CHEMISTRY

BOOKS - P BAHADUR CHEMISTRY (HINGLISH)

DILUTE SOLUTION AND COLLIGATIVE PROPERTIES

Exercise

1. The partial pressure of ethane over a saturated solution containing $6.56 \times 10^{-2} g$ of ethane is 1 bar. If the solution contains $5.00 \times 10^{-2} g$ of ethane, then what shall be the partial pressure of the gas?

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2. Calculate the concentration of CO_2 in a soft drink that is bottled with a partial pressure of CO_2 of 4 atm over the liquid at $25^{\circ} C$. The

Henry's law constant for CO_2 in water at $25^\circ C$ is $3.1 \times 10^{-2}\text{mol//litre-atm.}$

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3. At $37^\circ C$ and $0.80 atm$ partial pressure, the solubility of N_2 was found to be $5.6 \times 10^{-4} mol / L$. A deep sea diver breathes compresssed air with the partial pressure of N_2 equal to $4.0 atm$. The total volume of blood in his body is 5.0 litre. After sometime he comes back on the water surface where P'_{N_2}

is $0.80 atm$. Calculate the volume of N_2 escaped during his return from depth to surface, at $37^\circ C$ and $1 atm P$.

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4. The total concentration of dissolved particles in side red blood cells is approximately $0.30M$ and the membrane surrounding the cells is semipermeable. What would be the atmosheric pressure in atm inside the cells become if the cells were removed from blood plasma and placed in pure water at $298K$. Also what would happen to red blood cells?

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5. Arginine vasopressin is a pituitary harmone. It helps to regulate the amount of water in the blood by reducing the flow of urine from the kidneys. An aqueous solution containing $21.6mg$ of vasopressin in $100mL$ of solution contaning had an osmotic pressure of

$3.70 mmHg$ at $25^{\circ} C$. What is the molecular weight of the harmone?

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6. A solution is prepared by dissolving $1.08 g$ of human serum albumin, a protein obtained from blood plasma, in $50 cm^3$ of aqueous solution. The solution has an osmotic pressure of $5.85 mmHg$ at $298 K$.

a. What is the molar mass of albumin ?

b. What is the height of water column placed in solution ?

$d_{(H_2O)} = 1gcm^{-3}$

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7. The osmotic pressure of blood is $7.65atm$ at $37^\circ C$. How much glucose should be used per litre for an intravenous injection that is to have the same osmatic pressure as blood?

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8. At $25^{\circ}C$, a solution containing $0.2g$ of polyisobutylene in $100mL$ of benzene developed a rise of $2.4mm$ at osmotic equilibrium. Calculate the molecular weight of polyisobutylene if the density of solution is $0.88g/mL$.

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9. At $300K$, $36g$ of glucose present per litre in its solution has an osmotic pressure of 4.98^{-}.

If the osmotic pressure of the solution is 1.52^{-} at the same temperature, what would be its concentration?

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10. At $20^{\circ}C$, the osmotic pressure of urea solution is $400mm$. The solution is diluted and the temperature is raised to $35^{\circ}C$, when the osmotic pressureis found to be $105.3mm$. Determine extent of dilution.

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11. At $27^\circ C$, a 5% solution $(\text{wt.}/\text{vol})$ of cane-sugar is isotonic with $8.77 g/litre$ of urea solution. Find $m.\ wt.$ of urea, if $m.\ wt.$ of sugar is 342. Also report the osmotic pressure of solution is $100 mL$ each are mixed at $27^\circ C$.

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12. An aqueous solution of 2 per cent $(wt.\ /wt)$ non-volatile solute exerts a pressure of 1.004 bar at the boiling point of the solvent. What is the molecular mass of the solute?

A. 60.43 g

B. 41.35 g

C. 100.7 g

D. 23.22 g

Answer: B

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13. The vapour pressure of water is $12.3 kPa$ at $300 K$. Calculate vapour pressure of 1 molal solution of a solute in it.

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14. The weight of a non-volatile solute (molecular weight = 40), which should be dissolved in 114g octane to reduce its vapour pressure to 80% is __________ .

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15. A solution contaning 30 g of a non-volatile solute exactly in 90 g of water has a water has a vapour pressure of 2.8 K Pa at 298 K. Further 18 g of water is added to the solution and the new vapour pressure become 2.9 Pa at 298 K. Calculate.

Molecular mass of the solute.

Vapour presure of water of water at 2198 K.

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16. Find the molality of a solution containing a non-volatile solute if the vapour pressure is 2% below the vapour pressure or pure water.

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17. Dry air was suvvessively passed through a solution of $5g$ solute in $80g$ water and then through pure water. The loss in weight of solution was $2.5g$ and that of pure water was $0.04g$. What is mol.wt. of solute?

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18. Heptane and octane form an ideal solution. At $373K$, the vapour pressure of the two liquids are 105.0 kPa and 46.0 kPa, respectively. What will be the vapour pressure, of the mixture of $25g$ of heptane and $35g$ of octane ?

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19. The vapour pressure of ethanol and methanol are $44.0mmHg$ and $88.0mmHg$,

respectively. An ideal solution is formed at the same temperature by mixing $60g$ of ethanol with $40g$ of methanol. Calculate the total vapour pressure of the solution and the mole fraction of methanol in the vapour.

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20. At $310K$, the vapour pressure of an ideal solution containing 2moles of A and 3moles of B is $550mm$ of Hg. At the same temperature, if one mole of B is added to this solution, the vapour pressure of solution increase by $10 mm of Hg$. Calculate the $V.P$ of A and B in their pure state.

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21. Water boils at $95^{\circ} C$ in Denver, the mile high city. Calculate the atomospheric pressure in Denver. ΔH_{Vap} for $H_2O = 40.67 KJ mol^{-1}$.

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22. An aqueous solution of liquid X (mol weight $56)$ 28% by weight has a vapour pressure $150mm$. Find the vapour pressure of X if vapour pressure of water is $155mmofHg$.

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23. An aqueous solution of glucose containing $12g$ in $100g$ of water was found to boil at $100.34^{\circ}C$.

Calculate of K_b for water in $Kmol^{-1}Kg$.

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24. The boiling point of $CHCl_3$ was raised by $0.323^{\circ}C$ when $0.37g$ of naphthalene was dissolved in $35gCHCl_3$. Calculate the molecular weight of naphthalene. $\left(k'_b \text{ for} CHCl_3 = 3.9Kmol^{-1}kg\right)$.

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25. What will be the boliling point of bromine when $174.5mg$ of octa-atomic sulphur is added to $78g$ of bromine? k'_b for Br_2 is $5.2 K mol^{-1} kg$ and $b.\ pt.$ of Br_2 is $332.15K$

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26. What is the depression in freezing point of a solution of non-electrolyte if elevation in boiling point is $0.13K$?

$\left(k_b = 0.52 mol^{-1} kg, k_f = 1.86 mol^{-1} kg\right)$

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27. Pure benzene boiled at $80^{\circ} C$. The boiling point of a solution containing $1g$ of substance dissolved in $83.4g$ of benzene is $80.175^{\circ} C$. If latent heat of vaporization of benzene is $90 cal per g$, calculated the molecular weight of solute.

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28. For $[CrCl_3 . xNH_3]$, elevation in $b. pt$ of one molal solution is triple of one molal aqueous solution of urea. Assuming 100% ionisation of complex molecule, calculated the value of x.

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29. In a cold climate water gets frozen causing damage to radiator of a car. Ethylene glycol is used as an anifreezing agent. Calculate the amount of ethylene glycol to be added to $4kg$ of water to prevent it from freezing at -6° . (K_f for water = $1.85kgmol^{-1}$)

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30. A 5% solution (by mass) of cane sugar in water has freezing point of 271 K. Calculate the freezing point of a 5% glucose (by mass) in water. The freezing point of pure water is 273.15 K.

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31. Butylated hydroxytoluence (BHT) is used as an antioxidant in processed foods (it

prevent fats and oils from becoming rancid). A solution of $2.5g$ of BHT in $100g$ of benzene has a freezing point of $4.88K$. What is the molecular weight of BHT?

$(k_f(\text{benzene}) = 5.12 K mol^{-1} kg$, freezing point of benzene $= 5.45K)$

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32. Calculate the molecular weight of a substance whose 7.0% (by weight) solution in water freezes at $-0.89^{\circ} C$.

$\left(k_f \text{for} H_2O = 1.86 K \text{molality}^{-1}\right)$.

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33. What is osmotic pressure of the aq. Solution of the given solute at $27^{\circ} C$ if depression in freezing point is $0.93^{\circ} C$? Molal depression constant of water is $1.86 K mol^{-1} kg$? Assume molality as molarity.

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34. Calculate the osmotic pressure of 20% (wt./ vol.) anhydrous $Ca(NO_3)_2$ solution at $0^\circ C$ assuming 100% ionisation.

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35. The vapour pressure of a solution containing $2g$ of $NaCl$ in $100g$ water, which dissociated in one Na^+ and one Cl^- ion in water, is $751mm$, at $100^\circ C$. Calculate the one degree of ionisation of $NaCl$.

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36. 17.4% (wt./vol.) $K_2(SO_4)$ solution at $27^\circ C$ isotonic to 5.85% (wt./vol.) $NaCl$ solution at $27^\circ C$. IF $NaCl$ is 100% ionised, what is $\%$ ionisation of K_2SO_4 in aq. solution?

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37. Predict the osmotic pressure order for the following:

(I) $0.1N$ urea

(II) $0.1N NaCl$

(III) $0.1N Na_2SO_4$

(IV) $0.1N Na_3PO_4$

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38. An aqueous solution containing NH_4Cl completely ionised in water freezes at $-0.3272^\circ C$. K_f of water is $1.86K\text{molality}^{-1}$. The solution on heating to $50^\circ C$ gives a collection to dry gases which register

$2.463atm$ pressreu in 1 litre container at $27^{\circ}C$. Assuming no water vaporises at $50^{\circ}C$, calculate the temperature at which the solution on cooling back freezes out.

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39. Calculate the osmotic pressure at $17^{\circ}C$ of an aqueous solution containing $1.75g$ of sucrose per $150mL$ solution.

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40. At $27^{\circ}C$, $36g$ of glucose per litre has an $O.P.$ of $4.92atm$. If the osmotic pressure of solution is $1.5atm$ at the same temperature, what should be its concentration?

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41. (a) $10g$ of a certain non-volatile solute were dissolved in $100g$ water at $20^{\circ}C$. The vapour pressure was lowered from $17.3555mm$ to $17.2350mm$, calculate m. wt. of solute.

(b) The vapour pressure of pure water at

$25^{\circ} C$ is $23.62 mm$. What will be the vapour pressure of a solution of $1.5 g$ of urea in $50 g$ of water?

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42. The vapour pressure of pure benzene at a certain temperature is $640 mm$ og Hg. A non-volatile non-electrolyte solid weighing $2.175 g$ added $39.0 g$ of benzene. The vapour pressure of the solution is $600 mm$ of Hg. What is the molecular weight of solid substance?

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43. The vapour pressure of an aqueous solution of glucose is 750 mm of mercury at $100^\circ C$. Calculate the molatlity and mole fraction of solute.

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44. The molar volume of liquid bezene (density $= 0.877 gmL^{-1}$) increase by a factor of 2750 as it vaporises at $20^\circ C$ and that of liquid toluene (density $0.867 gmL^{-1}$) increases by a factor of 7720 at $20^{\circ} C$. A solution of benzene and tuluene at $20^{\circ} C$ has a vapour pressure of 46.0 torr. Find the mole fraction of benzene iin the vapour above the solution.

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45. A very small amount of a non-volatile solute (that does not dissociate) is dissolved in $56.8 cm^{3}$ of benzene (density $0.889 gcm^{3}$). At room temperature, vapour pressure of this solution is $98.88mmHg$ while that of benzene is $100mmHg$. Find the molality of this solution. If the freezing temperature of this solution is 0.73 degree lower than that of benzene, what is the value of molal the freezing point depression constant of benzene?

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46. The vapour pressure of two miscible liquids (A) and (B) are 300 and $500mm$ of

Hg respectively. In a flask 10 mole of (A) is mixed with 12 mole of (B). However, as soon as (B) is added, (A) starts polymerising into a completely insoluble solid. The polymerisation follows first-order kinetics. After 100 minute, 0.525 mole of a solute is dissolved whivh arrests the polymerisation completely. The final vapour pressure of the solution is $400mm$ of Hg. Estimate the rate constant of the polymerisation reaction. Assume negligible volume change on mixing and polymerisation and ideal behaviour for the final solution.

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47. $1.4g$ of acetone dissolved in $100g$ of benzene gave a solution which freezes at $277.12K$. Pure benzene freezes at $278.4K.2.8$ of solid (A) dissolved in $100g$ of benzene gave a solution which froze at $277.76K$. Calculate the molecular mass of (A).

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48. The molal freezing point constant of C_6H_6 is 4.90 and its melting point is $5.51^\circ C$. A solution of 0.816 g of a compound A dissolved in 7.5 g of benzene freezes at $1.59^\circ C$.Calculate molecular weight of compound A.

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49. The freezing point of a solution containing $50cm^3$ of ethylene glycol in $50g$ of water is found to be $-34^\circ C$. Assuming ideal behaviour, Calculate the density of ethylene glycol $\left(K_f\right.$ for water = $1.86 K kg mol^{-1}$).

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50. A solution of $0.643 g$ of an organic compound in $50 mL$ of benzene (density $0.879 g / mL$) lowered its freezing point from $5.51^{\circ} C$ to $5.03^{\circ} C$. Calculate the molecular weight of solid. $\left(K_f\right.$ for benzene is $5.12 K mol^{-1} kg$)

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51. Calculate the amount of ice that will separate out on cooling containing $50g$of ethylene glycol in $200g$ of water to $-9.3^{\circ}C\left(K_f\right.$ for water $=1.86Kmol^{-1}kg$)

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52. Calculate the freezing point of an aqueous soltuion of non-electrolyte having an osmotic pressure $2.0atm$ at $300K$. (

$K'_f = 1.86 K mol^{-1} kg$ and $S = 0.0821$ litre atm $K^{-1} mol^{-1}$)

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53. A decimolar solution of potassium ferrocyanide is 50% dissociated at $300K$. Calculate osmotic pressure of the solution. (Given $R = 8.341 JK^{-1} mol^{-1}$)

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54. 0.85% aqueous solution of $NaNO_3$ is apparently 90% dissociated at $27^{\circ}C$. Calculate its osmotic pressure. $(R = 0.0821 atm K^{-1} mol^{-1})$

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55. xg of non-electrolytic compound (molar mass =200) is dissolved in $1.0L$ of $0.05 M NaCl$ solution. The osmotic pressure of this solution is found to be $4.92 atm$ at $27^{\circ}C$.

Calculate the value of x. Assume complete dissociation of $NaCl$ and ideal behaviour of this solution.

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56. Calculate the boiling point of a solution containing $0.61g$ of benzoic acid in $50g$ of carbon disulphide assuming 84% dimerization of the acid. The boiling point and K_b of CS_2 are $46.2^\circ C$ and $2.3kgmol^{-1}$.

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57. A solution of a non-volatile solute in water freezes at $-0.30^{\circ} C$. The vapour pressure of pure water at $298K$ is $23.51 mmHg$ and K_f for water is $1.86 degree / molal$. Calculate the vapour pressure of this solution at $298K$.

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58. To $500 cm^3$ of water, $3.0 \times 10^{-3} kg$ acetic acid is added. If 23% of acetic acid is dissociated, what will be the depression in

freezing point? K_f and density of water are $1.86 K kg mol^{-1}$ and $0.997 g cm^{-3}$ respectively.

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59. The degree of dissociation of $Ca(NO_3)_2$ in a dilute aqueous solution containing 7 g of salt per 100 g of water at 100°C is 70%. Calculate the vapour pressure of solution.

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60. The freezing point of solution containing $0.2g$ of acetic acid in $20.0g$ of benzene is lowered by $0.45^{\circ}C$. Calculate the degree of association of acetic acid in benzene.

$(K_f = 5.12K^{\circ}mol^{-1}kg^{-1})$

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61. Two grams of benzoic acid (C_6H_5COOH) dissolved in $25.0g$ of benzene shows a depression in freezing point equal to $1.62K$.

Molal depression constant for benzene is $4.9 K kg^{-1} mol^{-1}$. What is the percentage association of acid if it forms dimer in solution?

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62. Phenol associates in benzene to certain extent to form a dimer. A solution containing $20 \times 10^{-3} kg$ of phenol in $1.0 kg$ of benzene hs its freezing point depressed by $0.69 K$. Calculate the fraction of phenol that has dimerized. (K_f for benzene is $5.12 K kg mol^{-1}$).

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63. Match the boiling point with K_b for x, y and z, if molecular weight of x, y and z are same.

	$b.pt$	k_b
x	100	0.68
y	27	0.53
z	253	0.98

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64. $1.22g$ of benzoic acid is dissolved in acetone and benzene separately. Boiling point of mixture with acetone increase by $0.17^\circ C$ and boiling point of mixture with benzene increases by $0.13^\circ C$.

$K_b(\text{acetone}) = 1.7 K kg \text{mol}^{-1}$,

Mass of acetone $= 100g$,

$K_b(\text{benzene}) = 2.6 k K g mol^{-1}$,

Mass of benzene $= 100g$,

Find molecular weight of benzoic acid in acetone and in benzene solution. Justify your answer with structure.

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65. $75.2g$ of C_6H_5OH (phenol) is dissolved in $1kg$ of solvent of $k_f = 14K\text{molality}^{-1}$. If depression in freezing point is $7K$. Calculate $\%$ of phenol that dimerises.

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66. Equal volume of $0.1M$ urea and $0.1M$ glucose are mixed. The mixture will have

A. (a) Lower osmotic pressure

B. (b) Same osmotic pressure

C. (c) Higher osmotic pressure

D. (d) None of these

Answer: B

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67. Glucose is added to 1 litre water to such an extent that $\frac{\Delta T_f}{K_f}$ becomes equal to $\frac{1}{1000}$, the weight of glucose added is:

A. (a) $0.32g$

B. (b) $0.42g$

C. (c) $0.22g$

D. (d) $0.18g$

Answer: D

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68. Mole fraction of component A in vapour phase is χ_1 and that of component A in liquid mixture is χ_2, then (p_A°)= vapour pressure of pure A, p_B° = vapour pressure of pure B), the total vapour pressure of liquid mixture is

A. $\frac{P_A^\circ . X_2}{X_1}$

B. $\frac{P_A^\circ . X_1}{X_2}$

C. (c) $\frac{P_B^\circ . X_1}{X_2}$

D. (d) $\frac{P_B^\circ . X_2}{X_1}$

Answer: A

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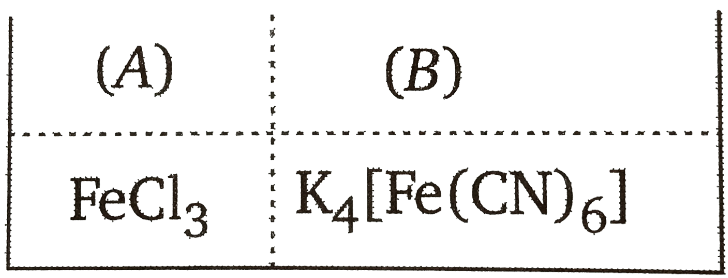
69. Two solution (A) containing $FeCl_{3(aq.)}$ and separated by semipermeable membrane sa shown below. If $FeCl_3$ solution on reaction with $K_4[Fe(CN)_6]$ in aqueous solution gives blue colour of $Fe_4[Fe(CN)_6]$, the blue colour will be noticed in:



A. (a) Blue colour formation in side A

B. (b) Blue colour formation in side B

C. (c) Blue colour formation in both sides

D. (d) No blue colour formation in either side

Answer: D

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70. The vapour pressure of an aqueous solution of glucose is $750 mm$ of Hg at $373 K$. Calculate molality and mole fraction of solute.

A. (a) $\frac{1}{10}$

B. (b) $\frac{1}{7.6}$

C. (c) $\frac{1}{35}$

D. (d) $\frac{1}{76}$

Answer: D

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71. An aqueous solution of methanol in water has vapour pressure:

A. Less than that of water

B. Equal to that of water

C. (c) More than that of water

D. (d) Equal to that methanol

Answer: C

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72. In which of the following molecular weight determination methods, sensitivity of the measurements decreases as the molecular weight of the solute increases?

A. (a) Elevation of boiling point / depression in f.pt.

B. (b) Viscosity

C. (c) Osmotic pressure

D. (d) None of these

Answer: A

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73. The boiling point of an azeotropic mixture of water and ethyl alcohol is less than that of the theoretical value of water and alcohol mixture. Hence the mixture shows

A. (a) That solution is highly saturated

B. (b) Positive deviation from Raoult's law

C. (c) Negative deviation from Raoult's law

D. (d) Nothing can be said

Answer: B

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74. To from a supersaturated solution of salt one must:

A. Cool slowly

B. Cool rapidly

C. (c) Add some salt to cold solution

D. (d) Use a clear vessel

Answer: B

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75. On mixing $10mL$ of acetone with $40mL$ of chloroform, the total volume of the solution is:

A. $< 50mL$

B. $> 50mL$

C. (c) $= 50mL$

D. (d) Can't be predicted

Answer: A

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76. The relative lowering of vapour pressure in case of dilute solution is directly proportional to:

A. Molality

B. Molarity

C. (c) Mole fraction

D. (d) All of these

Answer: D

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77. On mixing $10mL$ of carbon tetrachloride with $10mL$ of benzene the total volume of the solution is:

A. $> 20mL$

B. $< 20mL$

C. (c) $= 20mL$

D. (d) Can't be predicted

Answer: C

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78. Each pair forms ideal solution except:

A. C_2H_5Br and C_2H_5I

B. C_6H_5Cl and C_6H_5Br

C. C_6H_6 and $C_6H_5.CH_3$

D. C_2H_5I and C_2H_5OH

Answer: D

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79. The van't Hoff factor of $NaCl$ assuming 100% dissociation is:

A. $1/2$

B. 2

C. 1

D. 3

Answer: B

80. When mercuric iodide is added to the aqueous solution of potassium iodide, then:

A. Freezing point is raised

B. Freezing point is lowered

C. Freezing point does not change

D. Boiling point does not change

Answer: A

81. The correct relationship between the boiling points of very dilute solutions of $AlCl_3(t_1)$ and $CaCl_2(t_2)$ having the same molar concentration is:

A. $t_1 = t_2$

B. $t_1 > t_2$

C. $t_2 > t_1$

D. $t_2 \geq t_1$

Answer: B

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82. Two solutions of KNO_3 and CH_3COOH are prepared separately. Molarity of both is $0.1M$ and osmotic pressure are P_1 and P_2 respectively. The correct relationship between the osmotic pressure is :

A. $P_2 > P_1$

B. $P_1 = P_2$

C. $P_1 > P_2$

D. $\dfrac{P_1}{P_1 + P_2} = \dfrac{P_2}{P_1 + P_2}$

Answer: C

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83. A thermometer which can be used only for accurate mesurement for small differences in temperature is known a:

A. Beckmann's thermometer

B. Contact thermometer

C. Clinical thermometer

D. Platinum thermometer

Answer: A

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84. The experimental molecular weight of an electrolyte will always be less than its calculated value because the value of Van't Hoff factor. $'i,$ is:

A. Less than 1

B. Greater than 1

C. One

D. Zero

Answer: B

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85. If P° and P_S are the vapour pressure of the solvent and solution respectively,

n_1 and n_2 are the mole fractions of the solvent and solute respectively, then:

A. $P_S = P^\circ n_1$

B. $P_S - P^\circ n_2$

C. $P^\circ = P_S n_2$

D. $P_S = P^\circ (n_1 / n_2)$

Answer: A

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86. Solubility of deliquescent substances in water is generally:

A. High

B. Low

C. Moderate

D. Cannot be said

Answer: A

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87. The boiling point of $C_6H_6, CH_3OH, C_6H_5NH_2$ and $C_6H_5NO_2$ are $80^\circ C, 65^\circ C, 184^\circ C$ and $212^\circ C$ respectively. Which will show highest vapour pressure at room temerature:

A. C_6H_6

B. CH_3OH

C. $C_6H_5NH_2$

D. $C_6H_5NO_2$

Answer: B

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88. Why does the use of pressure cooker reduce cooking time ?

A. (a) Heat is more evenly distributed

B. (b) b.pt. of water inside the cooker is increased

C. (c) The high pressure tenderises the food

D. (d) All of these

Answer: B

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89. Water will boil at $101.5^{\circ} C$ at which of the following pressure:

A. (a) $76cm$ of Hg

B. (b) $76mm$ of Hg

C. (c) $> 76cm$ of Hg

D. (d) $< 76cm$ of Hg

Answer: C

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90. Which solution will show the maximum vapour pressure at $300K$?

A. (a) $1MNaCl$

B. (b) $1MCaCl_2$

C. (c) $1MAlCl_3$

D. (d) $1MC_{12}H_{22}O_{11}$

Answer: D

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91. The van't Hoff factor (i) for a dilute aqueous solution of glucose is:

A. (a) Zero

B. (b) 1.0

C. (c) 1.5

D. (d) 2.0

Answer: B

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92. A maximum or minima obtained in the temperature, composition curve of a mixture of two liquids indicates:

A. (a) An azeotropic mixture

B. (b) An eutectic formation

C. (c) That the liquids are immiscible with one another

D. (d) That the liquids are partially miscible at the maximum or minimum

Answer: A

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93. Benzoic acid dissolved in benzene shows a molecular weight of:

A. (a) 122

B. (b) 61

C. (c) 244

D. (d) 366

Answer: C

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94. A substance will be deliquescent if its vapour pressure is:

A. (a) Equal to the atmospheric pressure

B. (b) Equal to that of water vapour in the air

C. (c) Greater than that of water vapour in the air

D. (d) Lesser than that of water vapour in the air

Answer: D

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95. A supersaturates solution is a metastable state of solution in which solute concentration:

A. (a) Is equal to the solubility of that substance in water

B. (b) Exceeds than its solubility

C. (c) Less than its solubility

D. (d) Continuously change

Answer: B

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96. A liquid is in equilibrium with its vapour at its boiling point. On average, the molecules in the two phases have equal

A. (a) Potential energy

B. (b) Total energy

C. (c) Kinetic energy

D. (d) Intermolecular forces

Answer: C

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97. The ratio of the value of colligative property for KCl solution to that of sugar solution is:

A. (a) 1

B. (b) 0.5

C. (c) 2

D. (d) 4

Answer: C

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98. The lubricating action of an oil is more if it possess:

A. (a) High vapour pressure

B. (b) Low vapour pressure

C. (c) High surface tension

D. (d) High density

Answer: B

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99. The energy that favours dissolution of a solute in water is known as:

A. (a) Hydration energy:

B. (b) Lattice energy

C. (c) Ionisation energy

D. (d) Exothermic energy

Answer: A

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100. The natural semipermeable membrane is:

A. (a) Gelatinous $Cu_2Fe(CN)_5$

B. (b) Gelatinous $Ca_3(PO_4)_2$

C. (c) Plant cell

D. (d) Phenol layer

Answer: C

Watch Video Solution

101. Which aqueous solution has minimum freezing point?

A. (a) $0.01 M NaCl$

B. (b) $0.005 M C_2H_5OH$

C. (c) $0.005 M MgI_2$

D. (d) $0.005 M MgSO_4$

Answer: A

Watch Video Solution

102. Which aqueous will have the highest boiling point?

A. (a) 1% glucose in water

B. (b) 1% sucrose in water

C. (c) 1% $NaCl$ in water

D. (d) 1% $CaCl_2$ in water

Answer: C

Watch Video Solution

103. Which solution will have least vapour pressure?

A. (a) $0.01 M BaCl_2$

B. (b) $0.1 M$ urea

C. (c) $0.1 M Na_2SO_4$

D. (d) $0.1 M Na_3PO_4$

Answer: D

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104. One mole of non-volatile solute is dissolved in two mole of water. The vapour pressure of the solution relative to that of water is:

A. (a) $2/3$

B. (b) $1/3$

C. (c) $1/2$

D. (d) $3/2$

Answer: A

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105. The freezing point of a 0.05 molal solution of a non-electrolyte in water is:

$(K_f = 1.86 \text{molality}^{-1})$

A. (a) $-1.86^\circ C$

B. (b) $-0.93^\circ C$

C. (c) $-0.093^\circ C$

D. (d) $0.093^\circ C$

Answer: C

Watch Video Solution

106. The freezing point of 1 molal $NaCl$ solution assuming $NaCl$ to be 100% dissociated in water is:

A. (a) $-1.86^{\circ}C$

B. (b) $-3.72^{\circ}C$

C. (c) $+1.86^{\circ}C$

D. (d) $+3.72^{\circ}C$

Answer: B

Watch Video Solution

107. Osmotic pressure of 40% (wt./vol.) urea solution is $1.64 atm$ and that of 3.42% (wt./vol.) cane sugar is $2.46 atm$. When equal volumes of the above two solutions are mixed, the osmotic pressure of the resulting solution is:

A. (a) $1.64 atm$

B. (b) $2.46 atm$

C. (c) $4.10 atm$

D. (d) $2.05atm$

Answer: D

Watch Video Solution

108. Dry air was passed successively through solution of $5g$ of a solute in $180g$ of water and then through pure water. The loss in weight of solution was $2.50g$ and that of pure solvent $0.04g$. The molecualr weight of the solute is:

A. (a) 31.25

B. (b) 3.125

C. (c) 312.5

D. (d) None of these

Answer: A

Watch Video Solution

109. At $40^{\circ}C$ the vapour pressure of pure liquids, benzene and toluene, are $160 mmHg$ and $60 mmHg$ respectively. At the same temperature, the vapour pressure of an equimolar solution of the liquids, assuming the ideal solution will be:

A. (a) $140 mmHg$

B. (b) $110 mmHg$

C. (c) $220 mmHg$

D. (d) $100 mmHg$

Answer: B

Watch Video Solution

110. A 3.42% (wt./vol.) solution of cane sugar is isotomic with a 5.96% (wt./vol.) solution of raffinose. The molecular weight of raffinose is:

A. (a) 59.6

B. (b) 596

C. (c) 5.96

D. (d) 5960

Answer: B

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111. The vapour pressure of benzene at $90^{\circ} C$ is 1020 torr. A solution of $5g$ of a solute in $58.5g$ benzene has vapour pressure 990 torr. The molecualr weight of the solute is:

A. (a) 78.2

B. (b) 178.2

C. (c) 206.2

D. (d) 220

Answer: D

Watch Video Solution

112. $Y g$ of non-volatile organic substance of molecular mass M is dissolved in $250 g$ benzene. Molal elevation constant of benzene is K_b. Elevation in its boiling point is given by:s

A. (a) $\frac{M}{K_b Y}$

B. (b) $\frac{4 K_b Y}{M}$

C. (c) $\frac{K_bY}{4M}$

D. (d) $\frac{K_bY}{M}$

Answer: B

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113. The values of observed and calculated molecular wrights of silver nitrate are 92.64 and 170 respectively.The degree of dissociation of silver nitrate is:

A. (a) 60%

B. (b) 83.5%

C. (c) 46.7%

D. (d) 60.23%

Answer: B

Watch Video Solution

114. The depression in f.pt. of $0.01m$ aqueous solution of urea, soldium chloride and soldium sulphate is in the ration:

A. (a) $1 : 1 : 1 :$

B. (b) $1 : 2 : 3$

C. (c) $1 : 2 : 4$

D. (d) $2 : 2 : 3$

Answer: B

Watch Video Solution

115. The values of observed and calculated molecular weights of calcium nitrate are respectively 65.6 and 164. The degree of dissociation of calcium nitrate will be:

A. (a) $25\ \%$

B. (b) $50\ \%$

C. (c) $75\ \%$

D. (d) $60\ \%$

Answer: C

Watch Video Solution

116. The relationship between osmotic pressure at $273K$ when $10g$ glucose (P_1), $10g$ urea (P_2) and $10g$ sucrose (P_3) are dissolved in $250mL$ of water is:

A. (a) $P_1 > P_2 > P_3$

B. (b) $P_3 > P_1 > P_2$

C. (c) $P_2 > P_1 > P_3$

D. (d) $P_2 > P_3 > P_1$

Answer: C

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Watch Video Solution

117. An aqueous solution of urea has freezing point of $-0.52^{\circ} C$. If molarity and molality are same and K'_f for $H_2O = 1.86 K \text{molality}^{-1}$ the osmotic pressure of solution would be:

A. (a) $6.886 atm$

B. (b) $68.86 atm$

C. (c) $688.6 atm$

D. (d) $0.686 atm$

Answer: A

Watch Video Solution

118. Calculate the amount of ice that will separate out on cooling containing $50g$of ethylene glycol in $200g$ of water to $-9.3^\circ C\left(K_f\right.$ for water =$1.86Kmol^{-1}kg$)

A. (a) $38.71g$

B. (b) $38.71mg$

C. (c) $42g$

D. (d) $42mg$

Answer: A

Watch Video Solution

119. Insulin $(C_2H_{10}O_5)_n$ is dissolved in a suitable solvent and the osmotic pressure (π) of solutions of various concentrations $(g/cm^3)C$ is measured at $20^\circ C$. The slope of a plot of π against C is found to be

4.65×10^{-3}. The molecular weight of insulin is:

A. (a) 4.8×10^{5}

B. (b) 9×10^{5}

C. (c) 3×10^{5}

D. (d) 5.16×10^{6}

Answer: D

Watch Video Solution

120. A substance (A) is completely trimerised on dissolution in solvent B. The van't Hoff factor (i) for such change is:

A. (a) 1

B. (b) 2

C. (c) 3

D. (d) $1/3$

Answer: D

Watch Video Solution

121. An aqueous solution of a non-volatile solute boils at $100.17^{\circ} C$. At what temperature will the solution freeze? (Given: $K_b = 0.512$ and $K_f = 1.86$)

A. (a) $-0.544^{\circ} C$

B. (b) $-0.512^{\circ} C$

C. (c) $-0.272^{\circ} C$

D. (d) $-1.86^{\circ} C$

Answer: C

Watch Video Solution

122. The freezing point of aqueous solution that contains 5% by mass urea. 1.0% by mass KCl and 10% by mass of glucose is:

$$\left(K_f H_2O = 1.86 K \text{molality}^{-1}\right)$$

A. (a) $290.2K$

B. (b) $285.5K$

C. (c) $269.93K$

D. (d) $250K$

Answer: C

Watch Video Solution

123. A solution of protein (extracted from carbs) was prepared by dissolving $0.75g$ in $125cm^3$ of an aqueous solution. At $4^\circ C$ and osmotic pressure rise of $2.6mm$ of the solution was observed. Then molecular weight of protein is (assume density of solution is $1.00g/cm^3$):

A. (a) 9.4×10^5

B. b) 5.4×10^5

C. (c) 5.4×10^{10}

D. (d) 9.4×10^{10}

Answer: B

Watch Video Solution

124. The vapour pressure of water at room temperature is lowered by 5% by dissolving a solute in it. What is approximate molality of solution:

A. (a) 2

B. (b) 1

C. (c) 4

D. (d) 3

Answer: D

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125. The fish living in sea use the oxygen that is:

A. (a) Part of H_2O

B. (b) Dissolved in H_2O

C. (c) Part of salt

D. (d) None of these

Answer: B

Watch Video Solution

126. The vapour pressure of high $b.pt.$ liquids is........then the vapour pressure of a low boiling liquid:

A. (a) low

B. (b) High

C. (c) May be high or low

D. (d) Same

Answer: A

Watch Video Solution

127. The solubility of a salt in water is $40g$ at $30^{\circ} C$. The amount of water required to dissolve $120g$ at the same temperature is:

A. (a) $400g$

B. (b) $4 litre$

C. (c) $300g$

D. (d) $500g$

Answer: C

Watch Video Solution

128. $15g$ of a solute in $100g$ of water makes a solution of freeze at $-1^{\circ}C.30g$ of a solute in $100g$ of water will give a depression in $f.pt.$ equal to:

A. (a) $-2^{\circ}C$

B. (b) $0.5^{\circ}C$

C. (c) $2^{\circ}C$

D. (d) $1^{\circ}C$

Answer: C

Watch Video Solution

129. For the given electrolyte A_xB_y. The degree of dissociation $'\alpha'$ can be given as:

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

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

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

D. (d) Either of these

Answer: D

Watch Video Solution

130. On addition of a volatile liquid A to another volatile liquid B in any proportiona will always.........the vapour pressure of B:

A. (a) Decrease

B. (b) Increase

C. (c) Increase or decrease

D. (d) None of these

Answer: C

Watch Video Solution

131. The colligative properties are......... proportional to each other:

A. (a) Inversely

B. (b) Directly

C. (c) Both (a) and (b)

D. (d) None of these

Answer: B

Watch Video Solution

132. Shrinking of graphs in conc. $NaCl$ solution is due to:

A. (a) Exosmosis

B. (b) Endosmosis

C. (c) Both (a) and (b)

D. (d) None of these

Answer: A

Watch Video Solution

133. Realtive lowering in vapour pressure of a solution containing 1 mole K_2SO_4 in $54gH_2O$ is (K_2SO_4 in $100\,\%$ ionised) :

A. $\frac{1}{55}$

B. $\frac{3}{55}$

C. $\frac{3}{4}$

D. $\frac{1}{2}$

Answer: C

Watch Video Solution

134. Mixture containing $100 mL$ of $1M$ urea solution and $300 mL$ of $1M$ glucose solution at $T K$ will have osmotic pressure:

A. (a) $\frac{10ST}{4}$

B. (b) $3ST$

C. (c) $4ST$

D. (d) ST

Answer: D

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135. Mole fraction of vapour of A above solution in mixture of A and $B(X_A = 0.4)$ will be $\left(P_A^\circ = 100mm, P_B^\circ = 200mm\right)$:

A. (a) 0.4

B. (b) 0.8

C. (c) 0.25

D. (d) None of these

Answer: C

Watch Video Solution

136. $25 mL$ of an aqueous solution of KCl was found to requires $20 mL$ of $1 M AgNO_3$ solution when titrated using a K_2CrO_4 as indicator. Depression in freezing point of KCl solution with $100\,\%$ ionisation will be :

$\left(K_f = 2.0 mol^{-1} kg \text{and molarity} = \text{molality}\right)$

A. (a) 5.0

B. (b) 3.2

C. (c) 1.6

D. (d) 0.8

Answer: B

Watch Video Solution

137. Equal amounts of a solute are dissolved in equal amounts of two solvents A and B. The lowering of vapour pressure of solution A has twice the lowering of vapour pressure for solution B. If Mw_A and Mw_B are the molecular weights of solvents A and B, respectively , then a.$Mw_A = Mw_B$, b. $Mw_A = Mw_B/2$,

c.$Mw_A = 4Mw_B$, d. $Mw_A = 2Mw_B$

A. (a) $M_A = M_B$

B. (b) $M_A = M_B/2$

C. (c) $M_A = 4M_B$

D. (d) $M_A = 2M_B$

Answer: D

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138. The most likely an ideal solution is:

A. (a) $NaCl - H_2O$

B. (b) $C_2H_5OH - C_6H_6$

C. (c) $C_7H_{16(l)} - H_2O$

D. (d) $C_7H_{16(l)} - C_8H_{18(l)}$

Answer: D

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139. Phenol (mol.wt.94) is dimerised to 60% in a solvent, the observed molecular weight of phenol will be:

A. (a) Less than 94

B. (b) 134.2

C. (c) 100

D. (d) 150

Answer: B

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140. Pure water boils at $99.725^{\circ} C$ at Shimla. If K_b for water is $0.51 K mol^{-1} kg$ the boiling point of 0.69 molal urea solution will be:

A. (a) 100.35

B. (b) 100.08

C. (c) 99.37

D. (d) None of these

Answer: B

Watch Video Solution

141. At $10^{\circ} C$, the osmotic pressure of urea solution is $500 mm$.The solution is diluted and the temperature is raised to $25^{\circ} C$.when the osmotic pressure is found to be $105.3 mm$. Determine the extent of dilution.

A. (a) $V_f = 5V_i$

B. (b) $V_i > V_f$

C. (c) $V_f = 4V_i$

D. (d) $V_f = 6V_i$

Answer: A

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142. Normal boiling point of water is $373K$. Vapour pressure of water at $298K$ is $23mm$ enthalpy of vaporisation is $40.656kJmol^{-1}$ if atmopheric pressure becomes $23mm$, the water will boil at:

A. (a) $250K$

B. (b) $298K$

C. (c) $51.6K$

D. (d)$12.5K$

Answer: B

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143. van't Hoff factor for a dilute solution of a sodium argento cyanide is:

A. (a) 2.0

B. (b) 0.25

C. (c) 0.50

D. (d) 3.0

Answer: A

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144. The plots of $\frac{1}{X_A} vs. \frac{1}{Y_A}$ (where X_A and Y_A are the mole fraction of liquid A in liquid and vapour phase respectively) is linear with slope and intercept respctively are given as:

A. (a) $\frac{P_A^\circ}{P_B^\circ}$ and $\frac{(P_A^\circ - P_B^\circ)}{P_B^\circ}$

B. (b) $\frac{P_A^\circ}{P_B^\circ}$ and $\frac{(P_B^\circ - P_A^\circ)}{P_B^\circ}$

C. (c) $\frac{P_B^\circ}{P_A^\circ}$ and $\frac{(P_A^\circ - P_B^\circ)}{P_B^\circ}$

D. (d) $\frac{P_B^\circ}{P_A^\circ} \text{and} \frac{(P_B^\circ - P_A^\circ)}{P_B^\circ}$

Answer: B

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145. At a certain temperature pure liquid A and liquid B have vapour pressure 10 and 37 torr respectively. For a certain ideal solution of A and B, the vapours in equilibrium with the liquid has the components A and B in the partial pressure ratio $P_A : P_B = 1 : 7$. The mole fraction of A in the solution are:

A. (a) 0.346

B. (b) 0.654

C. (c) 0.5

D. (d) 0.8

Answer: A

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146. The vapour pressure of a solution of a non-volatile electrolyte B in a solvent A is $95\,\%$ of the vapour pressure of the solvent at the same temperature. If the molecular weight of the solvent is 0.3 times, the molecular weight of solute, the weight ratio of the solvent and solute are:

A. (a) 0.15

B. (b) 5.7

C. (c) 0.2

D. (d) 4.0

Answer: B

Watch Video Solution

147. For $[CrCl_3.\,xNH_3]$, elevation in $b.\,pt$ of one molal solution is triple of one molal aqueous solution of urea. Assuming $100\,\%$ ionisation of complex molecule, calculated the value of x.

A. (a) 4

B. (b) 5

C. (c) 6

D. (d) None of these

Answer: A

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148. At $40^\circ C$, the vapour pressure in torr of methyl and ethyl alcohol solutions is represented by $P = 119X_A + 135$, where X_A is mole fraction of methyl alcohol. The value of

$\frac{P_B^\circ}{X_B}$ at lim $X_A \to 0$), and $\frac{P_A^\circ}{X_A}$ at lim $X_B \to 0$

are:

A. (a) $135, 254$

B. (b) $135, 230$

C. (c) $119, 135$

D. (d) $140, 135$

Answer: A

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149. A liquid is kept in a closed vessel . If a glass plate (negligible mass)with a small hole is kept on top of the liquid surface, then the vapour pressure of the liquid in the vesel is :

A. More than what would be if the gas plate was removed

B. Same as what would be if glass plate was removed

C. Less as what would be if the gas plate was removed

D. Cannot be predicted

Answer: B

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150. For an ideal binary liquid solutions with $P_A^\circ > P_B^\circ$, which relation between X_A (mole fraction of A in liquid phase) and Y_A (mole fraction of A in vapour phase) is correct:

A. $X_A = Y_A$

B. $X_A > Y_A$

C. $X_A < Y_A$

D. $\frac{X_A}{X_B} < \frac{Y_A}{Y_B}$

Answer: D

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151. A solution of urea (mol. Mass $60 gmol^{-1}$) boils of $100.18^\circ C$ at one one atmospheric pressure. If k_f and K_b for water are 1.86 and

$0.512 K kg mol^{-1}$ respectively, the above solution will freeze at:

A. $-6.54^{\circ} C$

B. $6.54^{\circ} C$

C. $-0.654^{\circ} C$

D. $0.654^{\circ} C$

Answer: C

Watch Video Solution

152. The vapour pressure of two liquid P and Q are 80 torr and 60 torr respectively. The total vapour pressure obtained by mixing 3 moles of P and 2 mole of Q would be

A. $69 = 8\text{torr}$

B. 20torr

C. 140torr

D. 72torr

Answer: D

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153. A solution has $1:4$ mole ratio of pentane to hexane . The vapour pressure of pure hydrocarbons at $20^{\circ} C$are 440 mmHgfor pentane and 120mmHg for hexane .The mole

A. 0.786

B. 0.549

C. 0.478

D. 0.200

Answer: C

Watch Video Solution

154. Arrange the following solutions in order of increasing osmotic pressure. Assume 100% isonisation for electrolytes:

$1NNaCl$	$1NNa_2SO_4$	$INNa_3PO_4$
I	II	III

A. I gt II gt III

B. III gt II gt I

C. II gt III gt I

D. II gt I gt II

Answer: A

Watch Video Solution

155. A solution containing $10 g per dm^3$ of urea (mol.wt. $= 60 g mol^{-1}$) is isotonic with a 5% (mass//vol.) of a non-volatile solute. The molecular mass of non-volatile solute is:

A. $350 g mol^{-1}$

B. $200 gmol^{-1}$

C. $250 gmol^{-1}$

D. $300 gmol^{-1}$

Answer: D

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156. $1.0g$ of a non-electrolyte solute(mol. Mass $250.0 gmol^{-1}$) was dissolved in $5.12g$ benzene. If the freezing point depression constant, K_f

of benzene is $5.12 K kg mol^{-1}$, the freezing point of benzene will be lowered by:

A. $0.5K$

B. $0.2K$

C. $0.4K$

D. $0.3K$

Answer: C

Watch Video Solution

157. The ratio of vapour pressure over solution phase on mixing two immiscibe liquids is equal to:

A. Ratio of their weight

B. Ratio of their mol.wt.

C. Ratio of their moles in vapours phase

D. Ratio of their moles in liquids phase

Answer: C

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158. During osmosis, flow of water through a semipermeable membrane is:

A. From both sides of semipermeable membrane with unequal flow ratio

B. From solutions having low concentration only

C. From solutions having high concentration only

D. From both sides fo semipermeable membrane with equal flow rate

Answer: A

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159. The boiling point T'_b of a solvent becomes T_b on addition of X_1 mole fraction of solute. Heat of vaporisation of solvent is ΔH_{vap}. The relation between elevation in b.pt. $\Delta T_b = (T_b - T'_b)$ can be given by:

$$\frac{\Delta T_b}{T_b \times T'_b} = -\frac{2 \ln X_1}{\Delta H_{vap}}$$

A graph plotted between $\log_{10} X_1 vs \frac{1}{T_b}$ gives:

A. a straight line with slope $\frac{R}{\Delta H_{vap}}$ and intercept T'_b

B. a stright line with slope $\frac{2.303R}{\Delta H_{vap}}$ and intercept $\frac{1}{T_b}$

C. a straight line with slope $\frac{\Delta H_{vap}}{\Delta H_{vap}}$ and intercept $\frac{1}{T'_b \times 2.303}$

D. a straight line with slope $\frac{\Delta H_{vap}}{2.303R}$ and intercept $-\frac{\Delta H_{vap}}{2.303RT'_b}$

Answer: D

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160. At higher altitude, boiling of water is $95^{\circ} C$. The amount of $NaCl$ added to $1kg$ water $\left(k_b = 0.52 K mol^{-1} kg\right)$ in order to raise the b.pt. of solution to $100^{\circ} C$ is (assume 90% ionisation of $NaCl$):

A. $296.5g$

B. $281.25g$

C. $270g$

D. $310g$

Answer: A

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161. The elevation in boiling point of a solution dT_b is related with molality of solution (m) by the reaction:

$dT_b = \left[\frac{RT_b^2}{\Delta H_{vap}}\right]\left[\frac{M_1}{1+mM_1}\right]$, where M_1 is moalr mass of solvent and ΔH_{vap} is heat of vaporisation of solvent. For a dilute solution, the relation $\left(\frac{\partial T_b}{\partial T_n}\right)_{m \to 0}$ gives:

A. Molal ebullioscopic constant

B. Elevation in boiling point

C. Elevation in boiling ∂T_b becomes more predominant

D. Boiling point of solvent

Answer: A

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162. Elevation in boiling point of an aqueous solution of urea is $0.52\left(k_b \text{for water} = 0.52 K \text{molality}^{-1}\right)$. The mole fraction is urea in this solution is :

A. 0.98

B. 0.0567

C. 0.943

D. 0.02

Answer: D

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163. If quantities $\Delta T_f, \Delta T_b, \Delta p$ and π without subscript refer to the electrolyte solution and these with subscript refer to the non-electrolyte solution then which one is incorrect?

A. $i = \frac{\Delta T_f}{(\Delta T_f)0}$

B. $i = \frac{\Delta T_b}{(\Delta T_b)0}$

C. $i = \frac{\Delta P}{(P \circ)0}$

D. $i = \frac{\pi}{(\pi)_0}$

Answer: C

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164. An experimenter tries to determine the molecular weight to glucose by observing the depression in freezing point. He carries out his experiment in duplicates. In one he uses pure water as the solvent and in the other independent experiment by mistake, he uses a

$0.1N$ aqueous $NaCl$ as the solvent. It is expected that he will report:

A. (a) Same results in both the cases

B. (b) A higher value of molecular weight of glucose in the second case

C. (c) A lower value of molecular weight of glucose in the second case

D. (d) An average of the molecular weights of glucose and sodium chlorise in the second case

Answer: A

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165. $30mL$ of $0.1MKI_{aq.}$ and $10mL$ of $0.2MAgNO_3$ are mixed. The solution is then filtered out. Assuming that no change in total volume, the resulting solution will freezing at: $\left[K_f \text{for} H_2O = 1.86Kkgmol^{-1}\right.$, assume molality = molality]

A. (a) 0.22

B. (b) 0.28

C. (c) 0.149

D. (d) 0.074

Answer: B

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166. When $250mg$ of eugenol is added to $100g$ of camphor $\left(K_f = 39.7K\text{molality}^{-1}\right)$, it lowered the freezing point by $0.62^{\circ}C$. The molar mass of eugenol is:

A. (a) $160 g mol^{-1}$

B. (b) $165 g mol^{-1}$

C. (c) $200 g mol^{-1}$

D. (d) $250 g mol^{-1}$

Answer: A

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167. Two grams of benzoic acid (C_6H_5COOH) dissolved in $25.0g$ of benzene shows a depression in freezing point equal to $1.62K$.

Molal depression constant for benzene is $4.9 K kg^{-1} mol^{-1}$. What is the percentage association of acid if it forms dimer in solution?

A. (a) 90.2%

B. (b) 99.2%

C. (c) 9.8%

D. (d) 0.8%

Answer: B

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168. Select the correct mathematical representations for Raoult's law.

A. $P_S = P^\circ \dfrac{N}{n+N}$

B. $\dfrac{P^\circ - P_S}{P_S} = \dfrac{n}{N}$

C. $\dfrac{P^\circ - P_S}{P^\circ} = \dfrac{n}{n+N}$

D. $P_S \propto$ mole fraction of solvent

Answer: A::B::C::D

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169. Select the correct statements.

A. The melting of ice becomes fast if salt is spreaded on it

B. The boiling occurs late in pressure cooker

C. Osmosis is a bilateral (both direction) process

D. $1 N Na_2SO_4$ solution is hypertonic with respect to $1 N NaCl$ solution

Answer: A::B::C

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170. Which of the following pairs are correctly matched?

A. Determination of transport number by Hittorf's method

B. Determination of order of reaction by van't Hoff differential method

C. Determination of molecular weight of non-volatile solute by Victor Meyer's method

D. None of these

Answer: A::B

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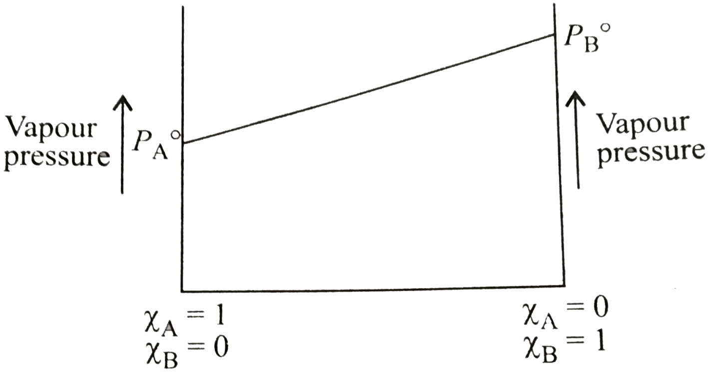
171. The following is a graph plotted between the vapour pressure of two volatile liquids against their respective mole fractions. Which of the following statements is/are correct?



A. When $X_A = 1$ and $X_B = 0,$ then

$P = P_A^\circ$

B. When $X_B = 1$ and $X_A = 0,$ then

$P > P_A^\circ$

C. When $X_A = 1$ and $X_B = 0,$ then

$P < P_B^\circ$

D. When $X_B = 1$ and $X_A = 0$, then

$$P = P_B^\circ$$

Answer: A::B::C::D

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172. The vapour pressure of a dilute solution of a solute is influeneced by:

A. tempressure of solution

B. mole fraction of solute

C. melting point of solute

D. degree of dissociation of solute

Answer: A::B::D

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173. Two miscible liquids A and B having vapour pressure in pure state P_A° and P_B° are mixed in mole fraction χ_A and χ_B to get a mixtue having total vapour vapour pressure of mixture P_M. Which of the following relations are correct?

A. $X_{=}\dfrac{P_M - P_B^\circ}{P_A^\circ - P_B^\circ}$

B. $\dfrac{X_A(l)}{X'_A\,(v)} = \dfrac{P_M}{P_A^\circ}$

C. $\dfrac{X_A(l)}{X'_A\,(v)} = \dfrac{P_M}{P_B^\circ}$

D. None of these

Answer: A::B

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174. For an ideal binary liquid system:

A. Raoult's law is obeyed

B. the change in enthalpy (ΔH) is zero

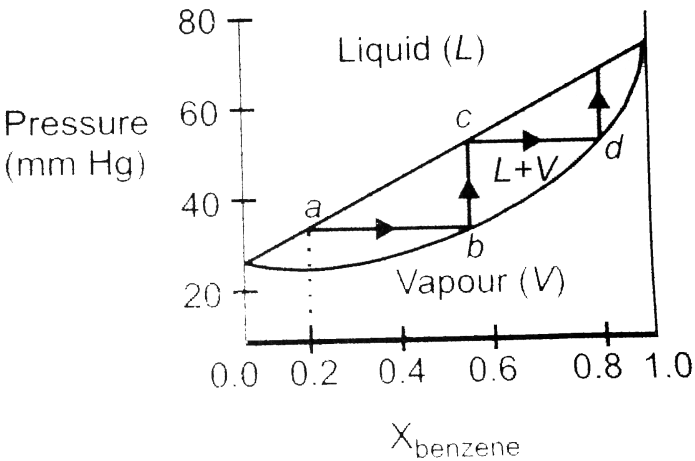
C. change in volume (ΔV) is zero

D. None of these

Answer: A::B::C

Watch Video Solution

175. A graph is plotted between the vapour pressure and mole fraction of a solutionn containing benzene and toluene. Select the correct statements.



