

(Physical Chemistry)

Liquid Solution

1. Liquid 'M' and liquid 'N' form an ideal solution. The vapour pressures of pure liquids 'M' and 'N' are 450 and 700 mmHg, respectively, at the same temperature. Then correct statement is :

(x_M = Mole fraction of 'M' in solution;

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x_N = Mole fraction of 'N' in solution;

y_M = Mole fraction of 'M' in vapour phase;

y_N = Mole fraction of 'N' in vapour phase)

(1) $\frac{x_M}{x_N} > \frac{y_M}{y_N}$

(2) $(x_M - y_M) < (x_N - y_N)$

(3) $\frac{x_M}{x_N} < \frac{y_M}{y_N}$

(4) $\frac{x_M}{x_N} = \frac{y_M}{y_N}$

[Jee Main, April 2019]

2. A set of solutions is prepared using 180 g of water as a solvent and 10 g of different non-volatile solutes A, B and C. The relative lowering of vapour pressure in the presence of these solutes are in the order [Given, molar mass of A = 100 g mol⁻¹; B = 200 g mol⁻¹; C = 10,000 g mol⁻¹]

(1) A > B > C

(2) A > C > B

(3) C > B > A

(4) B > C > A

[Jee Main, 2020]

3. Solute A associates in water. When 0.7 g of solute A is dissolved in 42.0 g of water, it depresses the freezing point by 0.2°C. The percentage association of solute A in water, is

[Given : Molar mass of A = 93 g mol⁻¹. Molal depression constant of water is 1.86 K kg mol⁻¹]

(1) 50 %

(2) 60 %

(3) 70 %

(4) 80 %

[JEE Main, June 2022]

4. At 35°C, the vapour pressure of CS₂ is 512 mm Hg and that of acetone is 344 mm Hg. A solution of CS₂ in acetone has a total vapour pressure of 600 mm Hg. The false statement amongst the following is:

(1) CS₂ and acetone are less attracted to each other than to themselves

(2) a mixture of 100 mL CS₂ and 100 mL acetone has a volume < 200 mL

(3) Raoult's law is not obeyed by this system

(4) heat must be absorbed in order to produce the solution at 35°C

[Jee Main, 2020]

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5. Henry's constant (in kbar) for four gases α , β , γ and δ in water at 298 K is given below :

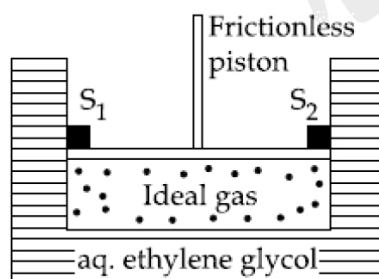
	α	β	γ	δ
K_H	50	2	2×10^{-5}	0.5

(Density of water = 10^3 kg m^{-3} at 298 K)

[Jee Main, 2020]

This table implies that :

- (1) α has the highest solubility in water at a given pressure
 - (2) The pressure of a 55.5 molal solution at δ is 250 bar
 - (3) Solubility of γ at 308 K is lower than at 298 K
 - (4) The pressure of a 55.5 molal solution of γ is 1 bar
6. The vapour pressures of two volatile liquids A and B at 25°C are 50 Torr and 100 Torr, respectively. If the liquid mixture contains 0.3 mole fraction of A, then the mole fraction of liquid B in the vapour phase is $\frac{x}{17}$. The value of x is _____. [JEE Main, June 2022]
7. The elevation in boiling point for 1 molal solution of non-volatile solute A is 3K. The depression in freezing point for 2 molal solution of A in the same solvent is 6 K. The ratio of K_b and K_f i.e., K_b/K_f is 1 : X. The value of X is [nearest integer] [JEE Main, July 2022]
8. A cylinder containing an ideal gas (0.1 mol of 1.0 dm^3) is in thermal equilibrium with a large volume of 0.5 molal aqueous solution of ethylene glycol at its freezing point. If the stoppers S_1 and S_2 (as shown in the figure) are suddenly withdrawn, the volume of the gas in litres after equilibrium is achieved will be _____. [Jee Main, 2020]
- (Given, $K_f(\text{water}) = 2.0 \text{ K kg mol}^{-1}$, $R = 0.08 \text{ dm}^3 \text{ atm K}^{-1} \text{ mol}^{-1}$)



9. The osmotic pressure of blood is 7.47 bar at 300 K. To inject glucose to a patient intravenously, it has to be isotonic with blood. The concentration of glucose solution in gmL^{-1} is _____ (Molar mass of glucose = 180 g mol^{-1} $R = 0.083 \text{ L bar K}^{-1} \text{ mol}^{-1}$) (Nearest integer)

[JEE Main, June 2022]

10. In a solvent 50% of an acid HA dimerizes and the rest dissociates. The Van't Hoff factor of the acid is $\times 10^{-2}$. (Round off to the nearest integer). [JEE Main, July 2021]

11. Of the following four aqueous solutions, total number of those solutions whose freezing point is lower than that of 0.10 M $\text{C}_2\text{H}_5\text{OH}$ is _____. (Integer answer) [JEE Main, August 2021]

(i) 0.10 M $\text{Ba}_3(\text{PO}_4)_2$

(ii) 0.10 M Na_2SO_4

(iii) 0.10 M KCl

(iv) 0.10 M Li_3PO_4



ANSWERS KEY

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|-----|-----|----|-----------------------------------|----|-----|----|-----|------|-----|-------|------|
| 1. | (1) | 2. | (1) | 3. | (4) | 4. | (2) | 5. | (2) | 6. | (14) |
| 7. | (1) | 8. | (2.17 or 2.18) and (2.18 to 2.23) | | | | 9. | (54) | 10. | (125) | |
| 11. | (4) | | | | | | | | | | |

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