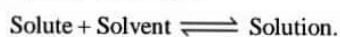


1. The solubility of a solid in a liquid is significantly affected by temperature changes.



The system being in a dynamic equilibrium must follow Le-chatelier's principle. Considering the Le-chatelier's principle which of the following is correct?

- (a)  $\Delta H_{\text{sol}} > 0$ ; solubility  $\uparrow$ ; temperature  $\downarrow$
  - (b)  $\Delta H_{\text{sol}} < 0$ ; solubility  $\downarrow$ ; temperature  $\uparrow$
  - (c)  $\Delta H_{\text{sol}} > 0$ ; solubility  $\downarrow$ ; temperature  $\uparrow$
  - (d)  $\Delta H_{\text{sol}} < 0$ ; solubility  $\uparrow$ ; temperature  $\uparrow$
2. The vapour pressure of a solution of the liquids A ( $p^\circ = 80 \text{ mm Hg}$  and  $x_A = 0.4$ ) and B ( $p^\circ = 120 \text{ mm Hg}$  and  $x_B = 0.6$ ) is found to be  $100 \text{ mm Hg}$ . It shows that the solution exhibits
- (a) positive deviation from ideal behaviour
  - (b) negative deviation from ideal behaviour
  - (c) ideal behaviour
  - (d) positive deviation for lower conc. and negative for higher conc.

3. Plot of  $\frac{1}{x_A}$  Vs  $\frac{1}{y_A}$  ( $x_A$  mole fraction of A in liquid state and  $y_A$  in vapour state) is linear whose slope and intercept respectively are given
- $p_B^\circ / p_A^\circ, \frac{p_B^\circ - p_A^\circ}{p_B^\circ}$
  - $p_A^\circ - p_B^\circ, \frac{p_A^\circ - p_B^\circ}{p_B^\circ}$
  - $p_B^\circ - p_A^\circ, \frac{p_B^\circ - p_A^\circ}{p_B^\circ}$
  - $p_B^\circ / p_A^\circ, \frac{p_A^\circ - p_B^\circ}{p_B^\circ}$
4. Coolant used in car radiator is aqueous solution of ethylene glycol. In order to prevent the solution from freezing at  $-0.3^\circ\text{C}$ . How much ethylene glycol must be added to 5 kg of water? ( $K_f = 1.86 \text{ K kg mol}^{-1}$ )
- 50 kg
  - 50 g
  - 45 g
  - 40 g
5. A solution contains non-volatile solute of molecular mass  $M_2$ . Which of the following can be used to calculate the molecular mass of solute in terms of osmotic pressure?
- $M_2 = \left(\frac{m_2}{\pi}\right) VRT$
  - $M_2 = \left(\frac{m_2}{V}\right) \frac{RT}{\pi}$
  - $M_2 = \left(\frac{m_2}{V}\right) \pi RT$
  - $M_2 = \left(\frac{m_2}{V}\right) \frac{\pi}{RT}$
6. Henry's law constant of oxygen is  $1.4 \times 10^{-3} \text{ mol. lit}^{-1} \cdot \text{atm}^{-1}$  at 298 K. How much of oxygen is dissolved in 100 ml at 298 K when the partial pressure of oxygen is 0.5 atm?
- 1.4 g
  - 3.2 g
  - 22.4 mg
  - 2.24 mg
7. What is the degree of dissociation of sodium chloride, if the molar mass determined by a cryoscopic method was found to be  $31.80 \text{ g mol}^{-1}$  [Atomic mass Na = 23 g mol $^{-1}$  Cl = 35.5 g mol $^{-1}$ ]
- 0.58
  - 0.73
  - 0.83
  - 0.92
8. A solution containing components A and B follows Raoult's law when
- A – B attraction force is greater than A – A and B – B
  - A – B attraction force is less than A – A and B – B
  - A – B attraction force remains same as A – A and B – B
  - Volume of solution is different from sum of volume of solute and solvent
9. Two 1-litre flask A and B are connected to each other by a valve which is closed. Flask A has benzene in equilibrium with its vapours at  $30^\circ\text{C}$ . The flask B, is evacuated, and the valve is opened. Which of the following is true. If temperature is kept constant.
- Some of the benzene molecules would move to flask B from flask A.
  - Vapour pressure will be half the initial value.
  - The vapour pressure remains unchanged
  - Some more of the liquid benzene in flask A would evaporate.
10. For a solution of two liquids A and B it was proved that  $P_S = x_A(p_A^\circ - p_B^\circ) + p_B^\circ$ . The resulting solution will be
- Non-ideal
  - ideal
  - semi-ideal
  - None of these
11. A 0.0020 m aqueous solution of an ionic compound  $\text{Co}(\text{NH}_3)_5(\text{NO}_2)\text{Cl}$  freezes at  $-0.00732^\circ\text{C}$ . Number of moles of ions which 1 mol of ionic compound produces on being dissolved in water will be ( $K_f = -1.86^\circ\text{C/m}$ )
- 3
  - 4
  - 1
  - 2
12. A solution of urea (mol. mass  $56 \text{ g mol}^{-1}$ ) boils at  $100.18^\circ\text{C}$  at the atmospheric pressure. If  $K_f$  and  $K_b$  for water are 1.86 and  $0.512 \text{ K kg mol}^{-1}$  respectively, the above solution will freeze at
- $0.654^\circ\text{C}$
  - $-0.654^\circ\text{C}$
  - $6.54^\circ\text{C}$
  - $-6.54^\circ\text{C}$

13. In mixture A and B components show -ve deviation as

- (a)  $\Delta V_{\text{mix}} > 0$
- (b)  $\Delta H_{\text{mix}} < 0$
- (c) A - B interaction is weaker than A - A and B - B interaction
- (d) A - B interaction is stronger than A - A and B - B interaction.

14. All form ideal solution except

- (a)  $\text{C}_6\text{H}_6$  and  $\text{C}_6\text{H}_5\text{CH}_3$
- (b)  $\text{C}_2\text{H}_6$  and  $\text{C}_2\text{H}_5\text{I}$
- (c)  $\text{C}_6\text{H}_5\text{Cl}$  and  $\text{C}_6\text{H}_5\text{Br}$
- (d)  $\text{C}_2\text{H}_5\text{I}$  and  $\text{C}_2\text{H}_5\text{OH}$ .

15. A binary liquid solution is prepared by mixing *n*-heptane and ethanol. Which one of the following statements is correct regarding the behaviour of the solution?

- (a) The solution is non-ideal, showing - ve deviation from Raoult's Law.
- (b) The solution is non-ideal, showing + ve deviation from Raoult's Law.
- (c) *n*-heptane shows + ve deviation while ethanol shows - ve deviation from Raoult's Law.
- (d) The solution formed is an ideal solution.

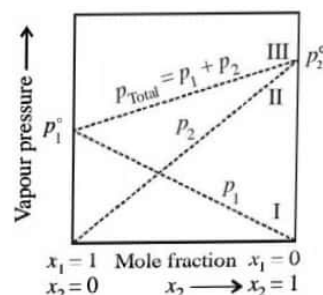
16. We have three aqueous solutions of NaCl labelled as 'A', 'B' and 'C' with concentrations 0.1M, 0.01M and 0.001M, respectively. The value of van't Hoff factor for these solutions will be in the order \_\_\_\_\_.

- (a)  $i_A < i_B < i_C$
- (b)  $i_A > i_B > i_C$
- (c)  $i_A = i_B = i_C$
- (d)  $i_A < i_B > i_C$

17. During depression of freezing point in a solution the following are in equilibrium

- (a) liquid solvent, solid solvent
- (b) liquid solvent, solid solute
- (c) liquid solute, solid solute
- (d) liquid solute, solid solvent

18. A plot of  $p_1$  or  $p_2$  vs the mole fractions  $x_1$  and  $x_2$  is given as.



In this figure, lines I and II pass through the point for which.

- (a)  $x_1 \neq 1; x_2 = 1$
- (b)  $x_1 = x_2 \neq 1$
- (c)  $x_1 = 1; x_2 \neq 1$
- (d)  $x_1 = x_2 = 1$

19. Which of the following modes of expressing concentration is independent of temperature?

- (a) Molarity
- (b) Molality
- (c) Formality
- (d) Normality

20. How many grams of concentrated nitric acid solution should be used to prepare 250 mL of 2.0M  $\text{HNO}_3$ ? The concentrated acid is 70%  $\text{HNO}_3$

- (a) 90.0 g conc.  $\text{HNO}_3$
- (b) 70.0 g conc.  $\text{HNO}_3$
- (c) 54.0 g conc.  $\text{HNO}_3$
- (d) 45.0 g conc.  $\text{HNO}_3$

21. Which among the following will show maximum osmotic pressure?

- (a) 1 M NaCl
- (b) 1 M  $\text{MgCl}_2$
- (c) 1 M  $(\text{NH}_4)_3\text{PO}_4$
- (d) 1 M  $\text{Na}_2\text{SO}_4$

22. The boiling point of 0.2 mol  $\text{kg}^{-1}$  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?

- (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.

23. Which of the following 0.10 m aqueous solutions will have the lowest freezing point ?  
 (a)  $\text{Al}_2(\text{SO}_4)_3$  (b)  $\text{C}_6\text{H}_{12}\text{O}_6$   
 (c)  $\text{KCl}$  (d)  $\text{C}_{12}\text{H}_{22}\text{O}_{11}$
24. If sodium sulphate is considered to be completely dissociated into cations and anions in aqueous solution, the change in freezing point of water ( $\Delta T_f$ ), when 0.01 mol of sodium sulphate is dissolved in 1 kg of water, is ( $K_f = 1.86 \text{ K kg mol}^{-1}$ )  
 (a) 0.372 K (b) 0.0558 K  
 (c) 0.0744 K (d) 0.0186 K
25. Which one of the following salts will have the same value of van't Hoff factor ( $i$ ) as that of  $\text{K}_4[\text{Fe}(\text{CN})_6]$ .  
 (a)  $\text{Al}_2(\text{SO}_4)_3$  (b)  $\text{NaCl}$   
 (c)  $\text{Al}(\text{NO}_3)_3$  (d)  $\text{Na}_2\text{SO}_4$
26. Mole fraction of the solute in a 1.00 molal aqueous solution is :  
 (a) 0.1770 (b) 0.0177  
 (c) 0.0344 (d) 1.7700
27. 25.3 g of sodium carbonate,  $\text{Na}_2\text{CO}_3$  is dissolved in enough water to make 250 mL of solution. If sodium carbonate dissociates completely, molar concentration of sodium ions,  $\text{Na}^+$  and carbonate ions,  $\text{CO}_3^{2-}$  are respectively (Molar mass of  $\text{Na}_2\text{CO}_3 = 106 \text{ g mol}^{-1}$ )  
 (a) 0.955 M and 1.910 M  
 (b) 1.910 M and 0.955 M  
 (c) 1.90 M and 1.910 M  
 (d) 0.477 M and 0.477 M
28. Azeotropic mixture of  $\text{HCl}$  and  $\text{H}_2\text{O}$  has  
 (a) 48%  $\text{HCl}$  (b) 22.2%  $\text{HCl}$   
 (c) 36%  $\text{HCl}$  (d) 20.2%  $\text{HCl}$
29. Freezing point of an aqueous solution is  $-0.186^\circ\text{C}$ . If the values of  $K_b$  and  $K_f$  of water are respectively  $0.52 \text{ K kg mol}^{-1}$  and  $1.86 \text{ K kg mol}^{-1}$ , then the elevation of boiling point of the solution in K is  
 (a) 0.52 (b) 1.04  
 (c) 1.34 (d) 0.052
30. Which of the following statements, regarding the mole fraction ( $x$ ) of a component in solution, is incorrect?  
 (a)  $0 \leq x \leq 1$   
 (b)  $x \leq 1$   
 (c)  $x$  is always non-negative  
 (d)  $-2 \leq x \leq 2$