A. At the point a, the mole fraction of toluene is 0.80

B. $b \rightarrow c$ represents condesation

C. $c \rightarrow d$ represents vaporization

D. $c \rightarrow d$ represents vaporization as well as condensation

Answer: A::B::C

Watch Video Solution

176. Art what temperature (s) a 5% solution (w/V) of glucose will develop an osmotic pressure of $7atm$?

A. $273K$

B. $306.94K$

C. $33.94^\circ C$

D. $33.94K$

Answer: B::C

Watch Video Solution

177. Among $0.1M$ solution of NH_2CONH_2, Na_2PO_4 and $Al_2(SO_4)_3$:

A. The $V.P.$ and freezing point are the highest for urea.

B. The elevation in boiling point is the highest for $Al_2(SO_4)_3$

C. The $V.P.$ and freezing point is the lowest for urea

D. The depression in freezing point in the highest for the $Al_2(SO_4)_3$

Answer: A::B::D

Watch Video Solution

178. A mixture of two immiscible liquids A and B, having vapour pressure in pure state obeys the following relationship if χ_A and χ_B are mole fractions of A and B in vapour phase over the solution

A. If $P'_A > P'_B$ then $X'_A < X'_B$

B. If $P'_A > P'_B$ then $n_A > n_B$

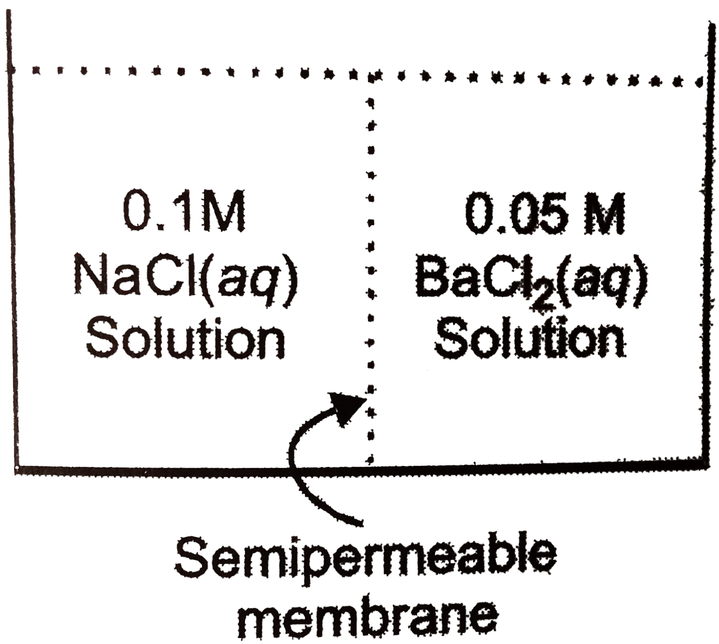
C. $\dfrac{P'_A}{P'_B} = \dfrac{w_A \times m_B}{m_A \times w_B}$

D. $P'_A = P_M . X'_A$

Answer: B::C::D

Watch Video Solution

179. Study the following figure, and select the correct statements.



A. There will be no mevement of any solution across the membrane

B. Water from $BaCl_2$ will flow towards the $NaCl$ solution

C. Water from $NACl$ will flow towards the $BaCl_2$

D. The osmotic pressure of $0.1 M NaCl$ is higher than the osmotic pressure of $0.05 M BaCl_2$, assuming complete dissociation of the electrolyte

Answer: B::D

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180. In the depression of freezing point experiment, it is found that the:

A. $V.P.$ of the solution is less than that of pure solvent

B. $V.P.$ os the solution is more than that of pure solvent

C. only solute molecules solidify at the freezing point

D. only solvent molecules solidify at the freezing point

Answer: A::D

Watch Video Solution

181. For different aqueous solutions of $0.1N$ urea, $0.1 N NaCl, 0.1 N Na_2SO_4$ and

$0.1 N Na_3PO_4$ solution at $27^\circ C$, select the correct statements:

A. The order of osmotic pressure is:

$$NaCl > Na_2SO_4 > Na_3PO_4 > \text{urea}$$

B. $\pi = \frac{\Delta T_b}{K_b} \times ST$ for urea solution

C. Addition of salt on ice increases its melting point

D. Addition of salt on ice brings in melting of ice earlier

Answer: A::B::D

Watch Video Solution

182. The azeotropic solution of two miscible liquids:

A. may show deviation from Raoult's

B. can be separated by sample distillation

C. are supersaturated temperature

D. boil at constant temperature

Answer: A::D

Watch Video Solution

183. Select the correct statements:

A. Boiling occurs only at boilling point of solvent

B. Boiling point of a liquid ischaracteristics temperature when pressure of liquid become equal to external pressure.

C. Boiling may take place at any temperature

D. Boiling occurs before $b.pt.$ at mountanis and above $b.pt.$ in pressure cooker.

Answer: C::D

Watch Video Solution

184. Freezing point of an aqueous solution is $-0.186^{\circ}C$. Elevation of boiling point of the same solution is ....if

$K_b = 0.512 K \text{molality}^{-1}$ and

$K_f = 1.86 K \text{molality}^{-1}$:

A. $0.186^\circ C$

B. $0.0512^\circ C$

C. $0.092^\circ C$

D. $0.237^\circ C$

Answer: B

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185. In mixture A and B ,components show -ve deviations as:

A. ΔV_{mix} is $+ve$

B. $A-B$ interaction is weaker than $A-A$ and $B-B$ interaction

C. ΔH_{mix} is $+ve$

D. $A-B$ interaction is stronger than $A-A$ and $B-B$ interaction

Answer: D

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186. If liquids A and B from an ideal solution, than :

A. $\Delta G_{mix} = 0$

B. $\Delta H_{\text{mixing}} = 0$

C. $\Delta G_{mix} = 0, \Delta S_{mix} = 0$

D. $\Delta S_{mix} = 0$

Answer: B

Watch Video Solution

187. In a 0.2 molal aqueous solution of weak acid HX (the degree of dissociation 0.3) the freezing point is (given $K_f = 1.85 K molality^{-1}$):

A. $-0.26^{\circ} C$

B. $+48^{\circ} C$

C. $-0.48^{\circ} C$

D. $-0.36^{\circ} C$

Answer: C

Watch Video Solution

188. A pressure cooker reduces cooking time because

A. the higher pressure inside the cooker crushes the food material

B. cooking involves chemical changes helped by rise in temperature

C. heat is more evenly distributed in the cooking space

D. boiling point of water involved in cooking increases

Answer: D

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189. The elevation in boiling point of a solution of $13.44g$ of $CuCl_2$(molecular weight = $134.4, k_b = 0.52K\text{molality}^{-1}\big)$ in 1 kg water using the following information will be:

A. 0.16

B. 0.05

C. 0.1

D. 0.2

Answer: A

Watch Video Solution

190. Which aqueous solution exhibits highest boiling point?

A. $0.015M$ glucose

B. $0.01MKNO_3$

C. $0.015M$ urea

D. $0.01MNa_2SO_4$

Answer: D

Watch Video Solution

191. Which liquids pair shows a positive deviation from Raoult's law?

A. Acetone-chloroform

B. Benzene-methanol

C. Water-nitric acid

D. Water-hydrochloric acid

Answer: B

Watch Video Solution

192. Which statement is false ?

A. Two sucrose solutions of same molality prepared in different solvents have same ΔT_f

B. Osmotic pressure, $\pi = MRT$

C. Osmotic pressure for $0.01M$ aqueous solution:

$BaCl_2 > KCl > CH_3COOH > \text{Sucrose}$

D. The vapour pressure of a component over a solution is proportional to its mole fraction

Answer: A

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193. If α is the degree of dissociation of Na_2SO_4, the van,t Hoff factor (i) used for calculating molaecular mass is:

A. $1+\alpha$

B. $1-\alpha$

C. $1+2\alpha$

D. $1-2\alpha$

Answer: C

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194. Benzene and toluene form nearly ideal solutions.At $20^\circ C$, the vapour pressure of benzene is 75 torr. The partial vapour pressure of benzene at$20^\circ C$ for a solution containing $78g$benzene and $46g$touene is torr is

A. 50

B. 25

C. 375

D. 53.5

Answer: A

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195. Equimolar solutions of two non-electroytes in the same solvent have:

A. Same $b. pt.$ but different $f. pt.$

B. Same $f. pt.$ but different $b. pt.$

C. Same $b.\ pt.$ and same $f.\ pt.$

D. Different $b.\ pt.$ and different $f.\ pt.$

Answer: C

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196. 18g of glucose $(C_6H_{12}O_6)$is added to 178.2 g of water. The vapour pressure of water for this aqueous solution at $100^\circ C$is :

A. 759 torr

B. 7.60 torr

C. 76.0 torr

D. 752.40 torr

Answer: D

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197. Equal weights of methane and oxygen are mixed in an empty container at $25^{\circ} C$. The fraction of the total pressure exerted by oxygen is

A. $\frac{2}{3}$

B. $\frac{1}{3} \times \frac{273}{298}$

C. $\frac{1}{3}$

D. $\frac{1}{2}$

Answer: C

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198. A 5.25% solution of a substance is isotonic with a 1.5% solution of urea (molar mass $= 60 g mol^{-1}$) in the same solvent. If the densities of both the solutions are assumed to be equal to $1.0 g cm^{-3}$, molar mass of the substance will be:

A. $90.0 g mol^{-1}$

B. $115.0 g mol^{-1}$

C. $105.0 g mol^{-1}$

D. $210.0 g mol^{-1}$

Answer: D

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199. A mixture of ethyl alcohol and propyl alcohol has a vapour pressure of $290 mm$at $300 K$ .The vapour pressure of propyl alcohol is $200 mm$ .if the mole fraction of ethyl alcohol is 0.6 ,its vapour pressure (in mm)at the same temperature will be

A. 350

B. 300

C. 700

D. 360

Answer: A

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200. At $80^{\circ} C$, the vapour pressure of pure liquid A is $520 mm$ Hg and that of pure liquid B is $1000 mmHg$. If a mixture of solution A and B boils at $80 \circ C$ and $1 atm$ pressure, the amount of A in the mixture is $(1 atm = 760 mmHg)$

a. $50 mol \%$, b.$52 mol \%$,c.$34 mol \%$,d. $48 mol \%$

A. 52 mol per cent

B. 34 mol per cent

C. 48 mol per cent

D. 50 mol per cent

Answer: D

Watch Video Solution

201. The vapour pressure of water at$20^{\circ}C$is $17.5mmHg$.if $18g$of glucose $(C_6H_{12}O_6$is added to $178.2g$ of water at$20^{\circ} C$, the vapour pressure of the resulting solution will be,

A. $17.675 mmHg$

B. $15.750 mmHg$

C. $16. 500 mmHg$

D. $17.325 mmHg$

Answer: D

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202. Two liquids X and Y from an ideal solution at$300K$, Vapour pressure of the Solution containing 1mol of X and 3mol of Y is 550 mmHg . At the same temperature, if 1 mol of Y is further added to this solution ,vapour pressur of the solutions increases by 100 mmHg Vapour pressure (in mmHg) of X and Y in their pure states will be,respectively

A. 200 and 300

B. 300 and 400

C. 400 and 600

D. 500 and 600

Answer: C

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203. A binary liquid solution of n-heptane and ethyl alcohol is prepared which of the following statements correctly represents the behaviour of this liquid solution?

A. The solution formed is an ideal solution

B. The solution is non-ideal, showing $+ve$ deviation from Raoult's law

C. The solution is non-ideal, showing $-ve$ deviation from Raoult's law

D. n-heptane shows $+ve$ deviation while ethanol shows $-ve$ deviation from Raoult's law

Answer: B

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204. If solution sulphate is considered to be completely dissociated into cations and anions in aqueous solution, the change in freezing point water (ΔT_f), when 0.01 mole of solution sulphate is dissolved in $1kg$ of water, is: $(K'_f = 1.86kgmol^{-1})$

A. $0.0372K$

B. $0.0558K$

C. $0.0744K$

D. $0.0744K$

Answer: B

Watch Video Solution

205. Heptane and octane form an ideal solution. At $373K$, the vapour pressure of the two liquids are 105.0 kPa and 46.0 kPa, respectively. What will be the vapour pressure, of the mixture of $25g$ of heptane and $35g$ of octane ?

A. $72.0kPa$

B. $36.1 kPa$

C. $96.2 kPa$

D. $144.5 kPa$

Answer: A

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206. A 5.2 molal aqueous of methyl alcohol, CH_3OH, is supplied. What is the molefraction of methyl alcohol in the solution ?

A. 0.100

B. 0.190

C. 0.086

D. 0.050

Answer: C

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207. Ethylene glycol is used as an antifreeze in a cold cliamate Mass of ethylene glycol which should be added to 4 kg for water to prevent it from freezing at $-6^{\circ}C$ will be (K_f for water $=1.86K kg mol^{-1}$ and molar mass of ethylene glycol $=62 g mol^{-1}$)

A. $800.00g$

B. $204.30g$

C. $400.00g$

D. $304.60g$

Answer: A

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208. The degree of dissociation (α) of a weak electrolyte, A_xB_y is related to van't Hoff's factor (i) by the expression:

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

B. $\alpha = \frac{i-1}{(x+y+1)}$

C. $\alpha = \frac{(x+y-1)}{i-1}$

D. $\alpha = \frac{(x+y+1)}{i-1}$

Answer: A

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209. K_f for water is $1.86 K kg mol^{-1}$. IF your automobile radiator holds $1.0 kg$ of water, how many grams of ethylene glycol $(C_2H_6O_2)$ must you add to get the freezing point of the solution lowered to $-2.8^\circ C$?

A. $93g$

B. $39g$

C. $27g$

D. $72g$

Answer: A

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210. 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

Answer: A

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211. A $0.004M$ solution of Na_2SO_4 is isotomic with a $0.01M$ solution of glucose at same temperature. The apparent degree of dissociation of Na_2SO_4 is:

A. 25%

B. 50%

C. 75%

D. 85%

Answer: C

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212. When $20g$ of naphthoic acid $(C_{11}H_8O_2)$ is dissolved in $50g$ of benzene $(K_f = 1.72Kkgmol^{-1})$, a freezing point depression of $2K$ is observed of $2K$ is observed. The van,t Hoff factor (i) is:

A. 0.5

B. 1.0

C. 2.0

D. 3.0

Answer: A

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213. The Henry's law constant for the solubility of N_2 gas in water at $298K$ is $1.0 \times 10^5 atm$. The mole fraction of N_2 in air is 0.8. The number of moles of N_2 from air dissolved in

10 moles of water at $298K$ and $5atm$. Pressure

is:

A. 4.0×10^{-4}

B. 4.0×10^{a}

C. 5.0×10^{-4}

D. 4.0×10^{-6}

Answer: A

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214. Dissolving $120g$ of urea $(Mw = 60)$ in $1000g$ of water gave a solution of density $1.15gmL^{-1}$. The molarity of solution is:

A. $1.78M$

B. $2.00M$

C. $2.05M$

D. $2.22M$

Answer: C

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215. The freezing point (in $.^{\circ} C$) of a solution containing $0.1g$ of $K_3[Fe(CN)_6]$ (Mol. wt. 329) in $100g$ of water $(K_f = 1.86 K kg mol^{-1})$ is :

A. -2.3×10^{-2}

B. -5.7×10^{-2}

C. (c) -5.7×10^{-3}

D. -1.2×10^{-2}

Answer: A

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216. For a dilute solution containing $2.5g$ of a non-volatile non-electrolyte solution in $100g$ of water, the elevation in boiling point at 1 atm pressure is $2^{\circ}C$. Assuming concentration of solute is much lower than the concentration of solvent, the vapour pressure (mm of Hg) of the solution is:

(take $k_b = 0.76 K kg mol^{-1}$)

A. 724

B. 740

C. 736

D. 718

Answer: A

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217. How many gm of glucose must be present in 0.45 litre of a solution for its osmotic pressure to be same as that of solution of $8.89gm$ glucose per litre?

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218. At $17^{\circ} C$ the osmotic pressure of an aqueous of sucrose is $1.855 atm$ per $150 mL$ solution. Calculate the weight of sucrose in solution.

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219. The osomotic pressure of a solution at $0^{\circ} C$ is $4 atm$. What will be its osmotic pressure at $546K$ under similar conditions?

a.$4atm$, b.$9atm$,c.$8atm$, d.$6atm$

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220. Calculating the osmotic pressure at $27^\circ C$ of an aqueous solution containing $4.4gm$ of glucose per $100mL$ solution.

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221. What weight of glucose (mol.wt. $= 180$) would have to be added to $1700g$ of water at $20^\circ C$ to lower its vapour pressure $0.001mm$? The vapour pressure of pure water is $17mmHg$ at $20^\circ C$.

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222. A solution of sucrose (mol. wt. 342) is prepared by dissolving $69.3g$ of it per litre of the solution. What is the osmotic pressure at $300K$?

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223. A 0.001 molal solution of $\left[Pt(NH_3)_4Cl_4\right]$ in water had freezing point depression of $0.0054^\circ C$. If K_f for water is 1.80, calculating the number f Cl^- ions furnished.

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224. The osmotic pressure of urea solution is $500 mm$ at $10^{\circ} C$. The solution is diluted and the temperature raised to $25^{\circ} C$, when the osmotic pressure is found to be $105.3 mm$. Find the extend if dilution.

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225. $0.002 m$ aqueous solution of an ionic compound $Co(NH_3)_5(NO_2)CI$ freezes at $-0.00732^{\circ} C$.Number of moles of ions which 1 mole of ionic compound produces in water will be $(K_f = 1.86^\circ C/m)$

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226. A mixture of nitrogen and hydrogen are initially in the molar ratio of $1:3$ related equilibrium to form ammonia when 25% of the material had reacted. If the total pressure of the system is $28 atm$, calculate the partial pressure of ammonia at the equilibrium.

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227. A mixture of two immiscible liquids nitrobenzene and water at $99^{\circ}C$ has a partial vapour pressure of water $733mm$ and that of nitrobenzene $27mm$. Calculate the ratio of the weights of nitrobenzene to the water in the distillate.

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228. xg of urea was dissolved in $500g$ of water and cooled upto $-0.5^{\circ}C$ whereby $128g$ of ice

separates out from the solution. If cryoscopic constant for water be $1.86^{\circ}C/m$. Calculate the value of x.

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229. The vapour pressure of CS_2 at $50^{\circ}C$ is 854torr and a solution of $2.0g$ sulphur in $100g$ of CS_2 has vapour pressure 848.9torr. If the formula of sulphur molecule is S_n, then calculate the value of n. (at mass of $S = 32$).

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230. $0.75g$ of a non-electrolyte was dissolved in $87.9g$ of benzene. This raised the boiling point of benzene by $0.25^{\circ}C$. If the molecular mass of non-electrolyte is 103, calculate the molal elevation constant for bezene.

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231. Calculating the mass of ascorbic acid $(C_6H_8O_6)$ to be dissolved in $74g$ of acetic acid to lower its melting point by $1.5^\circ C$. K_f for CH_3COOH is $3.9 K kg nol^{-1}$.

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232. The molal freezing point depression constant for benzene is $4.9 K kg mol^{-1}$. Selenium exists as a polymer of the type Se_n. When $3.26 g$ selenium is dissolved in $226 g$ of benzene, the observed freezing. If molecular formula of sulphur is S_n. Then find the value of n. (at. wt. of $S = 32$).

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233. $3.24g$ of sulphur dissolved in $40g$ benzene, boiling point of the solution was higher than that of benzene by $0.081K$. K_b for benzene is $2.53Kkgmol^{-1}$. If molecular formula of sulphur is S_n. Then find the value of n. (at.wt.of $S = 32$).

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234. Calculate the value of van't Hoff factor for a dilute solution of K_2SO_4 in water.

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235. A solution contains $0.8133g$ of K_2SO_4 in $500mL$. If osmotic pressure is found to be $0.69atm$ at $27^\circ C$. Calculate the value of van't Hoff's factor.

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236. A very small amount of a non-volatile solute (that does not dissociate) is dissolved in $56.8 cm^3$ of benzene (density $0.889 gcm^3$). At room temperature, vapour pressure of this solution is $98.88 mmHg$ while that of benzene is $100 mmHg$. Find the molality of this solution. If the freezing temperature of this solution is 0.73 degree lower than that of benzene, what is the value of molal the freezing point depression constant of benzene?

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237. The heat of reaction of a redox change is $9.65 \times 10^5 J$. If the same redox change is made in the working of cell showing cell efficiency $60\ \%$ and emf of $1.2V$. What was the number of electrons involved in cell reaction?

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238. Mole fraction of a solute (in a solvent of mol.wt.250) is 0.02. If elevation constant of solvent is $24.5 K molality^{-1}$, find the elevation in boiling point.

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239. The vapour pressure of a mixture of two volatile liquids is given by $P_M = 4.0X_A + 3.0$. Find the vapour pressure of pure B.

Watch Video Solution

240. A mixture of two immiscible liquids nitrobenzene and water boiling at $99^{\circ} C$ shows a partial pressure of the closest value of their weight ratio. (Water: nitrobenzene)

Watch Video Solution

241. How many triple point for sulphur system?

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242. Vapour pressure of a solvent is the pressure exterted by vapour when they are in equilibrium with its solvent at that temperature. The vapour pressure of solvent is dependent of 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 valatile liquids is given by $P_M = P_A^\circ . X_A + P_B^\circ . X_B$ where P_A° and P_B° are vapour pressures of pure components A and B and X_A, X_B are their mole fractions in mixture. For solute-solvent system, the relatio

becomes $P_M = P_A^\circ . X_A$ where B is non-volatile solute.

The vapour pressure of benzene and its solution with a non-electrolyte are 640 and $600 mm$ respectively. The molality of solution is:

A. 0.80

B. 0.86

C. 0.90

D. 0.95

Answer: B

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243. Vapour pressure of a solvent is the pressure exterted by vapour when they are in equilibrium with its solvent at that temperature. The vapour pressure of solvent is dependent of 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 valatile liquids is given by $P_M = P_A^\circ . X_A + P_B^\circ . X_B$ where P_A° and P_B° are vapour pressures of pure components A and B and X_A, X_B are their mole fractions in mixture. For solute-solvent system, the relatio becomes $P_M = P_A^\circ . X_A$ where B is non-volatile solute.

The amount of solute $(\mathrm{mol.\ wt.}\ 60)$ required to dissolve in $180g$ water to reduce the vapour pressure to $4/5$ of the pure water:

A. $120g$

B. $150g$

C. $200g$

D. $60g$

Answer: B

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244. Vapour pressure of a solvent is the pressure exterted by vapour when they are in equilibrium with its solvent at that temperature. The vapour pressure of solvent is dependent of 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 valatile liquids is given by $P_M = P_A^\circ . X_A + P_B^\circ . X_B$ where P_A° and P_B° are vapour pressures of pure components A and B and X_A, X_B are their mole fractions in mixture. For solute-solvent system, the relatio becomes $P_M = P_A^\circ . X_A$ where B is non-volatile solute.

The vapour pressure at $102^\circ C$ of a non-electrolytic solution having $b.\, pt.\, 375K$ is:

A. $750mm$

B. $770mm$

C. $760mm$

D. $780mm$

Answer: C

Watch Video Solution

245. Vapour pressure of a solvent is the pressure exterted by vapour when they are in equilibrium with its solvent at that temperature. The vapour pressure of solvent is dependent of 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 valatile liquids is given by $P_M = P_A^\circ . X_A + P_B^\circ . X_B$ where P_A° and P_B° are vapour pressures of pure components A and B and X_A, X_B are their mole fractions in mixture. For solute-solvent system, the relatio becomes $P_M = P_A^\circ . X_A$ where B is non-volatile solute.

If M is mol.wt. of solvent, K_b is molal elevation constant and t_b is its boiling point, P° is its vapour pressure ta temperature T and P_S is vapour pressure of non-volatile solute in it at TK, then:

A. $\dfrac{P^\circ - P_S}{P^\circ} = \dfrac{\Delta T_b}{K_b} \times M$

B. $\dfrac{P^\circ - P_S}{P^\circ} = \dfrac{K_b}{T_b} \times M$

C. $\dfrac{P^\circ - P_S}{P^\circ} = \dfrac{K_b}{T_b} \times \dfrac{M}{1000}$

D. $\dfrac{P^\circ - P_S}{P^\circ} = \dfrac{\Delta T_b}{K_b} \times \dfrac{M}{1000}$

Answer: D

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246. Vapour pressure of a solvent is the pressure exterted by vapour when they are in equilibrium with its solvent at that temperature. The vapour pressure of solvent is dependent of 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 valatile liquids is given by $P_M = P_A^\circ . X_A + P_B^\circ . X_B$ where P_A° and P_B° are vapour pressures of pure components A

and B and X_A, X_B are their mole fractions in mixture. For solute-solvent system, the relatio becomes $P_M = P_A^\circ . X_A$ where B is non-volatile solute.

A mixture of two volatile liquids A and B 1 and 3 moels respectively has a $V.P$ of $300mm$ at $27^\circ C$. IF one mole of A is further added to this solution, the vapour pressure becomes $290mm$ at $27^\circ C$. The vapour pressure of A is:

A. $250mm$

B. $316mm$

C. $220mm$

D. $270mm$

Answer: A

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247. Colligative properties i.e., the properties of solution which depends upon the number pf aprticles 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 electroetically because electrolytes dissociates to furnish more ions in solution. On the other hand experimentally obtained values of colligative properties for associating nature of solute ate lower than those obtained theoretically. The ratio of experimantal colligative properties to theoretical colligative properties is called as van't Hoff factor (i).

van,t Hoff factor (i) for dimerisation of benzoic acid in water, assuming $30\,\%$ degree of association is:

A. 0.85

B. 0.95

C. 0.90

D. 1

Answer: A

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248. Colligative properties i.e., the properties of solution which depends upon the number pf aprticles 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 electroetically because electrolytes dissociates to furnish more ions in solution. On the other hand experimentally obtained values of colligative properties for associating nature of solute ate lower than those obtained theoretically. The ratio of experimantal colligative properties to theoretical colligative properties is called as van't Hoff factor (i).

The degree of dissociation of electrolyte $A_x B_y$

is given by the relation:

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

B. $\alpha = \dfrac{i+1}{x+y-1}$

C. $\alpha = \dfrac{i-1}{x+y+1}$

D. None of these

Answer: A

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249. Colligative properties i.e., the properties of solution which depends upon the number pf aprticles 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 electroetically because electrolytes dissociates to furnish more ions in solution. On the other hand experimentally obtained values of colligative properties for associating nature of solute ate lower than those obtained theoretically. The ratio of experimantal colligative properties to theoretical colligative properties is called as van't Hoff factor (i).

The maximum elevation in $b.\ pt.$ is noticed in :

A. $1NNaCl$

B. $1NNa_2SO_4$

C. $1NNa_3PO_4$

D. $1NNa_4Fe(CN)_6$

Answer: A

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250. Colligative properties i.e., the properties of solution which depends upon the number pf aprticles 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 electroetically because electrolytes dissociates to furnish more ions in solution. On the other hand experimentally obtained values of colligative properties for associating nature of solute ate lower than those obtained theoretically. The ratio of experimantal colligative properties to theoretical colligative properties is called as van't Hoff factor (i).

For $1M$ solution of HA having $\alpha > 0.05$, the dissociation constant K_a in terms of van't Hoff factor `(i) can be written as :

A. $\frac{(i-1)^2}{i}$

B. $\frac{(i+1)^2}{i}$

C. $\frac{i}{(i-1)^2}$

D. $\frac{(i-1)^2}{(2-i)^2}$

Answer: D

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251. Colligative properties i.e., the properties of solution which depends upon the number pf aprticles 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 electroetically because electrolytes dissociates to furnish more ions in solution. On the other hand experimentally obtained values of colligative properties for associating nature of solute ate lower than those obtained theoretically. The ratio of experimantal colligative properties to theoretical colligative properties is called as van't Hoff factor (i).

The correct order of osmotic pressure for the solutions :

(I) $1N$ urea , (II) $1N NaCl$

(III) $1N Na_2SO_4$, (IV) $1N Na_3PO_4$ is:

A. $I > II > III > IV$

B. $IV > III > II > I$

C. $II > III > IV > I$

D. $I > IV > III > II$

Answer: C

Watch Video Solution

252. Colligative properties i.e., the properties of solution which depends upon the number pf aprticles 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 electroetically because electrolytes dissociates to furnish more ions in solution. On the other hand experimentally obtained values of colligative properties for associating nature of solute ate lower than those obtained theoretically. The ratio of experimantal colligative properties to theoretical colligative properties is called as van't Hoff factor (i).

van't Hoff coefficient $'g'$ for $100\,\%$ dissociated $NaCl$ solution is:

A. 1

B. 2

C. $1/2$

D. 3

Answer: A

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253. The molecular weight of non-volatile solute can be determined experimentally by osmotic pressure method or by cryoscopy or by ebullisocopy Berkeley-Hartley method for isotomic presure is commonly used for aqueous solutions. Elevation in $b.pt.$ or depression in $f.pt.$ on addition of non-valatile solute in a solvent is read by Beckmann's thermometer.

Which of the following statement is wrong :

A. Super heating or super cooling must be avoided during cryoscopy or equllioscopy measurements.

B. Addition of salt on ice brings it's early melting.

C. Water boils at relatively higher temperature in pressure cooker.

D. Beckman's thermometers are used to determine exact $b.pt.$ ot $f.pt.$ of solvent and solutions respectively.

Answer: D

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254. The molecular weight of non-volatile solute can be determined experimentally by osmotic pressure method or by cryoscopy or by ebullisocopy Berkeley-Hartley method for isotomic presure is commonly used for aqueous solutions. Elevation in $b.pt.$ or depression in $f.pt.$ on addition of non-valatile solute in a solvent is read by Beckmann's thermometer.

Select the correct statement :

A. Semi-permeable membrane of $Cu_2Fe(CN)_6$ is soluble in water but insoluble in non-aqueous solvents.

B. Cryoscopy gives better results of mol.wt. of polymers of high mol.wt.

C. During freezing a solution, whole of the solution freezes.

D. Only solvent freezes at its $f.pt.$ if solution is cooled.

Answer: D

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255. Properties such as boiling point, freezing point and vapour pressure of a pure solvent change when solute molecules are added to get homogeneous solution. These are called colligative properties. Applications of colligative properties are very useful in day-to-day life. One of its examples is the use of ethylene glycol and water mixture as anti-freezing liquid in the radiator of automobiles.

A solution M is prepared by mixing ethanol and water. Thus moel fraction of ethanol in

the mixture is 0.9.

Given: Freezing point depression constant of

water

$$\left(K_f^{\text{water}}\right) = 1.86 K kg mol^{-1}$$

Freezing point depression constant of ethanol

$$\left(K_f^{\text{ethanol}}\right) = 2.0 K kg mol^{-1}$$

Boiling point elevation constant of water

$$\left(K_b^{\text{water}}\right) = 0.52 K kg mol^{-1}$$

Boiling point elevation constant of ethanol

$$\left(K_b^{\text{ethanol}}\right) = 1.2 K kg mol^{-1}$$

Standard freezing point of water $= 273 K$

Standard freezing point of ethanol $= 155.7 K$

Standard boiling point of water $= 373K$

Standard boiling point of ethanol $= 351.5K$

vapour pressure of pure water $= 32.8mmHg$

Vapour pressure of pure ethanol $= 40mmHg$

Molecualr weight of water $= 18gmol^{-1}$

Molecular weight of ethanol $= 46gmol^{-1}$

In asweering the following questions, consider the solutions to be ideal dilute solutions and solutes to be non-volatile and non-dissociative.

The freezing point of the solution M is :

A. $268.7K$

B. $268.5K$

C. $234.2K$

D. $150.9K$

Answer: D

Watch Video Solution

256. Properties such as boiling point, freezing point and vapour pressure of a pure solvent change when solute molecules are added to get homogeneous solution. These are called colligative properties. Applications of colligative properties are very useful in day-to-day life. One of its examples is the use of ethylene glycol and water mixture as anti-freezing liquid in the radiator of automobiles.

A solution M is prepared by mixing ethanol and water. Thus moel fraction of ethanol in the mixture is 0.9.

Given: Freezing point depression constant of water

$$\left(K_f^{\text{water}}\right) = 1.86 K kg mol^{-1}$$

Freezing point depression constant of ethanol

$$\left(K_f^{\text{ethanol}}\right) = 2.0 K kg mol^{-1}$$

Boiling point elevation constant of water

$\left(K_b^{\text{water}}\right) = 0.52 Kkgmol^{-1}$

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Standard freezing point of water $= 273K$

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Standard boiling point of water $= 373K$

Standard boiling point of ethanol $= 351.5K$

vapour pressure of pure water $= 32.8 mmHg$

Vapour pressure of pure ethanol $= 40 mmHg$

Molecualr weight of water $= 18 gmol^{-1}$

Molecular weight of ethanol $= 46 gmol^{-1}$

In asweering the following questions, consider the solutions to be ideal dilute solutions and solutes to be non-volatile and non-dissociative.

The vapour pressure of the solution M is:

A. $39.3mmHg$

B. $36.0mmHg$

C. $29.5mmHg$

D. $28.8mmHg$

Answer: B

Watch Video Solution

257. A solution M is prepared by mixing ethanol and water. The mole fraction of ethanol in the mixture is 0.9

Given: Freezing point depression constant of water

$\left(K_f^{water} = 1.86 K kg mol^{-1}\right)$

Freezing point depression constant to ethanol

$\left(K_f^{ethanol}\right) = 2.0 K kg mol^{-1}\right)$

Boiling point elevation constant of water

$\left(K_b^{water}\right) = 0.52 K kg mol^{-1}\right)$

Boiling point elevation constant of ethanol

$(K_b^{ethanol}) = 1.2 K kg mol^{-1})$

Standard freezing point of water = $273K$

Standard freezing point of ethanol = $155.7K$

Standard boiling point of water = $373K$

Standard boiling point of ethanol = $351.5K$

Vapour pressure of pure water =$32.8mmHg$

Vapour pressure of pure ethanol =$40mmHg$

Molecular weight of water =$18gmol^{-1}$

Molecular weight of ethanol =$46gmol^{-1}$

In anwering the following questions consider the solutions to be ideal dilute solutions and solutes to be non-volatile and non-dissociative.

Water is added to the solution M such that the mole fraction of water in the solution becomes 0.9. The boiling point of this solution is

A. $380.4K$

B. $376.2K$

C. $375.5K$

D. $354.7K$

Answer: B

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258. Colligative properties of solution depend upon the number of particles present in solution. Experimental values colligative properties for electrolytes are always higher than these obtained theoretically because electrolyte dissociates to furnish more ions in solution. The ration of experimental values to theoretical values is called as van't Hoff factor (i).

van't Hoff factor for dimerisation of benzoic acid in water, assuming $70\,\%$ degree of association:

A. 0.65

B. 0.7

C. 1

D. 0.75

Answer: A

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259. Colligative properties of solution depend upon the number of particles present in solution. Experimental values colligative properties for electrolytes are always higher than these obtained theoretically because electrolyte dissociates to furnish more ions in solution. The ration of experimental values to theoretical values is called as van't Hoff factor (i).

For $1M$ solution of a weak acid HA, the dissociation constant K in terms of van't Hoff factor:

A. $\frac{(i-1)^2}{i}$

B. $\frac{i}{(i-1)^2}$

C. $\frac{(i-1)^2}{(2-i)}$

D. $\frac{(i-1)^2}{i}$

Answer: C

Watch Video Solution

260. Colligative properties of solution depend upon the number of particles present in solution. Experimental values colligative properties for electrolytes are always higher than these obtained theoretically because electrolyte dissociates to furnish more ions in solution. The ration of experimental values to theoretical values is called as van't Hoff factor (i).

The correct order of freezing point for the following, each are 1 molal solutions in water and take $\alpha = 1$:

(i) Urea , (ii) $NaCl$

(iii) Na_3PO_4 , (iv) Na_2SO_4

A. $iv < ii < iii < i$

B. $iii < iv < ii < i$

C. $I < ii < iv < iii$

D. $iii < iv < I < ii$

Answer: B

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261. Statement Addition of a non-volatile solute causes a depression in vapour pressure.

Explanation vapour pressure of a solution is directly proportional to mole fraction of solvent.

A. S is correct but E is wrong.

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is not correct explanation of S.

Answer: C

Watch Video Solution

262. Statement Osmosis is a bilateral process.

Explanation In osmosis net flow from dilute to concentrated solution is noticed.

A. S is correct but E is wrong.

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is not correct explanation of S.

Answer: C

Watch Video Solution

263. Statement Formation of semipermeable membrane between the walls of porous pot on hanging pot filled with $CuSO_4(aq.)$ partiallt dipped in $K_4Fe(CN)_6$ is due to osmosis.

Explanation The ions moves through the walls of porous pot and between the walls Cu^{2+}

and $Fe(CN)_6^{4-}$ gives insoluble gelatinous

mass of $Ca_2[Fe(CN)_6]_4$.

A. S is correct but E is wrong.

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is not correct explanation of S.

Answer: B

Watch Video Solution

264. Statement Boiling point of water is $100^{\circ} C$ although water boils below $100^{\circ} C$ on mountains.

Explanation Boiling point of a liquid is the temperature at which $V.P.$ of liquid becomes equal to $1 atm$.

A. S is correct but E is wrong.

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is not correct explanation of S.

Answer: C

Watch Video Solution

265. Statement An ideal solution is one which obey Raoult's law.

Explanation KCl_{aq}. is an ideal solution.

A. S is correct but E is wrong.

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is not correct explanation of S.

Answer: A

266. Statement Ebullioscopy or cryscopy can not be used for the determination of mol. wt. of polymers.

Explanation High molecular weight solute leads to very low value of ΔT_b or ΔT_f

A. S is correct but E is wrong.

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is not correct explanation of S.

Answer: C

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267. Statement For iostomic solutions $C_1 = C_2$.

Explanation For isotomic solutions $\pi_1 = \pi_2$.

A. S is correct but E is wrong.

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is not correct explanation of S.

Answer: B

Watch Video Solution

268. Statement Osmotic pressure of non-aqueous solutions can be determined by Berkeley-Hartley method.

Explanation The semipermeable membrane used in Berkeley-Hartley method is $Cu_2[Fe(CN)_6]$.

A. S is correct but E is wrong.

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is not correct explanation of S.

Answer: B

Watch Video Solution

269. Statement Near the freezing point of an aqueous solution of a non-volatile solute only ice separates out.

Explanation The remaining solution shows equilibrium between solid solvent-liquid solvent.

A. S is correct but E is wrong.

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is not correct explanation of S.

Answer: C

Watch Video Solution

270. Statement van't Hoff factor for electrolytes is always greater than unity.

Explanation The number of particles increases in solution due to electrolytic dissociation.

A. S is correct but E is wrong.

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is not correct explanation of S.

Answer: C

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271. Statement Super heating means to heat a liquid just above its boiling point.

Explanation On direct heating, the layer in contact with frame has relatively higher temperature than the other layers of liquid.

A. S is correct but E is wrong.

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is not correct explanation of S.

Answer: D

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272. Statement Reverse osmosis is used to purify saline water.

Explanation Solvent molecules pass from concentrate solution to dilute solution through semipermeable membrane if high pressure is applied on solution side.

A. S is correct but E is wrong.

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is not correct explanation of S.

Answer: C

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273. Statement All solutes becomes more soluble in water at higher temperature.

Explanation The amount of solute that dissolve depends upon nature, temperature and pressure (gases) of the substance.

A. S is correct but E is wrong.

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is not correct explanation of S.

Answer: D

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274. Statement The vapour pressure of $0.1M$ sugar solution is more than that of $0.1M$ potassium chloride solution.

Explanation Lowering of vapour pressure is directly proportional to the number of species present in the solution.

A. S is correct but E is wrong.

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is not correct explanation of S.

Answer: B

Watch Video Solution

275. Statement At equilibrium of Liquid $\Leftrightarrow$ vapour, kinetic energy liquid phase and vapour phase are same.

Explanation Kinetic energy of liquid or vapour is given by $3/3RT$ for one mole.

A. S is correct but E is wrong.

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is not correct explanation of S.

Answer: C

Watch Video Solution

276. Statement The boiling point of $0.1M$ urea solution is less than that if $0.1MKCl$ solution.

Elevation of boiling point is directly proportional to the number of species present in the solution.

A. S is correct but E is wrong.

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is not correct explanation of S.

Answer: B

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277. Statement If one component obeyed Raoult's law over a certain range of composition, the other component would not obey Henry's law in that range.

Explanation Raoult's law is a special case of Henry's law.

A. S is correct but E is wrong.

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is not correct explanation of S.

Answer: A

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278. Statement The water pouch of instant cold pack for treating athletic injuries breakes when squeezed and NH_4NO_3 dissolves lowering the temperature.

Explanation Addition of non-volatile solute into solvent results into depression of freezing point of solvent.

A. S is correct but E is wrong.

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is not correct explanation of S.

Answer: C

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279. Statement The vapour pressure of 0.45 molar urea solution is more than that of 0.45 molar solution of sugar.

Explanation Lowering of vapour pressure is directly proportional to the number of species present in the solution.

A. S is correct but E is wrong.

B. S is wrong but E is correct.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is not correct explanation of S.

Answer: B

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280. At $25^{\circ} C$, a solution containing $0.2g$ of polyisobutylene in $100 mL$ of benzene developed a rise of $2.4mm$ at osmotic equilibrium. Calculate the molecular weight of polyisobutylene if the density of solution is $0.88 g / mL$.

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281. Calculate osmotic pressure of a solution obtained by mixing $100mL$ of 3.4% solution "(weight/volume)" of urea "(molecular weight 60)" and $100mL$ of 1.6% solution "(weight/volume)" of cane sugar "(molecular weight 342)" at $20^{\circ}C$.

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282. A tube of uniform cross-sectional area $1cm^2$ is closed at one end with semipermeable membrane. A solution of $5g$ glucose per $100mL$ is placed inside the tube and is dipped in pure water at $27^{\circ}C$. When equilibrium is established, calculate:

a. The osmotic pressure of solution.

b.The height developed in vertical column.

Assume the density of final glucose solution $1gmL^{-1}$

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283. A beaker containing $20g$ sugar in $100g$ water and another containing $10g$ sugar in $100g$ water are placed under a bell-jar and allowed to stand until equilibrium is reached. How much water will be transferred from one beaker to other?

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284. At $10^{\circ}C$, the osmotic pressure of urea solution is $500mm$.The solution is diluted and the temperature is raised to $25^\circ C$.when the osmotic pressure is found to be $105.3mm$. Determine the extent of dilution.

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285. At $300K$, the vapour pressure of an ideal solution containing one mole of A and 3 mole of B is $550mm$ of Hg. At the same temperature, if one mole of B is added to this solution, the vapour pressure of solution increases by $10mm$ of Hg. Calculate the $V.P.$ of A and B in their pure state.

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286. The vapoure pressure of benzene and toluene at $20^{\circ}C$ are $75mm$ of Hg and $22mm$ of Hg respectively. $23.4g$ of benzene and $64.4g$ of toluene are mixed. If two forms ideal solution, calculate the mole fraction of benzene in vapour phase when vapour are in equilibrium with liquid mixture.

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287. A mixture of two immiscible liquids nitrobenzene and water at $99^{\circ}C$ has a partial vapour pressure of water $733mm$ and that of nitrobenzene $27mm$. Calculate the ratio of the weights of nitrobenzene to the water in the distillate.

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288. The vapour pressures of two pure liquids A and B that form an ideal solution are 300 and 800 torr, respectively, at tempertature T.A mixture of the vapours of A and B for which the mole fraction of A is 0.25 is slowly compressed at temperature T. Calculate

a. The composition of the first drop of the condensate.

b.The total pressure when this drop is formed.

c. The composition of the solution whose normal boiling point is T.

d. The pressure when only the last bubble of vapour remains.

e. Composition of the last bubble.

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289. Calculate the vapour pressure lowering of a $0.1m$ aqueous solution of non-electrolyte at $75 \circ C$.

$\Delta H = 9.720 Kcal mol^{-1}$, P_2 = 742.96 torr

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290. Dry air was successively passed through a solution of $5g$ solute in $80g$ water and then through pure water. The loss in weight of solution was $2.5g$ and that of pure water was $0.04g$. What is mol. wt. of solute ?

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291. What will be the boliling point of bromine when $174.5mg$ of octa-atomic sulphur is added to $78g$ of bromine? k'_b for Br_2 is $5.2K mol^{-1} kg$ and $b. pt.$ of Br_2 is $332.15K$

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292. An aqueous solution contaning 5% by weight of urea and 10% weight of glucose. What will be its freezing point? $(K'_f f \text{ or } H_2O \text{is} 1.86^\circ mol^{-1} kg)$

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293. Two elements A and B form compounds having molecular formula AB_2 and AB_4. When dissolved in $20g$ of benzene, $1g$of AB_2 lowers the freezing point by $2.3K$, whereas $1.0g$ of AB_4 lowers it by $1.3K$. The molar depression constant for benzene is $5.1Kkgmol^{-1}$. Calculate the atomic mass of A and B.

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294. If the boiling point of an aqueous solution is $100.1^\circ C$, what is its freezing point ? Given $l_f = 80$,$l_v = 540\text{cal}g^{-1}$ respectively, of H_2O.

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295. 1000 g of 1 molal aqueous solution of sucrose is cooled and maintained at $-3.534^\circ C$. Find out how much ice will separate out at this temperature. (K_f for water $= 1.86 km^{-1}$)

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296. A solution containing 0.1 mol of naphthalene and 0.9 mol of benzene is cooled out until some benzene freezes out. The solution is then decanted off from the solid and warmed upto $353K$ where its vapour pressure was found to be $670mm$. The freezing point and boiling point of benzene are $278.5K$ and $353K$ respectively, and its enthalpy of fusion is $10.67 KJ \text{mol}^{-1}$. Calculate the temperature to which the solution was cooled originally and the amount of benzene that must have frozen out. Assume ideal behaviour.

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297. One mole of $(C_6H_5)_3C.OH$ dissolved in $1000g$ of 100% sulphuric acid lowers the freezing point of sulphuric acid twice as one mole of CH_3OH shows in $1000g$ of 100% sulphuric acid. Comment on it associated in sulphuric acid.

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298. Calculate the osmotic pressure of 20% (wt./ vol.) anhydrous $CaCl_2$ solution at $0^\circ C$ assuming 100% ionisation.

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299. A certain mass of a substance when dissolved in $100 g C_6H_6$ lowers the freezing point by $1.28^\circ C$. The same mass of solute dissolved in $100g$ of water lowers of the freezing point by $1.40^\circ C$. If the substance has normal molecular weight in benzene and is completely dissocited in water, into how many ions does it dissocite in water ? K_f for H_2O and C_6H_6 are 1.86 and $5.12 K mol^{-1} kg$ respectively.

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300. The vapour pressure of a solution containing $2g$ of $NaCl$ in $100g$ water, which dissociated in one Na^{+} and one Cl^{-} ion in water, is $751mm$, at $100^{\circ}C$. Calculate the one degree of ionisation of $NaCl$.

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301. $1g$ of monobasic acid in $100g$ of water lowers the freezing point by 0.168°. If $0.2g$ of same acid requires $15.1mLmol^{-1}$ of $N/10$

alkali for complete neutralization, calculate the degree of dissociation of acid. K'_f for H_2O is $1.86 K mol^{-1} kg$.

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302. What will be the osmotic pressure of $0.1 M$ monobasic acid its pH is 2 at $25^{\circ} C$?

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303. A complex is represented as $CoCl_3 . XNH_3$. Its 0.1 molal solution in aqueous solution shows $\Delta T_f = 0.558^\circ . \left(K_f\right.$ for H_2O is $\left.1.86 K \text{molality}^{-1}\right)$ Assuming 100% ionisation of complex and co-ordination number of Co as six, calculate formula of complex.

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304. The freezing point of an aqueous solution of KCN containing $0.1892 mol kg^{-1}$ was $-0.704^\circ C$. On adding 0.45 mole of $Hg(CN)_2$, the freezing point of the solution was $= 0.620^\circ C$. If whole of $Hg(CN)_2$ is used in complex formation according to the equation,

$Hg(CN)_2 + mKCN \rightarrow K_m[Hg(CN)_{m+2}]$

what is the formula of the complex ? Assume $[Hg(CN)_{m+2}]^{m-}$ is not ionised and the complex molecule is 100% ionised. ($K_f(H_2O)$ is $1.86 kg mol^{-1} K$.)

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305. A 0.001 molal solution of a complex represented as $Pt(NH_3)_4Cl_4$ in water had freezing point depression of $0.0054^{\circ}C$. Given K_f for $H_2O = 1.86Km^{-1}$. Assuming 100% ionization of the complex, write the ionization nature and formula or complex.

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306. The freezing point of $0.08 molal NaHSO_4$ is $-0.345^{\circ} C$. Calculate the percentage of $HSO_4 + O$ ions that transfers a proton to water. Assume 100% ionization of $NaHSO_4$ and K_t for $H_2O = 1.86 K molality^{-1}$.

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307. The $K_{sp}(25^{\circ} C)$ of sparingly soluble salt $XY_2(s)$ is $3.56 \times 10^{-5} (\text{mol} L^{-1})^3$ and at $30^{\circ} C$, the vapour pressure of its saturated solution in water is $31.78 mm$ of Hg.

Given: Vapour pressure of pure water=31.82 mm of Hg

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308. An aqueous solution of an acid is so weak that it can be assumed to be practically unionised, boiled at $100.4^{\circ} C$. $25 mL$ of this solution was neutralised by $38.5 mL$ of $1N$ solution of $NaOH$. Calculate basicity of the acid if K_b for water is $0.52 K mol^{-1} kg$. Assume molality equal to molarity.

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309. The freezing point of 0.02 mole fraction acetic acid in benzene is $277.4K$. Acetic acid exists partly as dimer. Calculate the equilibrium constant for dimerization. The freezing point of benzene is $278.4K$ and the heat the fusion of benzene is $10.042 kJ mol^{-1}$. Assume molarity and molality same.

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310. Calculate the value of molal elevation constant for water if $\Delta S_{\text{vaporisation}}$ is $26.33 cal K^{-1} mol^{-1}$.

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Exercise 3B Objectice Problems

1. $1g$ mixture of glucose and urea present in $259mL$ aqueous solution shows the osmotic pressure of $0.74 atm$ at $27^{\circ} C$. Assuming solution to be dilute, select the correct statements:

A. Percentage of urea in mixture is 17.6

B. Relative lowering in vapour pressure of this solution is 5.41×10^{-4}

C. (c) The solution will boil at $100.015^{\circ} C$, if K_b of water is $0.5 K \text{molality}^{-1}$

D. If glucose is replaced by same amount of sucrose, the solution will show higher osmotic pressure at $27^{\circ} C$

Answer: A::B::C

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Exercise 9 Advanced Numerical

1. If at a particular tempreture, the density of $18M\ H_2SO_4$ is $1.8gCm^{-3}$, calcualte:

(a) Molality,

(b) $\%$ concentration by weight of solution (c) Mole fraction of water and H_2SO_4,

(d) Relative decrease in vapour pressure with repsect to H_2O solvent assuming H_2SO_4 almost unionised at this high concentration.

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2. At $300K$, two solutions of glucose in water of concentration $0.01M$ and $0.01M$ are separated by semipermeable membrane with respect to water. On which solution, the pressuer need be applied to prevent osmosis ?

Calculate magnitude of this applied pressure.

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3. Vapour pressure of C_6H_6 and C_7H_8 mixture at $50^{\circ}C$ are given by $P = 179X_B + 92$, where X_B is mole fraction of C_6H_6. Calculate (in mm):

(a) Vapour pressure of pure liquids.

(b) Vapour pressure of liquid mixture obtained by mixing $936gC_6H_6$ and $736g$ toluene.

(c) If the vapours are removed and condensed into liquid and again brought to the temperature of $50^{\circ}C$, what would be mole fraction of C_6H_6 in vapour state ?

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4. Ideal mixture of two miscible liquids A and B is placed in a cylinder containing piston. Piston is pulled out isothermally so that volume of liquid decreases but that of vapours increases. When negligibly small amount of liquid was left, the mole fraction of A in vapour phsae is 0.4. If $P_A^\circ = 0.4atm$ and $P_B^\circ = 1.2atm$ at the experimental temperature, calculate the total pressure at which the liquid is almost evaporated.

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5. The vapour pressure of water at $293K$ is $2338Pa$ and the vapour pressure of an aqueous solution is $2295.8Pa$. If solution density is $1010kg/m^3$ at $313K$, calculate the omotic pressure at $313K$.

(Molecular weight of solute $= 60$)

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6. Calculate the vapour pressure of solution having $3.42g$ of cane-sugar in $180g$ water at $40^\circ C$ and $100^\circ C$. Given that boiling point of water is $100^\circ C$ and heat of vaporisation is $10 kcal mol^{-1}$ in the given temperature range. Also calculate the lowering in vapour pressure of 0.2 molal cane-sugar at $40^\circ C$.

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7. What weight of solute $(M.wt.60)$ is required to dissolve in $180g$ of water to reduce the vapour pressure to $4/5th$ of pure water?

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8. Calculate the freezing point of an aqueous solution having mole fraction of water 0.8. Latent heat of fusion of ice is $1436.3 cal mol^{-1}$.

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9. The osmotic pressure of an aqueous solution of sucrose is $2.47 atm$ at $303 K$ and the molar volume of the water present in solution is $18.10 cm^3$. Calculate the elevation of boiling point of this solution. Given $\Delta H_{\text{vap}} = 540 cal / g$. Assume volume solvent equal to volume of solution.

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10. Vapour pressure of a solution containing solution of a sparingly soluble salt A_2B_3 is $31.8 mm$ of Hg at $40^{\circ} C$. IF vapour pressure of pure water is $31.9 mm$ of Hg at $40^{\circ} C$, calculate K_{SP} of A_2B_3 at $40^{\circ} C$.

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11. What is the ratio by weight of NaF and NaI which when dissolved in water produces the same osmotic effects as 0.1 molar solution of urea in water at same temperature? The weight of residue obtained on evaporation of the salt solution is 0.48 gram per $100 mL$ of solution evaporated. Assume complete dissociation of the salts.

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12. Chloroacetic acid has $K_a = 1.36 \times 10^{-3}$. Calculate the concentration of each ion and freezing point of $0.1 M$ its solution, assuming molarity and malality same.

$$\left(K_f \text{for} H_2O = 1.86 K \text{molality}^{-1}\right)$$

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