

## Solution and Colligative properties

## SET Self Evaluation Test -4

- The 2N aqueous solution of  $H_2SO_4$  contains
  - 49 gm of  $H_2SO_4$  per litre of solution
  - 4.9 gm of  $H_2SO_4$  per litre of solution
  - 98 gm of  $H_2SO_4$  per litre of solution
  - 9.8 gm of  $H_2SO_4$  per litre of solution
- The amount of  $KMnO_4$  required to prepare 100 ml of 0.1N solution in alkaline medium is [CPMT 1986]
  - 1.58 gm
  - 3.16 gm
  - 0.52 gm
  - 0.31 gm
- What weight of hydrated oxalic acid should be added for complete neutralisation of 100ml of 0.2N-NaOH solution? [MP PMT 1997]
  - 0.45 g
  - 0.90 g
  - 1.08 g
  - 1.26 g
- A 500 g tooth paste sample has 0.2g fluoride concentration. What is the concentration of F in terms of ppm level [AIIMS 1992]
  - 250
  - 200
  - 400
  - 1000
- To 5.85 gm of NaCl one kg of water is added to prepare of solution. What is the strength of NaCl in this solution (mol. wt. of NaCl = 58.5) [CPMT 1990; DPMT 1987]
  - 0.1 Normal
  - 0.1 Molal
  - 0.1 Molar
  - 0.1 Formal
- The degree of dissociation of  $Ca(NO_3)_2$  in a dilute aqueous solution containing 14g of the salt per 200g of water  $100^\circ C$  is 70 percent. If the vapour pressure of water at  $100^\circ C$  is 760 cm. Calculate the vapour pressure of the solution [UPSEAT 2000]
  - 746.3 mm of Hg
  - 757.5 mm of Hg
  - 740.9 mm of Hg
  - 750 mm of Hg
- The vapour pressure of pure benzene at a certain temperature is 200 mm Hg. At the same temperature the vapour pressure of a solution containing 2g of non-volatile non-electrolyte solid in 78g of benzene is 195 mm Hg. What is the molecular weight of solid [UPSEAT 2001]
  - 50
  - 70
  - 85
  - 80
- Which one of the following non-ideal solutions shows the negative deviation
  - $CH_3COCH_3 + CS_2$
  - $C_6H_6 + CH_3COCH_3$
  - $CCl_4 + CHCl_3$
  - $CH_3COCH_3 + CHCl_3$
- The O.P. of equimolar solution of Urea,  $BaCl_2$  and  $AlCl_3$ , will be in the order [DCE 2000]
  - $AlCl_3 > BaCl_2 > Urea$
  - $BaCl_2 > AlCl_3 > Urea$
  - $Urea > BaCl_2 > AlCl_3$
  - $BaCl_2 > Urea > AlCl_3$
- The osmotic pressure of a 5% solution of cane sugar at  $150^\circ C$  is (mol. wt. of cane sugar = 342) [CPMT 1986; Manipal MEE 1995]
  - 4 atm
  - 3.4 atm
  - 5.07 atm
  - 2.45 atm
- Which one of the following pairs of solutions can we expect to be isotonic at the same temperature [NCERT 1982]
  - 0.1M urea and 0.1M NaCl
  - 0.1M urea and 0.2M  $MgCl_2$
  - 0.1M NaCl and 0.1M  $Na_2SO_4$
  - 0.1M  $Ca(NO_3)_2$  and 0.1M  $Na_2SO_4$
- Which of the following would have the highest osmotic pressure (assume that all salts are 90% dissociated) [NCERT 1982]
  - Decimolar aluminium sulphate
  - Decimolar barium chloride
  - Decimolar sodium sulphate
  - A solution obtained by mixing equal of (b) and (c) and filtering
- Which solution will have the highest boiling point [NCERT 1981]



- (a) 1% solution of glucose in water  
 (b) 1% solution of sodium chloride in water  
 (c) 1% solution of zinc sulphate in water  
 (d) 1% solution of urea in water
14. The boiling point of a solution of 0.11 gm of a substance in 15 gm of ether was found to be  $0.1^\circ\text{C}$  higher than that of the pure ether. The molecular weight of the substance will be ( $K_b = 2.16$ ) [MP PET 2002]
- (a) 148 (b) 158  
 (c) 168 (d) 178
15. The boiling point of benzene is 353.23 K. When 1.80 gm of a nonvolatile solute was dissolved in 90 gm of benzene, the boiling point is raised to 354.11 K. the molar mass of the solute is [ $K_b$  for benzene =  $2.53\text{ K mol}^{-1}$ ] [DPMT 2004]
- (a)  $5.8\text{ g mol}^{-1}$   
 (b)  $0.58\text{ g mol}^{-1}$   
 (c)  $58\text{ g mol}^{-1}$   
 (d)  $0.88\text{ g mol}^{-1}$
16. The boiling point of 0.1 molal aqueous solution of urea is  $100.18^\circ\text{C}$  at 1 atm. The molal elevation constant of water is
- (a) 1.8 (b) 0.18 (c) 18 (d) 18.6
17. The freezing point of a solution containing 4.8 g of a compound in 60 g of benzene is  $4.48^\circ\text{C}$ . What is the molar mass of the compound ( $K_f = 5.1\text{ km}^{-1}$ ), (freezing point of benzene =  $5.5^\circ\text{C}$ )
- (a) 100 (b) 200  
 (c) 300 (d) 400
18. When 0.01 mole of sugar is dissolved in 100 g of a solvent, the depression in freezing point is  $0.40^\circ$ . When 0.03 mole of glucose is dissolved in 50 g of the same solvent, the depression in freezing point will be
- (a)  $0.60^\circ$  (b)  $0.80^\circ$   
 (c)  $1.60^\circ$  (d)  $2.40^\circ$
19. The freezing point of equimolar aqueous solution will be highest for [IIT 1990; DCE 2001]
- (a)  $\text{C}_6\text{H}_5\text{NH}_3^+\text{Cl}^-$  (aniline hydrochloride)  
 (b)  $\text{Ca}(\text{NO}_3)_2$   
 (c)  $\text{La}(\text{NO}_3)_3$   
 (d)  $\text{C}_6\text{H}_{12}\text{O}_6$  (glucose)
20. The Van't Hoff factor of the compound  $\text{K}_3\text{Fe}(\text{CN})_6$  is
- (a) 1 (b) 2  
 (c) 3 (d) 4

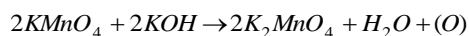


# AS Answers and Solutions

(SET -4)

1. (c) Wt. of  $H_2SO_4$  per litre =  $N \times \text{eq. mass} = 2 \times 49 = 98g$ .

2. (a) In alkaline medium  $KMnO_4$  act as oxidant as follows.



Hence its eq. wt. = m. wt. = 158

$$\text{Now, Normality} = \frac{\text{Mass}}{\text{Eq. mass}} \times \frac{1}{V(L)}$$

$$\text{mass} = 0.1 \times 158 \times \frac{100}{1000} g = 1.58 g.$$

3. (d) For complete neutralization equivalent of oxalic acid = equivalent of  $NaOH$  =

$$\frac{w}{\text{eq. wt}} = \frac{NV}{1000} \quad \therefore \frac{w}{63} = \frac{0.2 \times 100}{1000} \Rightarrow w = 1.26 gm.$$

4. (c)  $F^-$  ions in  $PPm = \frac{0.2}{500} \times 10^6 = 400$

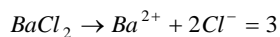
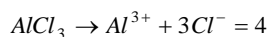
5. (b)  $5.85 g NaCl = 0.1 mol$  as it present in 1 kg of water ; molality =  $\frac{wt.}{m \text{ wt.} \times l} = \frac{5.85}{58.5 \times 1} = 0.1 molal$

6. (a)

7. (d)  $\frac{P^o - P_s}{P^o} = \frac{n}{n + N}$ ;  $\frac{P^o - P_s}{P^o} = \frac{w \times M}{m \times W} = 80$

8. (d)  $CH_3COCH_3 + CHCl_3$  is non ideal solution which shown negative deviation.

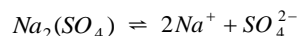
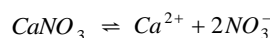
9. (a) The particle come of  $AlCl_3$  solution will be maximum due to ionisation less in  $BaCl_2$  and minimum in urea



More the number of particles in solution more is the osmotic pressure a colligative properties.

10. (c)  $\pi = \frac{5 \times 0.0821 \times 1000 \times 423}{342 \times 100} = 5.07 atm.$

11. (d) Osmotic pressure is a colligative properties equimolar solution of  $Ca(NO_3)_2$  and  $Na_2SO_4$  will produce same number of solute particles.



12. (a)  $Al_2(SO_4)_3$  Deci-molar gives maximum ion. \*\*\*  
Hence, its osmotic pressure is maximum.

13. (b)  $NaCl$  and  $ZnSO_4$  gives 2 ions but  $NaCl$  is more ionic than  $ZnSO_4$ .

14. (b)  $m = \frac{K_b \times w \times 1000}{\Delta T_b \times W}$

$$K_b = 2.16, w = 0.11, W = 15 g, \Delta T_b = 0.1$$

$$m = \frac{2.16 \times 0.11 \times 1000}{0.1 \times 15} = 158.40 \approx 158.$$

15. (c) The elevation ( $\Delta T_b$ ) in the boiling point

$$= 354.11K - 353.23K = 0.88K$$

Substituting these values in expression

$$M_{\text{Solute}} = \frac{K_b \times 1000 \times w}{\Delta T_b \times W}$$

Where,  $w$  = weight of solute,  $W$  = weight of solvent

$$M_{\text{solute}} = \frac{2.53 \times 1.8 \times 1000}{0.88 \times 90} = 58 gmol^{-1}$$

Hence, molar mass of the solute =  $58 gmol^{-1}$

16. (a)  $K_b = \frac{0.18}{0.1} = 1.8$

17. (d)  $m = \frac{K_f \times 1000 \times w}{W \times \Delta T_f} = \frac{5.1 \times 1000 \times 4.8}{60 \times 1.02} = 400.$

18. (d)  $\Delta T_f = mk_f$

$$0.40 = \frac{0.01 \times 1000}{100} \times k_f \Rightarrow k_f = 4$$

again  $\Delta T_f = mk_f$

$$= \frac{0.03 \times 1000}{50} \times 4$$

$$= 2.4$$

19. (d)  $La(NO_3)_3$  will furnish four ions and thus will develop more lowering in freezing point whereas glucose gives only one particle and thus minimum lowering in freezing point.

20. (d)  $K_3[Fe(CN)_6] \rightarrow 3K^+ + [Fe(CN)_6]^{3-}$ .

