CHEMISTRY

JEE MAINS & ADVANCED

CLASS - XII

MODULE – 01

The Solid State | Solutions | Electrochemistry | Chemical Kinetics | Surface Chemistry

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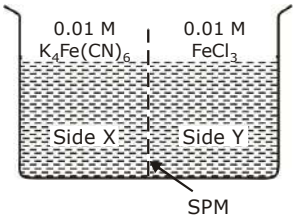
Q.48 A solution of a substance containing 1.05 g per 100 mL. was found to be isotonic with 3% glucose solution. The molecular mass of the substance is :
(1) 31.5 (2) 6.3
(3) 630 (4) 63

Q.49 The relationship between osmotic pressure at 273 K when 10 g glucose (P_1) 10 g urea (P_2) and 10 g sucrose (P_3) are dissolved in 250 ml of water is -
(1) $P_1 > P_2 > P_3$ (2) $P_3 > P_1 > P_2$
(3) $P_2 > P_1 > P_3$ (4) $P_2 > P_3 > P_1$

Q.50 Which one of the following pairs of solution can we expect to be isotonic at the same temperature -
(1) 0.1 M urea and 0.1 M NaCl
(2) 0.1 M urea and 0.2 M $MgCl_2$
(3) 0.1 M NaCl and 0.1M Na_2SO_4
(4) 0.1 M $Ca(NO_3)_2$ and 0.1 M Na_2SO_4

Q.51 $FeCl_3$ on reaction with $K_4[Fe(CN)_6]$ in aqueous solution gives blue colour. These are separated by a semipermeable membrane AB as shown. Due to osmosis there is



(1) Blue colour formation in side X.
(2) Blue colour formation in side Y.
(3) Blue colour formation in both of the sides X and Y.
(4) No blue colour formation.

EXERCISE-III

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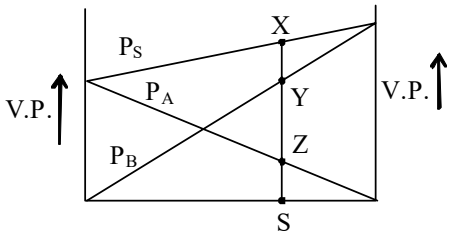
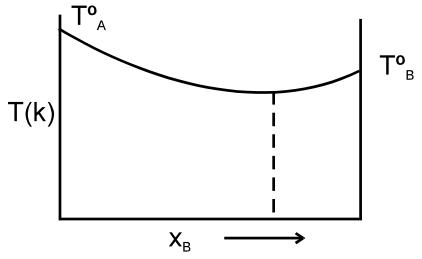
MCQ/COMPREHENSION/STATEMENT/MATCHING

Q.1 Consider following vapour pressure composition graph. Hence-



(A) V.P. of A = SZ
(B) V.P. of B = ZY
(C) V.P. of B = SY
(D) V.P. of solution at X = SZ + SY

Q.2 The diagram given below represents boiling point composition diagram of solution of component A and B, which is/are incorrect among the following?



(A) The solution shows negative deviation
(B) A-B-interactions are stronger than A-A and B-B
(C) The solution is ideal solution
(D) The solution shows positive deviation.

Q.3 The example of negative deviationis
(A) HCl & H_2O
(B) C_2H_5OH & H_2O
(C) $CHCl_3$ & CH_3COCH_3
(D) C_6H_6 & $C_6H_5CH_3$

Q.4 acetone and carbon disulphide form binary liquid solution showing positive deviation from Raolut law. The normal polling point (T_b) of pure acetone is less than that of pure CS_2. Pick out the **incorrect** statements among the following.
(A) Boiling temperature of mixture is always less than boiling temperature of acetone.
(B) Boiling temperature Azeotropic mixture is always less than boiling temperature of pure CS_2
(C) When a small amount CS_2(less volatile component) is added to excess of acetone boiling point of resulting mixture increases.
(D) A mixture of CS_2 and CH_3COCH_3 can be completely separated by simple fractional distillation.

Q.5 Which of the following is correct for an ideal solution ?
(A) Raoult's law is obeyed for entire concentration range and temperatures
(B) $\Delta H_{mix} = 0$
(C) $\Delta V_{mix} = 0$
(D) $\Delta S_{mix} = 0$

Q.6 Which of the following will form non-ideal solution ?
(A) C_2H_5OH and water
(B) HNO_3 and water
(C) $CHCl_3$ and CH_3COCH_3
(D) C_6H_6 and $C_6H_5CH_3$

Q.7 In which of the following pairs of solutions will the values of the vant Hoff factor be the same?
(A) 0.05 M $K_4[Fe(CN)_6]$ and 0.10 M $FeSO_4$
(B) 0.10 M $K_4[Fe(CN)_6]$ and 0.05 M $FeSO_4(NH_4)_2SO_4 \cdot 6H_2O$
(C) 0.20 M NaCl and 0.10 M $BaCl_2$
(D) 0.05 M $FeSO_4(NH_4)_2SO_4 \cdot 6H_2O$ and 0.02 M $KCl \cdot MgCl_2 \cdot 6H_2O$

Q.8 In which case van't Hoff factor are equal ?
(A) KCl, 50% ionised
(B) K_2SO_4, 40% ionised
(C) $FeCl_3$, 30% ionised
(D) $SnCl_4$, 20% ionised

Q.9 For the given electrolyte A_xB_y, the degree of dissociation 'α' can be given as

(A) $\alpha = \dfrac{i-1}{x+y-1}$

(B) $i = (1-\alpha) + x\alpha + y\alpha$

(C) $\alpha = \dfrac{1-i}{1-x-y}$

(D) None

Q.10 When $CuSO_4$ is dissolved in NH_4OH solution then the correct statement is
(A) Freezing point of solution is raised
(B) Boiling point of solution is lowered
(C) Freezing point of solution is lowered
(D) Boiling point of solution is raised

Q.11 Which has the equal boiling point ?
(A) 0.1 M Na_2SO_4
(B) 0.1 M $C_6H_{12}O_6$ (glucose)
(C) 0.1 M $MgCl_2$
(D) 0.1 M $Al(NO_3)_3$

Comprehenson # 1 (Q. No. 12 to 14)

Colligative properties i.e., the properties of solution which depend upon the number of particles present in solution are osmotic pressure, depression in freezing point, elevation in boiling point and lowering in vapour pressure. Experimental values of colligative properties for electrolytes are always higher than those obtained theoretically because electrolytes dissociate to furnish more ions in solution. On the other hand experimentally obtained values of colligative properties for associating nature of solute are lower than those obtained theoretically. The ratio of experimental colligative properties to theoretical colligative properties is called as vant Hoff factor (i).

Q.12 A weak monoprotic acid (molar mass 180) aqueous solution of 0.18 % w/v at 300 K has observed osmotic pressure 0.369 atm. What should be its Vant Hoff factor (i). ($R = 0.082$ atm $\times$ L/K $\times$ mole)
(A) 1.2 (B) 1.5
(C) 1 (D) 0.5

Q.13 What is observed molar mass of weak acid in solution in above question.
(A) 270 gm (B) 180 gm
(C) 120 gm (D) 90 gm

Q.14 If equal volume of 0.01 M NaOH is added in the solution of above weak acid solution then what will be new observed osmotic pressure at same temperature. Neglect the hydrolysis, dissociation of water and any volume contraction or expansion. Assume 100% dissociation of salt formed.
(A) 0.246 atm (B) 0.369 atm
(C) 0.123 atm (D) 0.492 atm

Comprehension # 2 (Q. No. 15 to 17)

Vapour pressure of a solvent is the pressure exerted by vapours when they are in equilibrium with its solvent at that temperature. The vapour pressure of solvent is dependent on nature of solvent, temperature, addition of non-volatile solute as well as nature of solute to dissociate or associate. The vapour pressure of a mixture obtained by mixing two volatile liquids is given by $P_M = P^o_A \cdot X_A + P^o_B \cdot X_B$ where P^o_A and P^o_B are vapour pressures of pure components A and B and X_A, X_B are their mole fraction in mixture. For solute-solvent system, the relation becomes $P_M = P^o_A \cdot X_A$ where B is non-volatile solute.

Q.15 The vapour pressure of benzene and its solution with a non-electrolyte are 640 and 600 mm respectively. The molality of the solution is -
(A) 0.80 (B) 0.86
(C) 0.90 (D) 0.95

Q.16 A mixture of two volatile liquids A and B for 1 and 3 moles respectivley has a V.P. of 300 mm at 27ºC. If one mole of A is further added to this solution, the vapour pressure becomes 290 mm at 27ºC. The vapour pressure of pure A is -
(A) 250 mm (B) 316 mm
(C) 220 mm (D) 270 mm

Q.17 The amount of solute (mol. wt. 60) required to dissolve in 180 g of water to reduce the vapour pressure to 4/5 of the pure water -
(A) 120 g (B) 150 g
(C) 200 g (D) 60 g

Q.18 **Column – I**

Column – II

Assuming all the solutes are non volatile and all solutions are ideal and neglect the hydrolysis of cation

and anion.

(A) 10 ml 0.1 M NaOH aqueous solution is added to 10 ml 0.1 M HCl aqueous solution (p) Osmotic pressure of solution increases

(B) 10 ml 0.1 M NaOH aqueous solution is added to 10 ml 0.1 M CH_3COOH aqueous solution (q) Vapour pressure of solution increases

(C) 10 ml 0.1 M HCl aqueous solution is added to 10 ml 0.1 M NH_3 aqueous solution (r) Boiling point of solution increases

(D) 10 ml 0.1 M HCl aqueous solution is added to 10 ml 0.1 M KOH aqueous solution (s) Freezing point of solution increases

Q.19

Column I	**Column II**
(A) Ideal solution solute	(P) Solute-solvent interactions are weaker than solute-
(B) Solutions showing	(Q) Solute-solvent interactions are similar to positive deviations solute-solute
(C) Solutions showing negative deviations	(R) Solute-solvent interactions are stronger than solute-solute interactions

Q.20

Column I	**Column II**
(A) Acetone + $CHCl_3$	(p) $\Delta S_{mix.} > 0$
(B) Ethanol + Water	(q) $\Delta V_{mix.} > 0$
(C) $C_2H_5Br + C_2H_5I$	(r) $\Delta H_{mix.} < 0$
(D) Acetone + Benzene	(s) Maximum boiling azeotropes
	(t) Minimum boiling azeotropes

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Q.21 At 10°C, the osmotic pressure of urea solution is 500 mm of Hg. The solution is diluted and the temperature is raised to 25°C, when the osmotic pressure is found to be105.3 mm of Hg . Determine extent of dilution.

Q.22 The freezing point of a solution containing 2.40 g of a compound in 60.0 g of benzene is 0.10°C lower than that of pure benzene. What is the molecular weight of the compound? (K_f is 5.12°C/m for benzene)

Q.23 A solution containing 3.24 g of a nonvolatile nonelectrolyte and 200 g of water boils at 100.130°C at 1atm. What is the molecular weight of the solute? (K_b for water 0.513°C/m)

Q.24 Two liquids A and B have $P_A^0 : P_B^0 = 1 : 3$ at a certain temperature. If the mole fraction ratio of $x_A : x_B = 1 : 3$, the mole fraction of A in vapour in equilibrium with the solution at a given temperature is-

Q.25 The vapour pressure of water at room temperature is lowered by 5% by dissolving a solute in it, then the approximate molality of solution is :

Q.26 Van't Hoff factor of $Ca(NO_3)_2$ is

ABOUT PHYSICS WALLAH

Alakh Pandey is one of the most renowned faculty in NEET & JEE domain's Physics. On his YouTube channel, Physics Wallah, he teaches the Science courses of 11th and 12th standard to the students aiming to appear for the engineering and medical entrance exams.

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