CHEMISTRY

JEE MAIN AND ADVANCED

SOLUTIONS

Example

1. Choose solvent solute in the following cases

(i) Brine solution

(ii) Crystalline copper sulphate

(iii) Aq. Solution of copper sulphate

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2. What will be the mass of a 0.500m solution of sodium acetate in water containing 0.15 mole of sodium acetate ?

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3. Molarity of H_2SO_4 is 18 M. Its density is $1.8g/cm^3$,hence molality is:

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4. Calculate mole fraction of ethyl alcohol and water in a solution containing 46 g ethyl and 36g water.

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5. Hery's law constant of CO_2 in water at 298 K is $\frac{5}{3}$ K bar. Determine its concentration (x) in rain water if CO_2 is 1% (by mass) in atmosphere $(1 \text{ atm} \approx 1 \text{ bar})$

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6. Vapour pressure of CH_3Cl and CH_2Cl_2 are 540 mm Hg and 402 mm Hg respectively. 101 g of CH_3Cl and 85 g of CH_2Cl_2 are mixed together. Determine

(i) The pressure at which the solution starts boiling.

(ii) Molar ratio of solute v/s solvent in vapour phase in equilibrium with solution.

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7. If in the diagram given at page (43), the value of pressure at 'Q' is 200 mm Hg and 'R' is 500 mm Hg. Then what will be the total pressure at mode fraction 'P' ?

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8. The vapour pressure of a pure liquid at $25^{\circ}C$ is 100 mm Hg. Calculate the relative lowering of vapour pressure if the mole fraction of solvent in solution is 0.8.

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9. What weight of solute (mol. Wt. 60) is required to dissolve in 180 g of water to reduce the vapour pressure to $4/5^{th}$ of pure water ?

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10. The boiling point of pure acetone is 56.38^(@)C $. When 0.707 g of a compound is dissolved \in 10 g of ace \rightarrow \neq there ise \leq vat$ 56.88^(@)C $\in b. p \hat{W} is the mol. wt. of the comound ?$ (K_(b)" of acetone"=1.72 K kg mole^(-1))`

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11. 0.9 g urea when dissolved in 45 g water caused elevation of $0.17^{\circ} C$ in b.p. Calculate molecular elevation constant of water.

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12. 5 g of a substance when dissolved in 50 g water lowers the freeezing by $1.2^{\circ} C$. Calculate molecular wt. of the substance if molal depression constant of water is $1.86^{\circ} C$ K kg $mo \leq^{-1}$.

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

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14. The normal freezing point of nitrobenzene $(C_6H_5NO_2)$ is $278.82K$. $A0.25$ molal solution of a certain solute in nitrobenzene causes a freezing point depression of 2 degrees. Calculate the value of K_f for nitrobenzene.

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15. What will be the concentration of sucrose solution which develops an osmotic pressure of 2 atm at $27^\circ C$?

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16. What would be the osmotic pressure of 0.05 M solution of sucorse at $5^\circ C$? Find out the concentration of a solution of glucose which would be isotonic with this solution of sucrose. (Molecular mass of sucrose = 342, Molecular mass of glucose = 180)

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17. In a solvent 50% of benzoic acid dimerises while rest ionises, determine molar mass of acid which is observed and also its van't Hoff factor.

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18. Partial pressure of N_2 gas at 298 K is 0.987 bargt If is bubbled through water at 298 K, how many millimoles of N_2 gas would be dissolved in 1 litre of water ? (Given : K_H for N_2 at 298 K =76.48 bar).

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19. The partial pressure of ethane over a 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 the partial pressure of the ethane gas will be

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24. Henry's law constant of CO_2 in water at 298K is $\frac{5}{3}K$ bar. IF pressure of CO_2 is 0.01 bar, find its mole fraction.

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(K_b of acetone=1.72 K kg mol^{-1})

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36. In a solvent 50% of benzoic acid dimerises while rest ionises, determine molar mass of acid which is observed and also its van't Hoff factor.

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Try Yourself

1. Henry's constant for argon is 40K bar in water, determine molal concentration of argon in water when it is stored above water at 10 bar pressure

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2. Solubility of a gas in water is 0.001 m at STP, determine its Henry's law constant.

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3. For a solution if $p_A^\circ = 600 \text{ mm Hg}, p_B^\circ = 840 \text{ mm Hg}$ under atmospheric conditions and vapour pressure of solution is 1 atm then find

(i) Composition of solution

(ii) Composition of vapour in equilibrium wiht solution

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4. Vapour pressure of water is 360 mm Hg, how much urea should be added to 200 mL water to reduce its vapour pressure by 0.5% (Molecular

wt. of urea =60) $\frac{100}{3}g$)

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5. Form among the following choose the solutions with positive and negative deviations

(1) ROH+ROR

(2) RSH+ROR

(3) $CHCl_3 + CH_3COCH_3$

(4) HF+ROH

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6. Two components in the ratio of x:y form an azeotropic mixture. They are mixed in the ratio of `x:2y, how many moles one of the pure component y will be evaporated before getting azeotropic solution ?

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7. The solution of 2.5 g of a non-volatile substance in 100 g of benzene boiled at a temperature $0.42^{\circ}C$ higher than the b.p. of pure benzene. Calculate mol. Wt. of the substance. (K_b of benzene is 2.67 K kg mole^{-1})

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8. An aqueous solution of glucose is made by dissolving 10 g of glucose in 90 g water at 303 K. If the V.P. of pure water at 303 K be 32.8 mm Hg, what would be V.P. fo the solution ?

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9. Vapour pressure of a solvent decreases by 1% on adding a non-volatile solute $NaSO_4$. If it dissociates up to 25% then determine mole-fraction of solute, if solvent is 5 mole.

$$\frac{0.01p_A^{\circ}}{p_A^{\circ}} = \frac{1.5n_B}{n_B + n_A}$$

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10. 1 m aq. Solution of a salt shows elevation in boiling point equal to 3 times of its K_b. Determine

(i) Freezing point of solution

(ii) Osmotic pressure at $27^\circ C$

K_f(water)=1.86 K kg "mole"^(-1)(i)0-T'_(f)=3xx1.86xx1(ii) pi=3xx1xx0.0821xx300" atm"`

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11. H_2S, a toxic gas with rotten egg like smell, is used for the qualitative analysis.If the solubility of H_2S in water at STP is $0.195m$, calculate Henry's law constant.

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12. Henry's law constant for CO_2 in water is $1.67 \times 10^8 Pa$ at $298K$. Calculate the quantity of CO_2 in $500mL$ of soda water when packed under $2.5atm CO_2$ pressure at $298K$.

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13. What is the effect on solubility of a gas in a liquid when tempetature is decreased and gas pressure is increased ?

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14. When crystallizes of a solute are introduced into a saturated solution, the excess of solute crystallizes out and solution remains saturated (True/False).

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15. Henry's constant for argon is 40K bar in water, determine molal concentration of argon in water when it is stored above water at 10 bar pressure

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A. ROH+ROR

B. RSH+ROR

C. $CHCl_3 + CH_3COCH_3$

D. $HF + ROH$

Answer:

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(i) Freezing point of solution

(ii) Osmotic pressure at $27^\circ C$

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Assigment Section A

1. The increase in the temperature of the aqueous solution will result in its

A. Molarity to increase

B. Molarity to decrease

C. Mole fraction to increase

D. Mass % to increase

Answer: B

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2. How many gram of dibasic acid (mol. Mass=200) should be present in 100ml of the aqueous solution to make it 0.1 N?

A. 1 g

B. 2 g

C. 10 g

D. 20 g

Answer: 1

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3. In abinary solution

A. Solvent may be liquid

B. Solid may be solvent

C. Solute may be gas

D. Any of these

Answer: 4

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4. One molar solution of sulphuric acid is equal to

A. Normal solution

B. $\frac{N}{2}$ solution

C. 2N solution

D. 4 N solution

Answer: 3

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5. Solvent and solutes are always defined on the basis of

A. Mass composition

B. Molar composition

C. Physical state

D. All of these

Answer: 4

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6. Unit of lowering of vapour pressure is

A. atm

B. Nm^{-1}

C. Unitless

D. Nm^2

Answer: 1

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7. A molal solution is one that contains one mole of a solute in

A. 1000 g of the solvent

B. One litre of solvent

C. One litre of solution

D. 22.4 litres of solution

Answer: A

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8. The temperature at which the vapour pressure of a liquid becomes equals to the external (atmospheric) pressure is its

A. Freezing point

B. Boiling point

C. Melting point

D. Critical temperature

Answer: 2

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9. Solubility of gas decreases in a liquid by

A. Increase of temperature

B. Cooling

C. Increasing pH

D. Decreasing pH

Answer: 1

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10. Vapour pressure is the pressure exerted by vapours

A. In equilibrium with liquid

B. In any condition

C. In an open system

D. In atmospheric conditions

Answer: 1

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11. V.P. of solvent in pure state is 600 mm Hg, when a non-volatile solute is added to it vapour pressure of solution becomes 594 mm Hg, then x_B will be

A. 0.01

B. 0.1

C. 0.99

D. 0.9

Answer: 1

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12. Which pair will form ideal solution ?

A. n-hexane+hexanol

B. hexanol+pentanone

C. n-butane+isobutane

D. butan-1-ol-+methanol

Answer: 3

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13. A solution is non-ideal when

A. $(\Delta p)_{sol.} \neq 0$

B. $(\Delta H)_{sol} = 0$

C. $(\Delta G)_{sol.} < 0$

D. $(\Delta V)_{sol.} = 0$

Answer: 1

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14. A 500 g toothpaste sample has 0.2 g fluoride concentration. What is the concentration of F^{Θ} in ppm ?

A. 4×10^3

B. $4 \times 10^{\circ}$

C. 4×10

D. 2×10^2

Answer: 2

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15. Azeotropy is the property of

A. All the solutions

B. Non-ideal solutions

C. Gas in liquid solution

D. Ideal solutions

Answer: 2

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16. 18% (w/V) solution of urea (Mol. Mass=60) is

A. 1 M

B. 2 M

C. 0.3 M

D. 3 M

Answer: 4

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17. If an ideal solution is made by mixing 2 moles of benzene $(p^{\circ} = 266mm)$ and 3 moles of another liquid $(p^{\circ} = 236mm)$. The total vapour pressure of the solution at the same temperature would be

A. 502 mm

B. 248 mm

C. 600 mm

D. 250.6 mm

Answer: 2

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18. 100 ml of liquid A and 25 ml of liquid B is mixed to give a solution which does not obey Raoult's law. The volume of the solution

A. Will be 125 ml

B. Can be $>$ or $<$ than 125 ml

C. Can be $>$,= or $<$ than 125 ml

D. Will be less than 125 ml

Answer: 2

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19. Pure water boils at 373 K and pure nitric acid boils at 359 K. The azeotropic mixture of water and nitric acid boils at T.K.

A. $T < 359K$

B. $T > 359K$

C. $T < 373K \text{but} > 359K$

D. Unpredictable

Answer: 2

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20. A solution with osmotic pressure π_1 is separated from another solution of osmotic pressure π_2 by SPM solvent flows from $\pi_1 \rightarrow \pi_2$, then

A. $\pi(1) \rightarrow \pi_2$

B. $\pi_1 < \pi_2$

C. Solutions are isotonic

D. Solutions are ideal

Answer: 2

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21. Correct statement among the following regarding osmosis is

A. Solvent flows from high concentration to low concentration

B. Solvent flows from low concentration to high concetration

C. Solute flows from high concentration to low concetration

D. Solute flows from low concentration to high concentration

Answer: 2

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22. 1 mole glucose is added to 1 L of water $K_b(H_2O) = 0.512 \text{ K kg mole}^{-1}$ boiling point of solution will be

A. $373.512K$

B. $100.512K$

C. $99.488K$

D. $372.488K$

Answer:

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23. At freezing point of a solution there is always

A. An equilibrium solution (I) $\Leftrightarrow$ solution (I)

B. Vapour pressure of solution (I) = solvent (s)

C. An equilibrium solvent (I) $\Leftrightarrow$ solvent (s)

D. Both (2) & (3)

Answer: 4

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24. Liquids A$\left(p_A^{\circ} = 360 \text{ mm Hg}\right)$ and $B\left(p_B^{\circ} = 320 \text{ mm Hg}\right)$ are mixed. If solution has vapour has vapour pressure 340 mm Hg, then number of mole fraction of B/mole solution will be

A. $\frac{33}{34}$

B. $\frac{1}{34}$

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

D. $\frac{1}{4}$

Answer: 3

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25. Which of the following chemical entities can act as semipermeable membrane ?

A. $Cu_2\left[Fe(CN)_6\right]$

B. $Cu(SCN_2$

C. BaC_2O_4

D. $BaSO_4$

Answer: 1

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26. Which of the following is a colligative property ?

A. Lowering of vapour pressure

B. Osmotic pressure

C. Freezing point

D. Boiling point

Answer: 2

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27. Which one of the following pairs of solution can we expect to be isotonic at the same temperature ?

A. 0.1 M urea and 0.1 M NaCl

B. 0.1 M urea and $0.2MMgCl_2$

C. 0.1 M NaCl and $0.1MNa_2SO_4$

D. 0.1 M $Ca(NO_3)_2$ and $0.1MNa_2SO_4$

Answer: 4

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28. The molal elevation/depression constant depends upon -

A. $\Delta H_{\text{solution}}$

B. Nature of solvent

C. Nature of solute

D. Freezing point of solution

Answer: 2

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29. A plant cell shrinks when it is kept in

A. Hypotonic solution

B. Hypertonic solution

C. Isotonic solution

D. Water

Answer: 2

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30. Benzoinc acid dimerises and its observed molecular wt. becomes 152.5, its van't Hoff factor will be

A. 0.75

B. 0.875

C. 0.8

D. 1.125

Answer: 3

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31. 3% solution of glucose is isotonic with 1% solution of a non-volatile non-electrolyte substance. The molecular mass of the substance would be

A. 180

B. 360

C. 420

D. 60

Answer: 4

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32. For associative solutes

A. $i < 1$ and $\alpha < 1$

B. $i > 1$ and $\alpha > 1$

C. $i < 1$ and $\alpha > 1$

D. $i > 1$ and $\alpha < 1$

Answer: 1

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33. The liquid used in car radiator is primarity a mixture of ethylene glycol is that

A. It helps in smooth combination

B. It lowers the boiling point of water

C. It causes the freezing point to decrease

D. It is more volatile

Answer: 3

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34. The normal freezing point of nitrobenzne $(C_6H_5NO_2)$ is 278.82 K.A 0.25 m solution of solute A in nitrobenzene decreases the freezing point to 276.82 K. The value of K_f for nitrobenzene is

A. 2K kg mol^{-1}

B. 4K kg mol^{-1}

C. 6K kg mol^{-1}

D. 8.0K kg mol^{-1}

Answer: 4

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35. Molarity of pure water is

A. 1

B. 55.55

C. 0.1

D. 5.55

Answer: 2

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36. van't Hoff factor for $SrCl_2$ at 0.01 M is 1.6. Percent dissociation of $SrCl_2$ is

A. 70

B. 55

C. 40

D. 30

Answer: 3

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37. In depression of freezing point method camphor is a suitable solvent as its

A. K_f is high

B. Sublimation is easier

C. Volatility is large

D. