UNIT : 6 SOLUTIONS

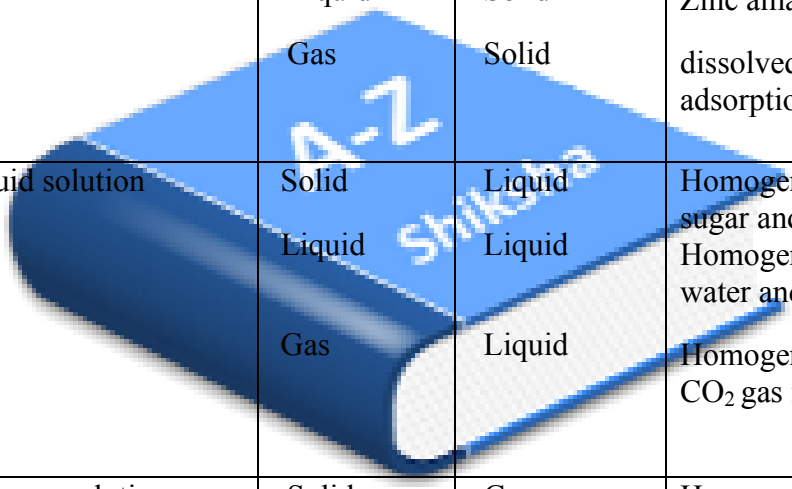
Important Points

When two or more than two substance mix and from a uniform or homogeneous mixture, Such a mixture is called solution.

Type of solutions

The solutions can be found in three states; Solid, Liquid and Gas. The solute and solvent can also be in three states. The physical state of the resulting solution can be decided on the basis of physical state of solute and solvent.

Sr No.	Type of solution	Physical state		Examples
		Solute	Solvent	
1	Solid solution	Solid	Solid	Alloy formed from copper and zinc (Brass).
		Liquid	Solid	Zinc amalgam-Zinc
		Gas	Solid	dissolved in mercury (Zn/Hg adsorption of H_2 gas on Pd.
2	Liquid solution	Solid	Liquid	Homogeneous mixture of sugar and water.
		Liquid	Liquid	Homogeneous mixture of water and ethanol.
		Gas	Liquid	Homogeneous mixture of CO_2 gas in water.
3	Gaseous solution	Solid	Gas	Homogeneous mixture of camphor in N_2 gas.
		Liquid	Gas	Air containing moisture
		Gas	Gas	Mixture of H_2 and O_2 gas.



$$\text{Formality}(F) = \frac{1000 \times \text{mass of solute}(\text{gram})}{\text{Formula mass of solute} \times \text{volume of solution}(\text{ml})}$$

$$\%\,V/V = \frac{100 \times \text{volume of solute}}{\text{volume of solute} + \text{volume of solvent}} = \frac{100 \times \text{volume of solute}(\text{ml})}{\text{volume of solvent}(\text{ml})}$$

$$\%\,W/V = \frac{100 \times \text{mass of solute}(\text{gram})}{\text{volume of solution}(\text{ml})}$$

$$\text{parts per million by mass to volume} = \frac{\text{amount of solute}(mg)}{\text{amount of solution}(litre)}$$

Factors which effect the solubility of gaseous solute in liquid solution formed by homogeneous Mixture of gaseous solute and are given as under.

(i) Nature of gaseous solute and the solvent (ii) Effect of temperature (iii) Effect of pressure

Henry's law : $p = K_H . X$ where, K_H is Henry's constant.

When solid solute is dissolved in solid solvent is gives solid Solution. The molecules are arranged in two ways:

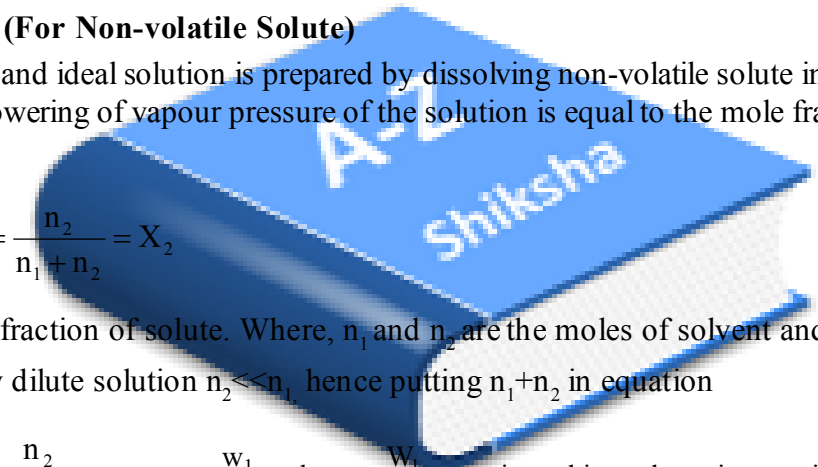
(1) Substituted solid solution **(2) Interstitial solid solution**

Solution-Colligative Properties

When solute substances are dissolved in pure solvent, the solutions are obtained. Some properties of solvent change viz. the vapour pressure of a solution prepared from a solvent is less than that of pure solvent, while the boiling point increases and freezing point decreases. The osmotic pressure also changes. The change in these properties depend in number of molecules of solute but not on nature of solute. Such properties are called colligative properties of solution.

Raoult's Law (For Non-volatile Solute)

"If dilute and ideal solution is prepared by dissolving non-volatile solute in a volatile solvent, the relative lowering of vapour pressure of the solution is equal to the mole fraction of the dissolved solute."



$$\frac{P_1^0 - P1}{P1^0} = \frac{n_2}{n_1 + n_2} = X_2$$

i.e. mole fraction of solute. Where, n_1 and n_2 are the moles of solvent and solute respectively.

|For Very dilute solution $n_2 << n_1$ hence putting n_1+n_2 in equation

$$\frac{P_1^0 - P1}{P1^0} = \frac{n_2}{n_1} \text{ but } = n_2 = \frac{w_1}{M_2} \text{ and } n_1 = \frac{W_1}{M_1}, \text{ putting this values in eqution}$$

$$\frac{P_1^0 - P1}{P1^0} = \frac{W_2 \times M_1}{M_2 \times W_1}$$ where, W_1 = mass of solvent, M_1 = molecular mass of solvent

W_2 = mass of solute, M_1 = molecular mass of solute

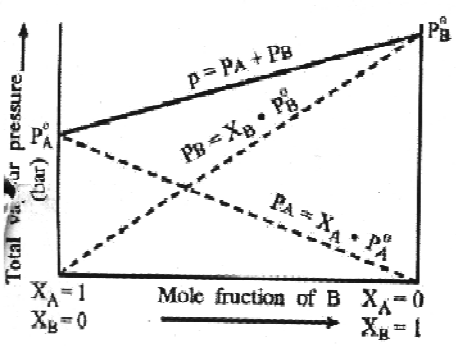
Raoult's Law (For Volatile Solute and Volatile Solvent)

Suppose in a binary solution X_A is the mole-fraction of solute A and its partial pressure is p and XB is the mole fraction of the solvent B and its partial pressure is PB then according to Raoult law $P_A \ \alpha \ X_A$ and $P_B \ \alpha \ X_B$.

According to experimental observations Raoul's law can be proved that if the vapour pressure of solute is P_A^0 and vapour pressure of pure solvent is P_B^0 then,

$P = p_A^0 X_A$ and $p_B^0 X_B$

Total Pressure $P = p_A + p_B$ Total pressure $p = p_A^0 \ X_A + p_B^0 \ X_B$



In vapour If at equilibrium stage, Y_A and Y_B are the mole-fractions of component A and component B respectively the at equilibrium the partial pressure P_A and P_B of each component can be obtained by equations given below.

$P_A = Y_A \cdot P_{total}$

$P_B = Y_B \cdot P_{total}$

$\Delta T_b = \dfrac{K_b \times 1000 \times w_2}{M_2 \times w_1}$ where K_b = Molal elevation constant W_1 = mass of solvent

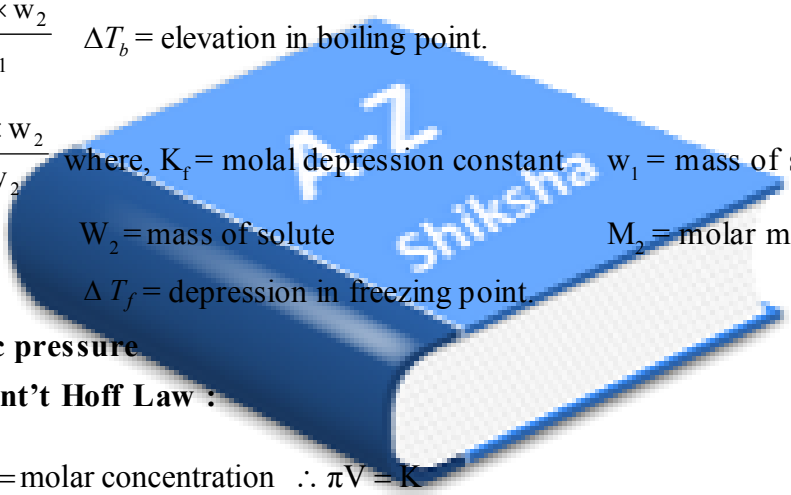
$\therefore K_b = \dfrac{\Delta T_b \times w_1 \times M_2}{1000 \times w_1}$ W_2 = mass of solute M_2 = molecular mass of solute

$\Delta T_f = \dfrac{K_f \times 1000 \times w_2}{M_2 \times w_1}$ ΔT_b = elevation in boiling point.

$K_f = \dfrac{\Delta T_f \times w_1 \times w_2}{1000 \times w_2}$ where, K_f = molal depression constant w_1 = mass of solvent

W_2 = mass of solute M_2 = molar mass of solute

ΔT_f = depression in freezing point.



Laws of osmotic pressure

(i) Boyle's-vant't Hoff Law :

$\pi \ \alpha \ C = \dfrac{n}{V}$ = molar concentration $\therefore \pi V = K$

(ii) Gay-Lussac van't Hoff Law :

$\pi = KT$ where, K = proportionality conctant

(iii) Avogadro's-vant't-Hoff law

$\pi \ \alpha \ n$ $\pi = \dfrac{nRT}{V}$ where, R is proportionality constant and its value is equation that of gas Constant

$\pi \ \alpha \ T$ (Boyle-van't-Hoff Law). $\therefore \pi V = nRT$

$\pi \alpha T$ (Gay-Lussac-van't-Hoff Law) where π = Osmotic pressure in bar

V = volume of solution in life

n = number of moles of solute

R = gas constant

T = absolute temperature in Kelvin.

Then, solution whose osmotic pressure is less it is known as hypotonic with comparison to higher pressure solution.

A solution whose osmotic pressure is higher, in comparison to solution having less osmotic pressure is called hypertonic solution.

Less than 0.91% W/V pure NaCl solution is hypotonic compared to fluid inside human blood NaCl solution having concentration more than 0.91% W/V is hypertonic with respect to fluid inside human body.

Van't Hoff factor (i) $= \dfrac{\text{Normal molar mass of solute}}{\text{Abnormal moral mass of solute}}$

$= \dfrac{\text{Theorical molar mass of solute}}{\text{Experimental moral mass of solute}}$

$= \dfrac{\text{Observed colligative property}}{\text{Theoritical collingative property}}$

By introducing van't Hoff factor (i) the formula to obtain molar mass can be written as follows

Raoult's law : $\dfrac{p_1^0 - p_1}{p_1^0} = i \quad \dfrac{n_2}{n_1 + n_2} \approx i \dfrac{n_2}{n_1}$

Molal elevation : $\Delta T_b = i K_b.m$

Molal depression : $\Delta T_f = i K_f.m$

Osmotic pressure of solution : $\pi = i \dfrac{nRT}{V}$

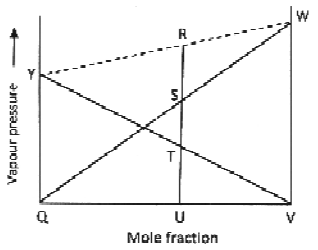
Molality $= \dfrac{1000 \times \text{Molarity}}{(1000 \times \text{density}) - (\text{molar mass of solute} \times \text{molarity})}$

$M.V = M_1.V_1 + M_2.V_2 + M_3.V_3, \qquad V = V_1 + V_2 + V_3$

$K_a = \text{Molarity} \times \left(\dfrac{\alpha^2}{1-\alpha}\right) \quad \alpha = \dfrac{i-1}{n-1} \quad i = \dfrac{\Delta T_{ob}}{\Delta T_{cal}} = \dfrac{\pi_{ob}}{\pi_{cal}} = \dfrac{M}{M_{ob}} = \text{Theoretical molar mass} \left[\dfrac{\Delta Tf}{\Delta Tb} = \dfrac{Kf}{Kb}\right]$

Degree of association (X) $= (1\text{-}i) \dfrac{n}{n-1}$

Degree of dissociation $(\alpha) = \dfrac{i-1}{n-1}$



$[(i)\ p = p_1^0.X + p_B^0.X_B \qquad (ii)\ p = p_A^0 + (p_B^0 - p_A^0) X_B$

UR = QY.VU+VW.QU

UR = QY+(VW-QY)QU

$(iii)\ p = p_B^0 + (p_A^0 - p_B^0) X_A$

UR = VW+ [(QY-VW)VU]

M.C.Q.

1. Which of the following possesses physical state of solute and solvent are liquid and solid respectively ?

   (a) solution of sugar in water (b) zinc amalgam

   (c) solution of Naphthelene in benzene (d) brass

2. Which of the following alternative is correct for physical state of solute and solvent for a solution of camphor in N_2 gas ?

   (a) solid, gas (b) solid, liquid (c) gas, solid (d) gas, gas

3. Which of the following is an example of solid solution ?

   (a) interstitial compound of hydrogen and Pd (b) WC

   (c) Zn / Hg (d) Given all

4. Which of the following pair of solution having same physical state of solute ?

   (a) homogenous mixture of chloroform in N_2 gas, solution of CO_2 in water

   (b) brass, sodium amalgam

   (c) homogenous mixture of camphor in N_2 gas, solution of H_2 gas in Pd metal

   (d) moist air, solution of ethanol in water

5. Which of the following pair of solution having same physical state of solvent ?

   (a) homogenous mixture of chloroform in N_2 gas, solution of CO_2 in water

   (b) brass, solution of salt in water

   (c) homogenous mixture of camphor in N_2 gas, moist air

   (d) solution of H_2 gas in Pd metal, solution of ethanol in water

6. Which of the following pair of solution having different physical state of solute ?

   (a) homogenous mixture of chloroform in N_2 gas, solution of CO_2 in water

   (b) brass, homogenous mixture of camphor in N_2 gas

   (c) sodium amalgam, moist air

   (d) solution of H_2 gas in Pd metal mixture of N_2 and O_2

7. Which of the following pair of solution having different physical state of solvent ?

   (a) homogenous mixture of N_2 gas in chloroform, mixture of N_2 and O_2

   (b) brass, solution of H_2 gas in Pd metal

   (c) sodium amalgam, solution of urea in water

   (d) solution of CO_2 in water, solution of Naphthelene in benzene

8. Which of the following compound possesses maximum solubility in water ?

   (a) pentan – 1 - ol (b) Pentane – 2, 3 – diol

   (c) pentane – 1, 2, 3 – triol (d) Pentane – 1, 2, 3, 4 – tetraol

9. Which of the following given compound is least soluble in water ?

(a) Hexan – 1 – ol (b) glycerol

(c) Propane – 1, 3 – diol (d) ethylene glycol

10. To convert molarity into which of the following unit of concentration, does not require density of the solution ?

(a) molality (b) normality (c) mole-fraction (d) % w/w

11. To convert molality into which of the following unit of concentration require density of the solution ?

(a) percentage weight by weight (b) percentage by volume

(c) mole-fraction (d) given all

12. Which of the following unit of concentration does not depend on temperature ?

(a) formality (b) molarity (c) molality (d) normality

13. Which of the following unit of concentration depends on temperature ?

(a) molality (b) normality (c) mole-fraction (d) given all

14. What would be the formality of solution prepared by dissolving 9.48 gm. Potash-alum dissolved in 5 litre water ? [M.W of Potash-alum = 948 gm/mole]

(a) 0.04 F (b) 0.02 F (c) 0.002 F (d) 0.004 F

15. What quantity of potash-alum is required to prepare 500ml solution having strength 1.5 F

(a) 711gm (b) 355.5 gm (c) 35.55 gm (d) 71.1 gm

16. What would be the concentration in % w/v of aqueous solution in which 80 ml ethanol is dissolved in 4 lt. Solution ?

(a) 4% v/v (b) 10% v/v (c) 2% v/v (d) 8% v/v

17. What would be the volume of acetone required to prepare 10% v/v acetone solution in 5 lt. Solution ?

(a) 50 ml (b) 5 ml (c) 100 ml (d) 500 ml

18. 15 % w/v solution of sugar is prepared by dissolving 1200 gm sugar in water, then, what would be the volume of the solution ?

(a) 8000 ml (b) 4 lt (c) 800 ml (d) 5000 ml

19. 0.004 gm O_2 is dissolved in an aqueous solution of 50 litre, then, what would be the ppm of solution by weight-volume ?

(a) 0.04 (b) 0.008 (c) 0.004 (d) 0.08

20. The concentration of Ca^{2+} ion in a sample of water is 0.0002 M then what would be the concentration of Ca^{2+} in ppm by weight-volume ? (Atomic wt. of ca = 40 gm/mole)

(a) 4 (b) 8 (c) 0.08 (d) 0.4

21. The concentration of F^- ion in a sample of water is 10 ppm; then, concentration of F^- ion in a solution in % w/v is

(a) 10^{-3} (b) 10^{-2} (c) 10 (d) 10^{-4}

22. What would be the weight of O_2 gas in gram dissolved in an aqueons solution of 500ml having strength 5 ppm ?

(a) 0.025 (b) 2.5×10^{-4} (c) 2.8×10^{-3} (d) 2.8×10^{-5}

23. What would be the molarity of solution prepared by taking a mixture of 1400 ml 0.3 M, 700 ml 0.4 M and 500 ml 1.2 M aqueous solutions ?

(a) 0.5 M (b) 0.8 M (c) 0.6 M (d) 0.7 M

24. What quantity of KOH is required to prepare 10 % w/w KOH solution having weight 1000 gm ?

(a) 50 gm (b) 25 gm (c) 100 gm (d) 150 gm

25. What amount of water is added in an aqueous solution of 5000 ml having concentration 1.5 M to prepare 0.5 M solution ?

(a) 15 litre (b) 5 litre (c) 10 litre (d) 20 litre

26. On Which factors, the solubility of gaseous solute in liquid depends ?

(a) temperature (b) Pressure of the gas

(c) Nature of gaseous solute and solvent (d) Given all

27. At 293 K temperature, if partial pressure of all given gases are same, then, which of the following gas possesses maximum solubility in water ?

(a) He (b) N_2 (c) H_2 (d) O_2

28. At 298 K temperature, if partial pressure of all given gases are same, then, which of the following gas possesses least solubility in water ?

(a) carbon dioxide (b) formaldehyde (c) methane (d) vinyl chloride

29. At 298 K temperature, if partial pressure of all given gases are same, then, which of the following is the correct ascending order of solubility of gases in water ?

(a) $Ar < HCHO < CH_4 < CH_2 = CH - Cl$

(b) $Ar < CH_2 = CH - Cl < CH_4 < HCHO$

(c) $Ar < CH_4 < HCHO < CH_2 = CH - Cl$

(d) $Ar < HCHO < CH_2 = CH - Cl < CH_4$

30. At 293 K temperature, if partial pressure of all given gases are same, then, which of the following is the correct descending order of solubility of gases in water ?

(a) $H_2 > N_2 > O_2 > He$ (b) $N_2 > H_2 > O_2 > He$

(c) $O_2 > N_2 > H_2 > He$ (d) $O_2 > H_2 > N_2 > He$

31. At 293 K temperature, for solubility of all given gases, in water, which gas possesses higher value of KH ?

(a) He (b) N_2 (c) H_2 (d) O_2

32. At 293 K temperature, for solubility of all given gases, in water, which gas possesses lower value of KH ?

(a) Carbon dioxide (b) formaldehyde (c) methane (d) vinyl chloride

33. At 298 K temperature, for solubility of all given gases, which of the following is the correct ascending order of values of Henry's constant ?

(a) CH_4 <Ar < HCHO < $CH_2 = CH - Cl$

(b) HCHO < $CH_2 = CH - Cl$ < CH_4 <Ar

(c) HCHO < CH_4 < $CH_2 = CH - Cl$ < Ar

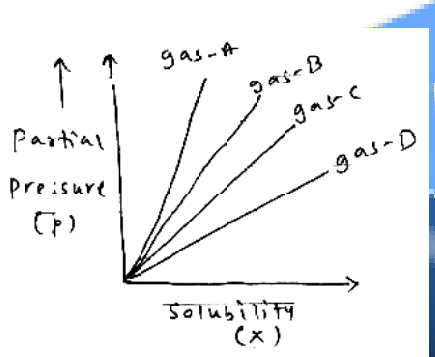
(d) $CH_2 = CH - Cl$ < HCHO < CH_4 < Ar

34. At 293 K temperature, for solubility of all given gases, which of the following is the correct descending order of values of Henry's constant ?

(a) $H_2 > N_2 > O_2 >$ He (b) $N_2 > H_2 > O_2 >$ He

(c) He > $N_2 > H_2 > O_2$ (d) $O_2 > H_2 > N_2 >$ He

35. At constant temperature, on the basis of the given graph, which gas possesses higher solubility?



(a) A

(b) B

(c) C

(d) D

36. In which of the following specific condition, CO_2 gas is filled in cold drinks, and in soda water ?

(a) at high temperature and high pressure (b) at low temperature and high pressure

(c) at low temperature and low pressure (d) at high temperature and low pressure

37. In which condition, Henry's law is applicable ?

(a) ideal behaviour of gaseous solute at high pressure and low temperature

(b) gaseous solute neither associate nor dissociate in solution

(c) gaseous solute react with solvent

(d) applicable in given all conditions

38. Now a days, divers uses the cylinder having gaseous mixture contains -

(a) 2 % O_2 and 98 % He (b) 11.7 % He, 56.2 % N_2 and 32.1 % O_2

(c) 11.7 % N_2, 56.2% He and 32.1% O_2 (d) 11.7 % He, 56.2 % O_2 and 32.1 % N_2

39. Due to which reason, O_2 gas liberates from the blood of tissues of animal bodies

(a) less temperature of tissues (b) partial pressure of oxygen gas is more in tissues

(c) partial pressure of carbon dioxide is less in tissues

(d) partial pressure of oxygen gas is less in tissues

40. Which of the following is not a substitutional solid solution ?

(a) wc (b) brass (c) steel (d) monel metal

41. Which of the following is a substitutional solid solution ?

(a) wc (b) bronze (c) steel (d) monel metal

42. Solute + solvent $\rightleftharpoons$ solution; $\Delta H > O$. what would be the change in solubility of substance on increasing the temperature at equilibrium ?

(a) increases (b) decreases (c) remains constant(d) can't be predicted

43. Which of the following is a colligative property ?

(a) vapour pressure (b) boiling point (c) freezing point (d) osmotic pressure

44. What will be the ratio of any colligative properties of 1.0 m aqueons solutions of Nacl, Na_2So_4 ad K_4 $[Fe(CN)_6]$ (Assume that solute completely (100%) dissociates in the solution)

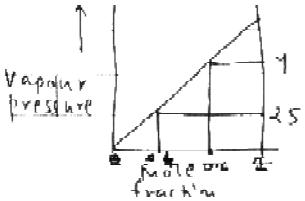
(a) 2:3:4 (b) 1:2:4 (c) 2:3:5 (d) 1:3:5

45. At constant temperature, vapour pressure of aqueous solutions of Na_2so_4, urea and $AlCl_3$ are equal with the vapour pressure of aqueous solution of 1.2 m kcl solution; then molality of an aqueons of Na_2So_4, urea and $AlCl_3$ are respectively –

(a) 3.6 .2.4 m,4.8 m (b) 0.8 m,2.4 m, 0.6 m

(c) 0.6 m, 3.6 m, 0.8 m (d) 3.6 m, 1.2 m, 2.4 m

46. Mention the correct value of y in the Reference of given below



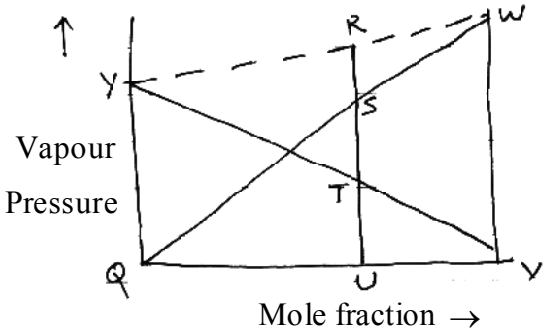
(a) 62.5 Torr

(b) 37.5 Torr

(c) 60 Torr

(d) 16.33 Torr

47. In the reference of given graph, The value of RU – YQ × UV is



(a) YQ.UV (b) QU. UW (c) VW. QU (d) ST.YQ

48. Ionic substances are completely dissociates in the given solutions, then which of the following solutions possesses highest freezing point ?

(a) 0.01m Urea (b) 0.01m NaCl

(c) 0.01m $BaCl_2$ (d) 0.01m $Al_2(SO_4)_3$

49. In Binary ideal solution forms by liquid A and B, at constant temperature, mole-fraction of liquid A in vapour state is 0.4 and its partial vapour pressure is 400 mm, then what will be the partial vapour pressure of B ?

(a) 600 mm (b) 300 mm (c) 500 mm (d) 200 mm

50. 1.0 molal aqueous solution of a substance boils at 100.55 °C ; then, at what approximate temperature, it freezes ? (Kb = 0.51 °C – kg - $mole^{-1}$ and Kb = 1.86 °C – kg - $mole^{-1}$)

(a) 272 K (b) 271 K (c) 375 K (d) 274 K

51. Ionic substances are completely dissociates, then aqueous solution of which of the following substances having least freezing point ?

(a) glucose (b) NaCl (c) $Al_2(SO_4)_3$ (d) $CaCl_2$

52. 0.2 M aqueous solution of NH_4Cl is isotonic with which of the following aqueous solution ?

(a) 0.1 M Na_3PO_4 (b) 0.2 M K_2SO_4 (c) 0.1 M $Al_2(SO_4)_3$ (d) none of thses

53. At constant temperature, osmotic pressure of an aqueous solution of 1.5 M NH_4NO_3 and *x*N $Al_2(SO_4)_3$ are equal, then mention the value of X. (Assume that ionic solid substances completely dissociates in the solution)

(a) 0.1 (b) 3.6 (c) 1.2 (d) 0.6

54. At constant temperature, vapour pressure of an aqueous solution of 1.5M NH_4NO_3 and *x*M $Al_2(SO_4)_3$ are equal; then calculate the molality of an aqueous solution of $Al_2(SO_4)_3$. (Assume that ionic solid substances completely dissociates in the solution)

(a) 0.3 m (b) 2.1 m (c) 3.75 m (d) 0.6 m

55. Boiling point of the aqueous solution prepared by dissolving 1.5 mole substances in 1000 gm water at 1 atmosphere pressure is 100.5°C; then which of the following alternative is correct for the solution ? (Kb = 0.152°C – kg - $mole^{-1}$)

(a) i = 1 (b) 1 < i < 2 (c) i < 1 (d) i > 2

56. Which of the following aqueous solution is isotonic with 0.2 m $Na_4[CoF_6]$ solution ? (Assume that ionic solid substances completely dissociates in the solution)

(a) 0.2 m urea (b) 0.25 m $AlCl_3$ (c) 0.15m $CaCl_2$ (d) 0.2 m $CuSo_4$

57. Which type of solution, moist air is ?

(a) gas (b) liquid (c) solid (d) colloidal

58. Aqueous solutions are separated by semipermeable membrane. For which pair of the given solution having maximum osmotic pressure ? (Assume that ionic solid substances completely dissociates in the solution)

(a) 0.5 m NaCl | 0.1 m Na_2SO_4 (b) 0.3 m NaCl | 0.1 m Na_2SO_4

(c) 0.5 m NaCl | 0.1 m $FeCl_3$ (d) 0.5 m NaCl | 0.1 m sugar

59. At constant temperature, the vapour pressure of an aqueous solution of Na_2SO_4 and 0.3 m Na_3PO_4 are approximately equal; then, what would be the molality of an aqueous solution of Na_2SO_4 ? (Assume that ionic solid substances completely dissociates in the solution)

(a) 0.5 m (b) 0.6 m (c) 0.4 m (d) 1.2 m

60. What will be the ratio of elevation in boiling point of aqueous solution of 1 m sugar, 1 C_sCl, and 1 m Na_2SO_4 ? (Assume that ionic solid substances completely dissociates in the solution)

(a) 3 : 2 : 1 (b) 1 : 3 : 2 (c) 1 : 2 : 3 (d) 3 : 1 : 2

61. At constant temperature, solubility of which of the following substances decreases with increase in temperature ?

(a) aqueous solution of sugar (b) aqueous solution of salt

(c) aqueous solution of CO_2 (d) aqueous solution of KNO_3

62. At constant temperature, in a closed vessel, an ideal solution is formed by liquid – A and liquid – B; and mole-fraction of A and B are 0.6 and 0.4 respectively. If vapour pressure of pure liquids are 125.0 and 62.5 mm respectively, then their mole-fraction in vapour state are respectively – (In vessel, no other component is in gaseous form)

(a) 0.6 and 0.4 (b) 0.4 and 0.6 (c) 0.25 and 0.75 (d) 0.75 and 0.25

63. At constant temperature, two liquids having osmotic pressure π_1 and π_2 are seperated by semipermeable membrane, then, what will be the osmotic pressure of the system ?

(a) $\pi_1 + \pi_2$ (b) $\pi_1 - \pi_2$ (c) $\frac{\pi_1 + \pi_2}{2}$ (d) $\frac{\pi_1 - \pi_2}{2}$

64. Which of the following pair of solutions forms ideal solution ?

(a) Chloro benzene, chloro ethane (b) benzene-toluene

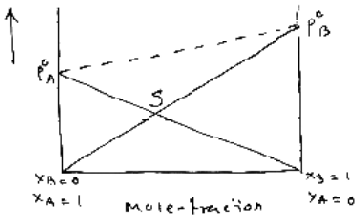
(c) acetone-chloroform (d) water, HCL

65. Which of the following pair forms true solutions ?

(a) Hexane, heptane (b) chloro benzen, bromo benzen

(c) chloro ethane, bromo ethane (d) phenol, aniline

66. What state does point s indicate ?



(a) Mole-fraction and partial vapour pressure of both the liquids are same

(b) Mole-fraction of the both the liquids are same, but their partial vapour pressures are different

(c) Mole-fraction and partial vapour pressures of both the liquids are different

(d) Mole-fraction of both the liquids are different, but their partial pressures are same.

67. What would be the elevation in boiling point of 0.1 m NaCl solution ? (Assume that Nacl dissociates completely)

(a) kb/10 (b)10 kb (c) kb/5 (d) k b/20

68. Which of the following semipermeable membrane is best one ?

(a) parchment paper (b) copper frrocyanide

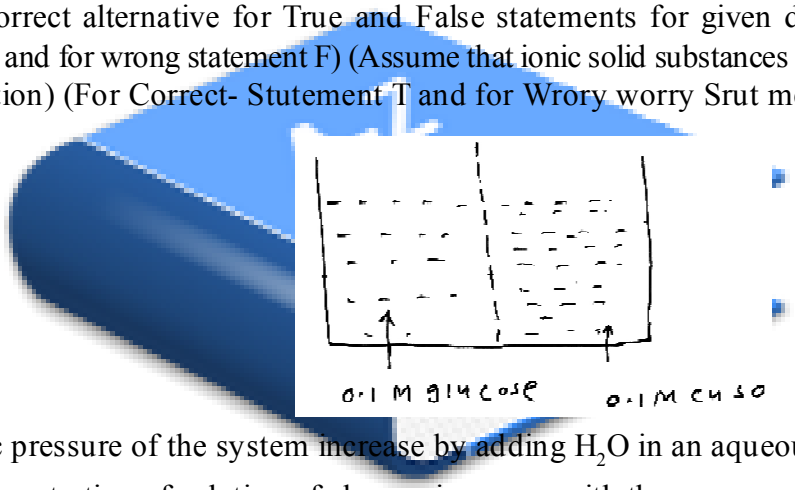
(c) butter paper (d) cello phane

69. At constant temperature, binary ideal solution is formed by two liquids A and B. At equilibrium, mole-fraction of liquid A is 0.7 and in vapour state mole-fraction of A is 0.4 $P^o a + P^o b = 90$ mm then at the same temperature, what will be the vapour pressure of pure liquid A and B ?

(a) 40 mm, 50 mm (b) 30 mm, 60 mm (c) 50 mm, 40 mm (d) 20 mm, 70 mm

70. At constant temperature, binary ideal solution is formed by two liquids A and B. At equilibrium, mole-fraction of liquid B is 0.4 and vapour state mole-fraction of B is 0.25. $P^oB=40$ mm, then at the same temperature, what will be the vapour pressure of pure liquid 'A' ? (a) 80 mm (b) 60 mm (c) 40 mm (d)50 mm

71. Choose correct alternative for True and False statements for given diagram. (For correct statement T and for wrong statement F) (Assume that ionic solid substances completely dissociates in the solution) (For Correct- Stutement T and for Wrory worry Srut ment F)



(i) Osmotic pressure of the system increase by adding H_2O in an aqueous solution of C_uSO_4

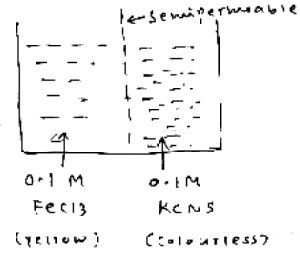
(ii) The concentration of solution of glucose increases with the passage of time.

(iii) Osmotic pressure of the system decreases by adding glucose in the solution of glucose.

(iv) The concentration of solution of C_uSO_4 increases with the passage of time.

(a) FTTF (b) TFFT (c) FFTT (d) TTFF

72. Choose correct alternative for True and False statements for given figure (For correct statement T and for wrong statement F) (Assume that lomic solid substances completely dissociates in the solution)



(I) concentration of an aqueous solution of $FeCl_3$ increases with the pressure of time.

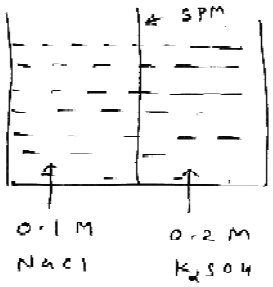
(ii) aqueous solution of $FeCl_3$ gradually turns reddish

(iii) concentration of an aqueous solution of KCNS increases with the passage of time

(iv) aqueous solution of KCNS remains colourless.

(a) FTTF (b) TFFT (c) FFTT (d) TTFF

73. What would be the osmotic pressure of the system at 300 k temperature ? (R=8.314 x 10-2 litre-bar-mole-1 k-1) (Assume that lomic solid substances completely dissociates in an aqueous solution)

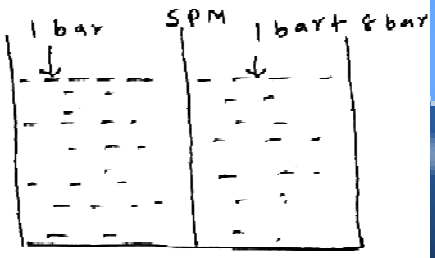


(a) 25 bar
(b) 10.0 membrane bar
(c) 24.9 bar
(d) 19.95 bar

74. At constant temperature, 2 litres aqueous solution of each 0.2 M kcl and 0.3 M $AlCl_3$ are in contact with each other by semipermeable membrane. When osmosis stops, then, what mililitre water diffuses from semipermeable membrane to the other side ? (Assume that ionic solids dissociates completely in the aqueous solution)

(a) 500 ml (b) 600 ml (c) 800 ml (d) 1000 ml

75. Choose the correct alternative for the given diagram for correct and wrong statements. (T is for false statement) (Assume that ionic solid substances dissociates completely in the aqueous solution)



(I) concentration of solution of NaCl increases with the passage of time
(ii) concentration of solution of urea decreases with the passage of time
(iii) concentration of solution of NaCl decreases with the passage of time
(iv) concentration of solution of urea increases with the passage of time

(a) FTTF (b) TFFT (c) FFTT (d) TTFF

76. Which of the following solution is hypotonic with fluids in RBC ?(Assume that ionic solid substances completely dissociates in the solution)

(a) 0.2 M NaCl (b) 0.1 M NaCl (c) 0.18 M NaCl (d) given all

77. At constant temperature, Which of the following solution is hypotonic in the comparison with fluids in RBC ? (Assume that ionic solid substances completely dissociates in the solution)

(a) 0.17 M NaCl (b) 0.12 M NaCl (c) 0.1 M NaCl (d) given all

78. X M NaCl is isotonic with fluids present in RBC (Red Blood Corpusceles), then what would be the value of x ? (M.w. Of NaCl =58.5 gm/mole) (Assume that ionic solid substances completely dissociates in the solution)

(a) 0.15 (b) 0.05 (c) 0.18 (d) 0.78

79. Which of the following solution is hypotonic in comparison with the solution of 0.4 M glucose?

(a) 0.1 M $CaCl_2$ (b) 0.2 M NaCl (c) 0.15 M $FeCl_3$ (d) 0.3 M urea

80. Which of the following solution is hypotonic in comparison with 0.15 M kCl solution ?(Assume that ionic solid substances completely dissociates in the solution)

(a) 0.1 M $CaCl_2$ (b) 0.08 M $FeCl_3$ (c) 0.2 M urea (d) 0.12 $BaCl_2$

81. Which of the following solution is isotonic with fluid of RBC ? (For NaCl, i=2)

(a) 5.6% w/v glucose (b) 2.8% w/v glucose

(c) 1.5% w/v urea (d) 0.91% w/v urea

82. Which of the following solution is isotonic with fluid of RBC ? (For NaCl, 2=2)

(a) 2.02 % w/v glucose (b) 4.02% w/v glucose

(c) 8.0% w/v urea (d) both b and c

83. In Which of the following solution, RBC get burst ? (Molecular wt, $CaCl_2$=111, $FeCl_3$=162.5, glucose=180 and urea=60 gm/mole) (Assume that ionic solid completely dissociates in aqueous solution)

(a) 1.2% w/v urea (b) 0.2 MkCl (c) 0.09% M $FeCl_3$ (d) 6.0% w/v glucose

84. In Which of the following solution, RBC get shrinks ? (Molecular wt, $CaCl_2$=111, $FeCl_3$=162.5, glucose=180 and urea=60 gm/mole) (Assume that ionic solid completely dissociates in aqueous solution)

(a) 0.1% w/v $CaCl_2$ (b) 2% w/v urea (c) 1.0% w/v $FeCl_3$ (d) 5.0% w/v glucose

85. $FeCl_3$ ionizes 80% in their aqueous solution, then what will be the value of Vant 'Hoff factor i ?

(a) 4 (b) 2.7 (c) 3.4 (d) 3.1

86. $CaCl_2$ ionices 80% in their aqueons solution of 0.2 m $CaCl_2$, then, molality of solution is -

(a) 0.48 m (b) 0.52 m (c) 0.6 m (d) 2.6 m

87. A substances associates in their solution as dimer (or bimolecule), then what will be the value of Van't hoff factor i ?

(a) 0.2 (b) 0.4 (c) 0.6 (d) given all

88. A substance associates as trimer in their solution; then, what would be the value of Van't Hoff factor i ?

(a) 0.4 (b) 0.3 (c) 0.2 (d) 0.25

89. A substance associates as bimolecule in their solution; then what would be the value of Van't Hoff factor i ?

(a) 0.4 d" i < 1 (b) 0.5 d" i < 1 (c) 0 < i < 1 (d) 0.6 d" i < 1

90. The solute remains as dimer in the m-molal solution; then elevation in boiling point irrelevant with the solution is -

(a) $\frac{mkb}{2}$ (b) $\frac{3mkb}{5}$ (c) $\frac{3mkb}{4}$ (d) $\frac{mkb}{3}$

91. Which of the following ratio is irrelevant formula mass and experimental molecular weight obtained from colligative properties of solution of ionic solid of AB type ?

(a) 3 : 2 (b) 5 : 3 (c) 4 : 3 (d) 5 : 2

92. Which of the following ratio of correct molecular wt (formula weight) and experimental molecular weight obtained from colligative properties of solution of ionic solid of AB type is possible ?

(a) 5 : 3 (b) 4 : 1 (c) 7 : 3 (d) 5 : 2

93. A substance associates as trimer in their solution, then which of the following ratio is irrelevant for real molecular weight and experimental molecular weight obtained from colligative properties of solution ?

(a) 2 : 3 (b) 2 : 5 (c) 1 : 4 (d) 1 : 2

94. A substance associates as trimer in their solution, then which of the following alternative is possible for depression in freezing point of m molal solution ?

(a) $\frac{mkf}{2}$ (b) $\frac{mkf}{4}$ (c) $\frac{mkf}{5}$ (d) $\frac{mkf}{8}$

95. Which of the following unit of concentration is common in the field of pharmacy ?

(a) formality (b) molarity (c) molality (d) normality

96. A substance associates as trimer in their solution, then what would be the maximum freezing point of their m molal solution is positive ?

(a) $Tf - \frac{mkf}{2}$ (b) $Tf - \frac{mkf}{3}$ (c) $Tf - \frac{2mkf}{3}$ (d) $Tf - 2mkf$

97. Boiling point of the 0.2 m aqueons solution of a substance is 100.4 °C ; then what would be the freezing point of th solution ? (Kb = 0.513°, K+" = 1.86

(a) – 0.372 ~C (b) – 0.37 ~C (c) – 1.45 ~C (d) – 0.5 ~C

98. Aqueous solution of 0.5 m H2So4 is more concentrated then 0.5 m H2So4 solution; then what will be the possible density of that solution ?

(a) $1.07 - \frac{9m}{m1}$ (b) 1.06 9m/m1 (c) 1.05 9m/m1 (d) 1.02 9m/m1

99. Which of the following is irrelevant with the boiling point of an aqueous solution of xm AlCl3 ?

(a) Tb + 3 × kb (b) Tb + 5 × kb (c) $Tb - \frac{7xkb}{2}$ (d) $Tb - \frac{5 \times kb}{2}$

100. Which of the following is suitable alternative for density of the solution, when molarity (m) and molality (m) of an aqueous solution of urea is same at fixed temperature ? (molecular wt of urea = 60 gm/mole ?

(a) $1 - \frac{3M}{50}$ (b) $1 - \frac{M}{25}$ (c) $\frac{50 + 3m}{50}$ (d) $\frac{25 + 2m}{25}$

101. Choose the correct option for true and false statement. (For true statement 'T' and for false statement 'F' is used)

(i) solubility of gas in liquid increases with increase in partial pressure of the gas.

(ii) solubility of gas in liquid increases with increase in temperature

(iii) solubility of gas in liquid isK_H is less

(iv) solubility of gas in liquid increases, as partial pressure of gas decreases and temperature increases.

(a) TTFF (b) FTTT (c) TFFF (d) FFTT

102. Boiling point of an aqueous solution of 0.05m FeCl3 is 100.087 °C; then, what will be the value of Van't Hoff factor i ? (Kb = 0.513 °C – kg - $mole^{-1}$)

(a) 4 (b) 3.4 (c) 2.5 (d) 2.8

103. Difference of boiling point and freezing point of an aqueous solution of glucose is 104 °C at 1 bar pressure; then what will be the molality of the solution ? (Kb = 0.513° and K+" = 1.86 °C – kg - $mole^{-1}$)

(a) 2.373 m (b) 1.05 m (c) 2.151 m (d) 1.68 m

104. Difference of boiling point and freezing point of 0.2 m acetic acid prepared in benzene is 75.7 oC; then, state the value of Van't Hoff factor i ? (For benzene, Kb = 2.65 OC – kg – mol^{-1}, Kf = 5.12 oC – kg – mol^{-1}, Tb = 80 °C, Tf = 5.5 °C)

(a) 1.44 (b) 0.64 (c) 0.83 (d) 0.77

105. Difference in boiling point and freezing point of 10 kg aqueous solution of urea is 100.2372 OC; then what quantity of urea dissolved in the solution ? (Kb = 0.513° and K+" = 1.86 °C – kg - $mole^{-1}$)

(a) 59.64 (b) 38.946 (c) 51.65 (d) 40.5

106. 500 ml solution of HCl is prepared by dissolving 14.6 gm HCl in water. What will be the molarity of HCl in the solution ? (Molecular weight of HCl = 36.5 gm/mole)

(a) 0.4 M (b) 0.3 M (c) 0.8 M (d) 0.3 M

107. What would be the molality of the solution prepared by dissolving 60 gm NaOH in 1.5 kg water ? (Moleculea weight of NaOH = 40 gm/mole)

(a) 0.5 m (b) 1.0 m (c) 0.8 m (d) 0.4m

108. What would be the molarity of 3.0 N H_2SO_4 solution ?

(a) 6 M (b) 1.5 M (c) 3 M (d) 1 M

109. What quantity of NaOH is needed to prepare 1.2 m, 800 ml NaOH solution ?

(a) 3.84 (b) 60 (c) 42 (d) 38.4

110. What would be the molarity and normality of solution prepared by dissolving 19.6 gm H_2SO_4 in dissolved water to prepare 800 ml solution ? (Molecular weight of H_2SO_4 is 98 gm/mole)

(a) 0.5 M, 0.25 N (b) 0.25 M, 0.125 N

(c) 0,25 M, 0.5 N (d) 0.125 M, 0.25 N

111. What amount of H_2SO_4 required to prepare 2 litre of 0.5 N H_2SO_4 solution ? (Molecular weight of H2SO4 is 98 gm/mole)

(a) 98 gm (b) 24.5 gm (c) 49 gm (d) 73.5 gm

112. What will be the concentration of solution prepared by dissolving 50 gm glucose in 200 gm water ?

(a) 25 % w/w (b) 20 % w/w (c) 35 % w/w (d) 15 % w/w

113. What quantity of urea required to prepare 20 % w/w solution having weight 150 gm ?

(a) 20 gm (b) 40 gm (c) 10 gm (d) 30 gm

114. What is the normality of an aqueous solution of 0.5 $Al_2(SO_4)_3$?

(a) 3 N (b) 1 N (c) 1.5 N (d) 2.5 N

115. What will be the mole-fraction of ethanol in solution, prepared by dissolving 9.2 gm ethanol in 900 gm water ? (Molecular weight of water and ethanol are 18 and 48 gm/mole respectively)

(a) 0.04 (b) 0.004 (c) 0.4 (d) 0.0004

116. What will be the mole-fraction of water and NaOH respectively, when 260 gm NaOH dissolved in 1.8 kg water ? (M.W of watll Naoh = 18440)

(a) 0.96, 0.4 (b) 0.0962, 0.38 (c) 0.0962, .038 (d) 0.962, 0.0038

117. What would be the mole-fraction of solute in an aqueous solution of a substances heaving strength 4.5 m ?

(a) 0.75 (b) 0.075 (c) 0.45 (d) 0.045

118. The density of 98% w/w H_2SO_4 solution is 1.8 gm/mole then, molarity of the solution is -

(a) 20 M (b) 10 M (c) 18 M (d) None of these

119. Molarity and molality of an aqueous solution of H_2SO_4 are 1.56 (M) and 1.8 (M) respectively; then, waqht will be the density of the solution ?

(a) 1.835 gm/ml (b) 1.55 gm/ml (c) 1.02 gm/ml (d) 1.725 gm/ml

120. A solution is preparesd from A, B, C and D mole-fraction of A, B and C are 0.1, 0.2 and 0.4 respectively then, mole-fraction of D is -

(a) 0.2 (b) 0.1 (c) 0.3 (d) 0.4

121. The density of 4 M H2SO4 solution is 1.992 gm/ml then, what will be the molality of the solution ? (Molecular weight of H2SO4 is 98 gm/mole)

(a) 3 M (b) 3.5 M (c) 1.2 M (d) 0.4 M

122. Molarity of 1.2 N aqueous solution of $AlCl_3$ is -

(a) 3.6 m (b) 2.4 m (c) 1.2 m (d) 0.4 m

123. What will be the molality of the solution prpared using 500 gm of 25 % w/w NaOH and 500 gm of 15 % w/w NaOH solution ? (Molecular weight of NaOH = 40 gm/mole)

(a) 12.74 m (b) 6.25 m (c) 9 m (d) 5 m

124. What wiil be the molality of solution prepared by taking 25 % w/w NaOH and 15 % w/w NaOH solution ? (Molecular weight of NaOH = 40 gm/mole)

(a) 12.74 m (b) 5.5 m (c) 9 m (d) 4 m

125. The density of 2.5 M NaOH solution is 1.15 gm/ml; then, which of the following alternative is correct for molarity and molality ?

(a) M > m (b) M < m (c) M = m (d) can't be predicted

126. Which of the following is correct for an ideal solution ?

(a) "H = 0, "V = 0, "S = 0 (b) "H `" 0, "V = 0, "S = 0

(c) "H = 0, "V = 0, "S `" 0 (d) "H = 0, "V `" 0, "S = 0

127. Boiling point of Aqueous solutions of 0.05 m ABC and 0.02 m X_2Y_3 are same at 1 bar pressure; then, what will be the values of Van't Hoff factor (i) for solute in both the solutions ?

(a) 1.04, 5.1 (b) 1.9, 4.75 (c) 1.2, 3.4 (d) 1.5, 3.7

128. Which of the following substances having concentration of aqueous solution 1% w/w, possesses higher boiling point ? (Molecular weight of Kcl, $BaCl_2$, glucose and $Al_2(SO_4)^3$ are 74.5, 208, 342 gm'mole respectively) (Assume that inonic solids dissociates completely in their aqueous solution)

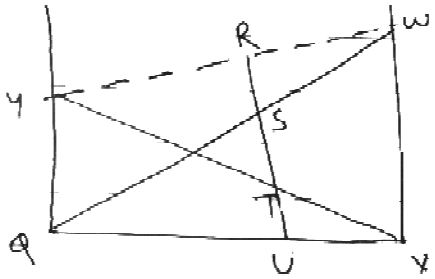
(a) KCl (b) $BaCl_2$ (c) glucose (d) $Al_2(SO_4)_3$

129. Molecular weight of biomolecules such as protein can be determined by _____ method.

(a) osmotic pressure measurement (b) Depression in freezing point measurement

(c) Elevation in boiling point measurement (d) Vapour pressure measurement

130. In the references of the following graph, UR -Oy = _____.



(a) (SU -VW)QU

(b) VU(VW – QY)

(c) (VW – QY)QU

(d) VW(QV – VU)

131. What will be the elevation in boiling point of an aqueous solution of 0.5 m NaCl ? (i = 1.8)

(a)2.04, 5.1 (b) 1.9, 4.57 (c) 1.2, 3.4 (d) 1.4, 3.7

132. When 2 gm phenol id dissolve in 100gm benzene; then depression in freezing point is 0.69 K. If its association is dimeric, then calculate its degree of association (X). Molal depression constant for solvent is 5.12 K - kg - mole-1.

(a) 0.0734 (b) 0.374 (c) 0.00734 (d) 0.734

133. At 353 K temperature, the Vapour pressure of pure liquids A and B are 600mm and 800 mm respectively. If mixture of liquids A and B boils at 353 K and 1 bar pressure, then mole proportion of B in percent is -

(a) 80% (b) 60% (c) 20% (d) 40%

134. 90 gm glucose and 120 gm urea dissolved in 1.46 kg aqueous solution, then what will be the boiling point of the solution at 1 bar pressure ? (Kb = 0.512°C -kg – mole^{-1}, molecular weight of glucose and urea are 180 and 60 gm/mole respectively)

(a) 100.876°C (b) 101.024°C (c) 100.248°C (d) 100.007°C

135. pH of 0.2M dibasic acid H_2A is 1.699; then, what will be its osmotic pressure at T K temperature ?

(a) 0.22 RT (b) 0.02 RT (c) 0.4 RT (d) 0.1 RT

136. Boiling point of an aqueous soultion of 0.4m $AlCl_3$ is 100.7°C; then what would be the pressure of ionization of $AlCl_3$? Kb – 0.512°C - kg - mole-1.

(a) 80.67% (b) 60.5% (c) 76.54% (d) 84.75%

137. The vapour pressure of homogenous mixture of 10 mole of liquid X and 30 mole of liquid Y at constant temperature is 550 mm. In this solution, 10 mole of liquid Y increases, hence, increase in vapour pressure is 10 mm. Then, find the vapor pressure of pure liquid X and Y at that temperature.

(a) P°x = 200 mm, P°y = 500 mm (b) P°x = 400 mm, P°y = 600 mm

(c) P°x = 600 mm, P°y = 300 mm (d) P°x = 350 mm, P°y = 500 mm

138. What amount of urea dissolved in 1 kg water at constant temperature, so that vapour pressure of the solution reduced by 2% ? (M.W of urea = 60 gm/mole)

(a) 68 gm (b) 60 gm (c) 50 gm (d) 75 gm

139. What would be tne volume of 15% w/v and 5% w/v NaOH solution required to prepare 1 litre aqueous solution of 2M NaOH ? (M.w of Naoh = 40 gram/mole)

(a) 300 ml, 700ml (b) 250 ml, 750ml (c) 400 ml, 600ml (d) 280 ml, 720ml

140. At constant temperature, vapour pressure of an aqueous solution of 1.5 kg glucose decreases to 0.98% in comparision with vapour pressure of pure water then, what quantity of glucose in gram dissolved in the solution ? (Molecular weight of glucose = 180 gm/mole)

(a) 148.5 gm (b) 14.85 gm (c) 125 gm (d) 135 gm

141. At constant pressure, 0.5 m NaCl aqueous solution is diluted by adding water in it. Which of the following statement is correct in this reference ?

(a) Van't Hoff factor (i) and boiling point of the solution both decreases

(b) Van't Hoff factor (i) and boiling point of the solution both increases

(c) Van't Hoff factor (i) decreases while boiling point of the solution both increases

(d) Van't Hoff factor (i) increases while boiling point of the solution both decreases

142. Boiling point of an aqueous solution of 0.5 m ionic solid substance is 100.5OC; then state the value of i ? (Kb = 0.512°C -kg – mole^{-1})

(a) 1.95 (b) 1.85 (c) 1.25 (d) 0.85

143. Aqueous solution of substance boils at 100.5°C at 1 bar pressure; then at what temperature it freezes ? (Kb = 0.512°C -kg - mole^{-1}, Kf = 1.86°C - kg – mole^{-1})

(a) 11.2°C (b) 29.84°F (c) 271.8°K (d) -1.2°C

144. 1.4 m aqueous solution of a weak electrolyte AB_2 ionizes 20%, then, state boiling point and freezing point of the solution respectively.

(a) 100.86 °C, -3.12°C (b) 101°C, -3.65°C

(c) 274°C, -3.65°C (d) 374°C, -3.65°C

145. Solute substance in a 1.4 m aqueous solution associates by 25%, then, find the boiling point and freezing point of solution; where, solute exists as trimer in the solution; thus, n = 3. (Kb = 0.512°C • kg • mole^{-1}, Kf = 1.86°C • kg • mole^{-1})

(a) 100.448°C, -2.28°C (b) 373.58°K, -3.65°C

(c) 100.59°C, 2.17°C (d) 213°F, 270.83°k

146. Molecular mass of a weak acid HA is 60gm/mol Ifs experimental molecular mass in its 0.7 M aqueous solution obtained from colligative properties is 50gm/mol. Then calculate ionistion consteint of weak acid HA.

(a) 0.023 (b) 0.0085 (c) 0.035 (d) 0.085

147. At constant temperature, the total pressure of a homogeneous mixture of gas-A and gas-B in a closed container collected on water is 2.0 bar. Their ratio of mole frachion is 1.6 If the values of their K_H are $2.4 \times 10^{+4}$ bur and 4.8×10^4 bar respectively then calcwate its ration of mole fraction when dissolhed in H_2O.

(a) 1:2 (b) 2:1 (c) 3:1 (d) 1:3

148. If one of the colligative property of 0.3m aqueous tisdn. of Na cl and x m aqueows solution of H_2So_4 then what would be the approximate vulwe of aqueows solution of H_2So_4 ? (Density of × m H_2So_4 solution = 1.185 gm/ml)

(a) 0.464 N (b) 0.928 N (c) 0.232 N (d) 0.53 N

149. At one bar pressure the value of ratio of mole fraction of O_2 and N_2 gas in air is 1:4 The values of KH of O_2 and N_2 are 3.3×10^7 Torr and 6.60×10^7 Torr respectively. Then calculate the value of ratio of mole fractions of O_2 and N_2 gases will be. (1 Torr = 1mm)

(a) 3:1 (b) 2:1 (c) 1:2 (d) 1:3

150. According to Boyle-van't-Hoff law at a constelnt temperature, osmotic pressure of a solution is directly proportional to its molarity. It means $\pi \alpha C$, where C = molarity of solution

$\therefore \pi = Kc$ Then calcalate the value of k in sI unit at 24°c temperatuve. (R = 8. 314 J/mole k)

(a) 24.942 J/mol (b) 2494.2 J/mol (c) 0.024942 J/mol (d) 2.4942 J/mol

151. Boiling point of an aqueous solution of urea at one bar pressure is 373.41 k. Then at a constant temperature, calculate the percentage decrease in vapoure pressure of a solution compared to (k_b = 0.512 k.kg. mol^{-1})

(a) 1.42 % (b) 2.56 % (c) 4.17 % (d) 3.44 %

152. Calculate P^H of a solution prepared by mixing equal volume of an aqueous solution of HCI having P^H = 2 and P^H = 5 at 298 k temp.

(a) 3.5 (b) 3.0 (c) 7.0 (d) 2.3

153. Which of the following is the correct formula for Rqoult's law when non-volatile solute is mixed with liquid solveut. where n=mole traction of solute N= mok fraction of solveet, P= vapoure pressure of solution P^o = vapoure pressure of pure sovent and ΔP=Decrease in vapoure pressure.

(a) $\frac{\Delta p}{p} = \frac{n}{N}$ (b) $\frac{\Delta p}{p^0} = \frac{n}{N}$ (c) $\frac{\Delta p}{p} = \frac{n}{n+N}$ (d) $\frac{\Delta p}{p} = \frac{N}{n+N}$

154. Decrease in Freezing point of 75.2 gm pnenol when dissolved in a solvent having $k_f = 14\,k.\,k_g.\,mole^{-1}$. is 7 k. Calculate the percentege of association of phenol if it is forms a dimev in the solutio.

(a) 62.5 % (b) 80.5 % (c) 70 % (d) 75 %

155. Which of the following is correct option when kcl is dissolved in H_20.?

(a) ΔH = +ve, ΔS = +ve, ΔG = +ve (b) ΔH = +ve, ΔS = –ve, ΔG = –ve

(c) ΔH = +ve, ΔS = +ve, ΔG = –ve (d) ΔH = –ve, ΔS = –ve, ΔG = +ve

156. Naphthalene is soluble in ether or benzene because. ?

(a) dipole-dipole attraction is equal (b) London forces are equal

(c) Hydrogen bond (d) Ionic attraction

157. Four Liauids are given.

(i) Water : more polar and capacity to torm H-bond.

(ii) Hexanol : moderatly pdar and partial capacity to form H-bond.

(iii) Chloro form : moderatly polar and does not capable to form H-bond.

(iv) Octane : non polar and does not capable to form H-bond.

which of the following pair of liquids mixed with each other in very less proportion.

(a) I, IV (b) I, II (c) II, III (d) III, IV

158. Which of the following is applicable for the solubility of gases in liquid.

(a) Increases with increase in temperature and pressure.

(b) decreases with increase in temp and pressure.

(c) Increases with decrease in temp and increase in pressure.

(d) Decreases with decrease in temp and increase in pressure.

159. Eoncentration of lead metal in a blood of any person is more than that of 10 microgram. dm^{-1}, than that person is considered as on effect of poision sectrion. Then calculate its concentration in ppb (parts per billion)

(a) 1 (b) 10 (c) 100 (d) 1000

160. The ratio of $\frac{RT}{\pi}$ of 6 % $^{w}/_{v}$ and 9 % $^{w}/_{v}$ is one for both. what would be the value of atomic weight of A and B respectively. (AB_2 and A_2B are electrolytes)

(a) 60, 90 (b) 40, 40 (c) 40, 10 (d) 10, 40

161. Decrease in vapour pressure of an aqueous soln. of an electrolyte is 4% what would be the percentage increase in elevation in Boiling point ? ($k_b = 0.512\,k.\,k_g.\,mol^{-1}$)

(a) 0.55 % (b) 0.02 % (c) 5.5 % (d) 2 %

162. Which of the following option is correct for a homogeneous mix tare of liquid A and liquid B which shows positive deviation according to Result's laco.

(a) A-B inter molecular attraction is more than inter molecular attraction in A-A and B-B

(b) Inter molecular attraction in A-B is less than in termolecular attraction in A-B and B-B.

(c) Inter molecular attraction in B-B is less than intermolecular attraction in B-B is less than intermolecnalr attraction in A-A

(d) Inter molecular attraction in A-A is less than in termolecular attraction B-B

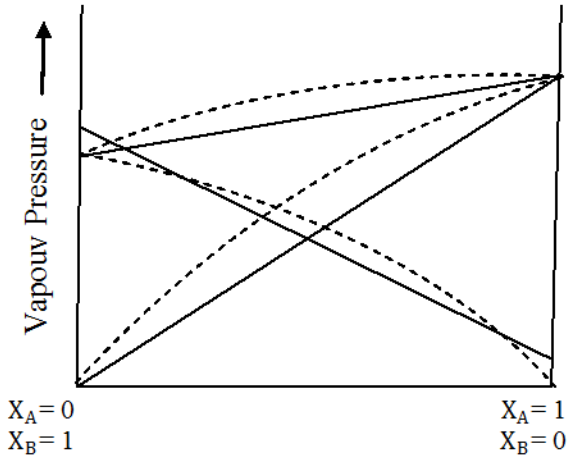
163. Select the true and false statements with reference to the graph of mole fraction Vapour pressure. T = True statement F = False statement.

(i) Azeotropic mixture of liquid A and liquid B has highest boiling point.

(ii) When vapour pressure of both liquids in q mixture is same then $X_A < X_B$.

(iii) It shows positive deviation on the basis of Raoult's law.

(iv) When $X_A = X_B$ then $P_A < P_B$.



(a) TFTF (b) FFTF (c) FTTF (d) FFTT

ANSWER KEY

1	b	26	d	51	c	76	b	101	c	126	c	151	a
2	a	27	d	52	a	77	a	102	b	127	d	152	d
3	d	28	a	53	b	78	a	103	d	128	a	153	a
4	d	29	b	54	d	79	c	104	d	129	a	154	d
5	c	30	d	55	c	80	c	105	a	130	c	155	c
6	a	31	a	56	b	81	a	106	c	131	a	156	b
7	c	32	b	57	a	82	a	107	b	132	d	157	a
8	d	33	c	58	d	83	a	108	b	133	a	158	c
9	a	34	c	59	c	84	b	109	d	134	b	159	c
10	b	35	d	60	c	85	c	110	c	135	a	160	c
11	b	36	c	61	c	86	b	111	c	136	a	161	a
12	c	37	b	62	d	87	c	112	b	137	b		
13	b	38	b	63	b	88	a	113	d	138	a		
14	d	39	d	64	b	89	b	114	a	139	a		
15	b	40	a	65	d	90	d	115	b	140	d		
16	c	41	a	66	d	91	d	116	c	141	d		
17	d	42	a	67	c	92	a	117	b	142	a		
18	a	43	d	68	d	93	c	118	c	143	c		
19	d	44	c	69	a	94	a	119	c	144	b		
20	b	45	b	70	a	95	a	120	c	145	d		
21	a	46	b	71	a	96	b	121	c	146	c		
22	c	47	c	72	c	97	c	122	d	147	d		
23	a	48	a	73	b	98	d	123	b	148	a		
24	c	49	a	74	d	99	b	124	b	149	c		
25	c	50	b	75	d	100	c	125	a	150	b		

Hints

(23) $[M \cdot V = M_1 \cdot V_1 + M_2 \cdot V_2 + M_3 \cdot V_3 , \quad V = V_1 + V_2 + V_3]$

$\therefore M \cdot 2600 = 0.3 \times \mathbf{1400} + 0.4 \times \mathbf{700} + 1.2 \times \mathbf{500}$

$\therefore M = 0.5$

(25) $M_1 \cdot V_1 = M_2 \cdot V_2$ 5000ml = 5 lit.

$1.5 \times 5 = 0.5 \times V_2$

$\therefore V_2 = 15$ lit.

$\therefore$ Amount of water added = 15-15 = 10 lit.

(35) Slope = k_H

Solubility of gas is more which have less value of k_H

$\therefore$ gas D has more solubility.

(45) $n_1 \bullet m_1 = n_2 \bullet m_2$

Where n_1 = number of ions produse when 1st substanle is dis solved in H_2O

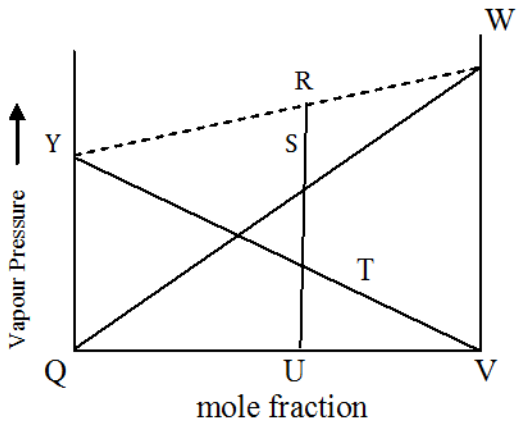
m_1 = mulality of 1st substanle.

n_2 = number of ions produced wheh 2nd substance is dissolved in H_2O. according to its formula.

The values of n_1 for Na_2So_4, ureq and $Alcl_3$ are 3, 1 and 4 respectively.

we get 0.8m, 2.4m and 0.6m for Na_2So_4, ureq and $Alcl_3$.

(47)



$p = p_A^0 \cdot X_A + p_B^0 \cdot X_B$

$UR = QY \cdot VU + VW \cdot QU$

$\therefore UR - QY \cdot VU = VW \cdot QU$

(49) $Y_A = 0.4$ Aand $P_A = 400$ mm

$P_B = 1000 - 400 = 600$mm

$P_A = P_{Total} \times Y_A$

$\therefore 400 = P \times 0.4$

$\therefore P_{Total} = 1000$ mm

(50) $\frac{\Delta Tf}{\Delta Tb} = \frac{Kf}{Kb}$ $\therefore \Delta T_f = \frac{Kf}{Kb} \times \Delta T_b$

$= \frac{1.86}{0.51} \times 0.55 = 2\ K$

$\therefore T_f = 273 - 2 = 271\ K$

(53) $n_1 M_1 = n_2 M_2$

For $NH_4 No_3$ values for n_1 and M_1 are 2 and 1.5 resp

For $Al_2 (so_4)_3$ $n_2 = 5$

$\therefore \quad M_2 = \frac{2}{5} \times 1.5 = 0.6$

Normality of $Al_2(SO_4)_3 = 6 \times$ molarity

$= 6 \times 0.6$

$= 3.6\ N$

(58) Answer = D

Highest os motic pressure is for that pair having highest difference between $n_1 M_1$ and $n_2 M_2$

(62) $p_A = p_A^0 \times X_A$

$= 125 \times 0.6$

$= 75$ mm

$p_B = p_B^0 \times X_B = 62.5 \times 0.4 = 25$ mm

$P_{Total} = p_A + = p_B = 75 + 25 = 100$ mm

$p_A = P_{Total} \times Y_A$

$\therefore 75 = 100 \times Y_A$

$\therefore Y_A = 0.75$

Similarly $\therefore Y_B = 0.25$

(67) For Na C1 value of i = 2.0

$\therefore \Delta Tb = i \cdot m \cdot Kb = 2 \times 0.1 \times Kb$

$\therefore \Delta Tb = \frac{Kb}{5}$

(69) $X_B = 1 - X_A = 1 - 0.7 = 0.3 \quad Y_B = 1 - Y_A = 1 - 0.4 = 0.6$

NNNoe $p_A = p_A^0 \times X_A$ Nand $p_A = P_{Total} \times Y_A$

$\therefore p_A = p_A^0 \times 0.7$ $\therefore p_A = P_{Total} \times 0.4$

$\therefore p_A^0 \times 7 = P_{Total} \times 4$

Similarly $p_B^0 \times 3 = P_{Total} \times 6$

By dividing

$\frac{p_A^0 \times 7}{p_B^0 \times 3} = \frac{P_{Total} \times 4}{P_{Total} \times 6}$ $\therefore p_A^0 = \frac{p_B^0 \times 2}{7}$

$p_A^0 + p_B^0 = 90$

$\therefore \frac{p_B^0 \times 2}{7} + p_B^0 = 90$

$\therefore 9p_B^0 = 630$

$\therefore p_B^0 = 70$ mm and

$p_A^0 = 20$ mm

(70) $X_A = 1 - X_B = 1 - 0.4 = 0.6$

$Y_A = 1 - Y_B = 1 - 0.25 = 0.75$

$p_B = p_B^0 \times X_B$ $\quad$ $p_B = P_{Total} \times Y_B$

$\therefore\ p_B = 40 \times 0.4$ $\quad$ $\therefore\ 16 = P_{Total} \times 0.25$

$= 16$ mm $\quad$ $\therefore\ P_{Total} = 64$ mm

$p_A = P_{Total} \times Y_A = 64 \times 0.75 = 48$ mm

Now $p_A = p_A^0 \times X_A$

$\therefore\ 48 = p_A^0 \times 0.6$

$\therefore\ p_A^0 = 80$ mm

(73) Whiten × Suppose × m1 H_2O is transferred from aqueous solution of KCI to aqueous solution of $Alcl_3$ then the phenomenon osmosis stops. So morality of soluble particles in both solutions becomes equal at this time.

M_1 = modality of kcl solution

M_2 = modality of kcl solution when x ml water is reduced.

$M_1 V_1 = M_2 V_2$

$0.2 \times 2000 = M_2 \times (2000\ x)$

$\therefore\ M_2 = \frac{400}{2000\ X}$

Similarly volume of $Alcl_3$ Solution increases by addition of x m_1 H_2O.

morality of $Alcl_3$ solution = $\frac{600}{2000 + X}$

Now morality soluble particles in kcl solution = morality of soluble particles in $Alcl_3$ soln.

$\therefore\ n_1 \cdot M_1 = n_2 \cdot M_2$

$\therefore\ \frac{2 \times 400}{2000 - X} = \frac{4 \times 600}{2000 + X}$

$\therefore\ x = 1000$

(74) Liquid present in Red Blood cells is isotonic with 0.91 % $^{w}/_{v}$ solution of Nacl

$\therefore$ morality of soluble particles in 0.91 % $^{w}/_{v}$ Nacl solution

$= \frac{2 \times 1000 \times 0.91}{58.5 \times 100}$

$= 2 \times 0.1555$

$= 0.311$ M

(75) π = MRT where M = effective molarity of solutions kept in contact with semi-permeable membrane.

$\therefore\ \pi = 0.2$ M (molarity of soluble particles in Naclsdn)

$= 3 \times 0.2 - 2 \times 0.1$

$= 0.4$ M.

(86) $^{o}l_o \frac{\text{dissociation}}{100} = \frac{i-1}{n-1}$

Fecl3 ionises 80% in its aqueous solution

$\therefore\ \frac{80}{100} = \frac{i-1}{4-1}$ $\quad$ $\therefore\ i = 3.4$

(87) when association of any substance takes place in a solution then degree of association$^{is} \leq 1$.

$\therefore\ 0 < \frac{i-1}{\frac{1}{n} - 1} \leq 1$

$\therefore\ 0 < \frac{1-i}{1-\frac{1}{n}} \leq 1$

$\therefore\ 0 < 1 - i \leq 1 - \frac{1}{n}$

$\therefore\ -1 < -i \leq -\frac{1}{n}$

$\therefore\ 1 > i \geq \frac{1}{n}$

Here n = 2 (given)

$\therefore 1 > i \geq \frac{1}{2}$ means $0.5 \leq i < 1$

(90) For association (given) n=2

$\therefore i \geq \frac{1}{2}$

$\therefore imKf \geq \frac{mKf}{2}$

$\therefore \Delta Tf \geq \frac{mKf}{2}$

(91) $i = \frac{\Delta T_{ob}}{\Delta T_{cal}} = \frac{\pi_{ob}}{\pi_{cal}} = \frac{M}{M_{ob}}$

where M = Actual molecular mass of solute

Mob = experimental molecular mass of solute.

For AB Type ionic compound $i \leq 2$

$\therefore \frac{M}{M_{ob}} \leq 2$ $\qquad$ 5 : 2 > 2 : 1

(96) The substance forms trimer in a solution due to association.

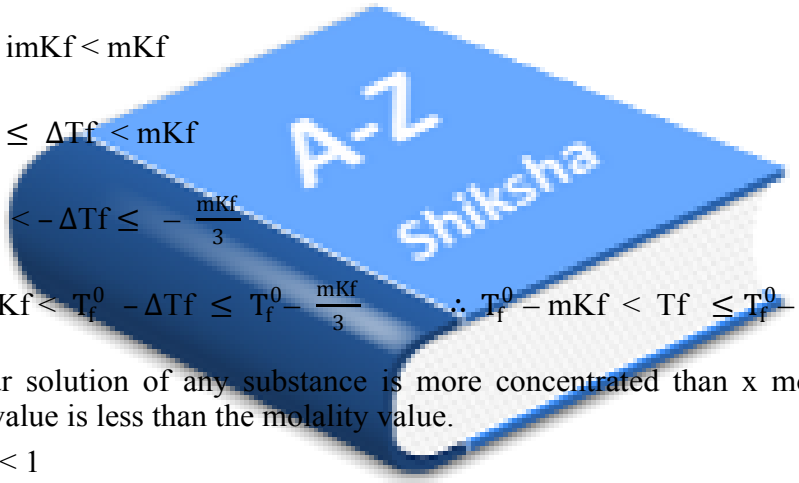
$\therefore \frac{1}{3} \leq i < 1$

$\therefore \frac{mKf}{3} \leq imKf < mKf$

$\therefore \frac{mKf}{3} \leq \Delta Tf < mKf$

$\therefore -mKf < -\Delta Tf \leq -\frac{mKf}{3}$

$\therefore T_f^0 - mKf < T_f^0 - \Delta Tf \leq T_f^0 - \frac{mKf}{3}$ $\qquad \therefore T_f^0 - mKf < Tf \leq T_f^0 - \frac{mKf}{3}$



(98) If x molar solution of any substance is more concentrated than x molul solution so its molarity value is less than the molality value.

$\therefore \frac{\text{molarity}}{\text{molarity}} < 1$

Now $\frac{\text{molarity}}{\text{molarity}} = \frac{1000 \times W}{M \times V} \times \frac{M \times W_0}{1000 \times W}$

$\therefore \frac{\text{molarity}}{\text{molarity}} = \frac{W_0 \text{ gm}}{V \text{ ml}}$ $\qquad \therefore \frac{W_0}{V} < 1 \frac{gm}{ml}$

Now $\frac{W_0}{V} = \frac{W_0 + W - W}{V} = \frac{W_0 + W}{V} - \frac{W}{V}$ = density of soln $(d \frac{gm}{ml}) - \frac{W}{V}$

$\therefore \frac{W_0}{V} = d + \frac{W}{V} = d + \frac{1000 \times W}{M \times V} \times \frac{M}{1000}$

$\therefore \frac{W_0 \text{ gm}}{V \text{ ml}} = d \frac{gm}{ml} + \frac{\text{molarity} \times M}{1000}$ $\quad$ (M = mol. mass of solute)

$\therefore d \frac{gm}{ml} + \frac{\text{molarity} \times M}{1000} < 1 \frac{gm}{ml}$ $\quad \therefore d \frac{gm}{ml} < 1 \frac{gm}{ml} + \frac{\text{molarity} \times M}{1000}$

Here for 0.5 M H_2So_4 aqueour solution $d < (1 + \frac{0.5 \times 98}{1000}) \frac{gm}{ml}$ $\quad \therefore d < 1.049 \frac{gm}{ml}$

(100) $\frac{\text{molarity}}{\text{molarity}} = \frac{1000 \times W}{M \times V} \times \frac{M \times W_0}{1000 \times W}$

$\therefore \frac{\text{molarity}}{\text{molarity}} = \frac{W_0}{V} \frac{gm}{ml}$

Now molarity = Molality

$\therefore \frac{W_0}{V} = 1 \frac{gm}{ml}$

$\therefore d \frac{gm}{ml} = 1 \frac{gm}{ml} + \frac{\text{molarity} \times M}{1000}$

For urea molecular mass (M) = 60 $\frac{gm}{ml}$

$\therefore d = 1 + \frac{\text{molarity} \times 60}{1000}$

$\therefore d = \frac{50+3M}{50}$

(103) $T_b - T_f = 104$

$\therefore T_b^0 + \Delta T_b - (T_f^0 - \Delta T_f) = 104$

$\therefore 100 + \Delta T_b - (0 - \Delta T_f) = 104$

$\therefore \Delta T_b + \Delta T_f = 4$

For glucose i = 1

$\therefore mKb + mKf = 4$

$\therefore m = \frac{4}{Kb + Kf} = \frac{4}{0.513 + 1.86}$

$\therefore m = 1.68$

(104) $T_b - T_f = 100.2372$

$\therefore T_b^0 + \Delta T_b - (T_f^0 - \Delta T_f) = 100.2372$

$\therefore 100 + \Delta T_b - (0 - \Delta T_f) = 100.2372$

$\therefore \Delta T_b + \Delta T_f = 0.2372$

For urea i = 1 $\therefore mKb + mKf = 0.2372$

$\therefore m = \frac{0.2372}{Kb + Kf} = \frac{0.2372}{0.513 + 1.86}$

$\therefore m = 0.1$

(105) $T_b - T_f = 75.7$

$\therefore T_b^0 + \Delta T_b - (T_f^0 - \Delta T_f) = 75.7$

$\therefore 80 + \Delta T_b - (5.5 - \Delta T_f) = 75.7$

$\therefore \Delta T_b + \Delta T_f = 1.2$

$\therefore imKb + imKf = 1.2 \quad \therefore i = \frac{1.2}{m(Kb + Kf)} = \frac{1.2}{0.2(2.65 + 5.12)} \quad \therefore i = 0.77$

(117) $X = \frac{m}{55.55 + m}$ X = mole fraction of solute

m = molality = 4.5 m

$\therefore X = \frac{4.4}{55.55 + 4.5} = 0.075$

(118) Density of 98 % $^{W}/_{W}$ H_2SO_4 = 1.8 $\frac{gm}{ml}$

w = 98 gm

$\therefore\ d = \frac{W + W_0}{V}\ \therefore\ V = \frac{W + W_0}{d}$

$\therefore\ V = \frac{100}{1.8}$ ml molarity (m) = $\frac{1000 \times w}{M \times V}$

$= \frac{1000 \times 98 \times 1.8}{98 \times 100}$

= 18 M

(119) and (121)

molality = $\frac{100 \times \text{molrity}}{(1000 \times \text{density}) - (\text{mol .mass of solute} \times \text{molrity})}$

use above formula to solve the question

(123) mass of N_aOH in 500gm 25% $^{W}/_{W}$ N_aOH solution

= 5 × 25 = 125gm. and

mass of H_2O = 5 × 75 = 375gm.

mass of N_aOH in 500gm 15% $^{W}/_{W}$ N_aOH = 5 × 15 = 75gm.

and mass of H_2O = 5 × 85 = 425gm.

mass of N_aOH in a mixed solution when both solutions are mixed W = 125 + 75 = 200gm.

and mass of H_2O wo = 375 + 425 = 800gm.

Now molality of mlxed solution = $\frac{1000 \times w}{M \times W_0} = \frac{1000 \times 200}{40 \times 800}$ = 6.25 m

(124) molality of 25% $^{W}/_{W}$ N_aOH

= $\frac{1000 \times w}{M \times W_0} = \frac{1000 \times 25}{40 \times 75}$ = 8.33 m

molality of 15 % $^{W}/_{W}$ NaOH = $\frac{1000 \times w}{M \times W_0} = \frac{1000 \times 15}{40 \times 85}$ = 4.41 m

when two different wncentration containing solutions of same substances are mixed then

conc of dil. solution < concentration of mixed solution < conc. of concentration soln.

$\therefore$ 4.41 m < conc. (molality) of mixed solution < 8.33 in

(128) From graph

$p = p_A^0 + (p_B^0 - p_A^0) X_B$

$\therefore$ UR = QY + (VW – QY)QU

(129) $\frac{n \times \%\, W/W}{\text{molecular mass (formula weigh}} = X$

If volue of x is hignest than solution hare highest Boiling point.

(n = no. of ions in a formula)

(134) mass of solvent in a solution wo = 1460 - (90 + 120) = 1250gm.

mole of glucose = $\frac{90}{180} = 0.5$

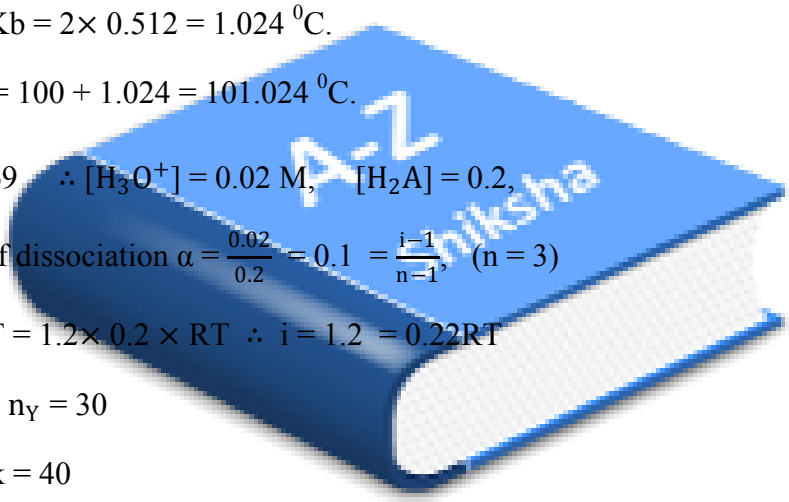
mole of urea = $\frac{120}{60} = 2$

Total moles of solute in a solution = 0.5 + 2 = 2.5

molality = $=\frac{1000 \times n}{W_0} = \frac{1000 \times 2.5}{1250} = 2.0$ m

$\Delta Tb = mKb = 2 \times 0.512 = 1.024\ ^0C.$

$\therefore Tb = 100 + 1.024 = 101.024\ ^0C.$



(135) pH = 1.669 $\therefore [H_3O^+] = 0.02$ M, $[H_2A] = 0.2$,

Degrce of dissociation $\alpha = \frac{0.02}{0.2} = 0.1 = \frac{i-1}{n-1}$, (n = 3)

π = iMRT = 1.2× 0.2 × RT $\therefore$ i = 1.2 = 0.22RT

(137) $n_X = 10$, $n_Y = 30$

Total mok = 40

$\therefore X_X = 0.25$ $X_Y = 0.75$

Total uapour pressure = P = $p_X + p_X$

$\therefore n_X \cdot p_X^0 + n_Y \cdot p_Y^0 = P$ $\therefore 0.25p_X^0 + 0.75p_Y^0 = 550$ .....(1)

If mole of liqulid y is in creased by 10 then its uapour pressure is increased by 10 mm.

$\therefore n_X = 10$, $n_Y = 40$ $\therefore$ Total mole = 50

$X_X = 0.2$, $X_Y = 0.8$ and total vapor pressure P = $p_X + p_X$ = 560 mm

$\therefore 0.2p_X^0 + 0.8p_Y^0 = 560$ .....(2)

By soloing eqn. (1) and (2) we get $p_X^0 = 400$ mm and $p_Y^0 = 600$ mm

(138) $\Delta p = \frac{2p^0}{100}$ ∴ $\frac{\Delta p}{p^0} = \frac{1}{50}$ = X (mole fraction of urea)

$= \frac{m}{55.55+m}$

∴ m = 1.134 (molality of urca)

∴ mass of urea (W_2) = 1.134× 60 = 68 gm.

(139) Suppose V_1 litcr 15 % $^{W}/_{V}$ NaOH and V_1 liter 5 % $^{W}/_{V}$ NaOH solution is requirecl to pre paec one litev 2 M NaOH solution.

80 gm. NaOH is required to prepare one liter 2m NaOH solution.

∴ V_1 + V_2 = 1 liter.....(1) .

$150V_1$ + $50V_2$ = 80 gm. ……(2)

By soluing (i) and (ii)

are get V_1 = 300 ml. and V_2 = 700 ml.