delhi)*

a. Unchanged b. Doubled
c. Halved d. Tripled

17. At 100°C, the vapour pressure of a solution of 6.5 g of a solute in 100 g water is 732 mm. If $K_b = 0.52$, the boiling point of this solution will be: *(2016 - I)*

a. 103° C b. 101° C
c. 100° C d. 102° C

Abnormal Molar Mass

18. The freezing point depression constant (K_f) of benzene is 5.12 K kg mol^{-1}. The freezing point depression for the solution of molality 0.078 m containing a non-electrolyte solute in benzene is (rounded off upto two decimal places) : *(2020)*

a. 0.80 K b. 0.40 K
c. 0.60 K d. 0.20 K

19. The van't Hoff factor (i) for a dilute aqueous solution of the strong electrolyte barium hydroxide is: *(2016 - II)*

a. 2 b. 3
c. 0 d. 1

20. Which one of the following electrolytes has the same value of van't Hoff's factor (*i*) as that of $Al_2(SO_4)_3$ (if all are 100% ionised)? *(2015)*

a. $K_3[Fe(CN)_6]$ b. $Al(NO_3)_3$
c. $K_4[Fe(CN)_6]$ d. K_2SO_4

21. The boiling point of 0.2 mol kg^{-1} solution of X in water is greater than equimolal solution of Y in water. Which one of the following statements is true in this case? *(2015)*

a. Molecular mass of X is greater than the molecular mass of Y
b. Molecular mass of X is less than the molecular mass of Y
c. Y is undergoing dissociation in water while X undergoes no change
d. X is undergoing dissociation in water

22. Of the following 0.10 m aqueous solutions, which one will exhibit the largest freezing point depression? *(2014)*

a. $C_6H_{12}O_6$ b. $Al_2(SO_4)_3$
c. K_2SO_4 d. KCl

Answer Key

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
c	c	a	c	a	b	c	d	c	a	b	a	d	d	b	a	b
18	19	20	21	22												
b	b	c	d	b												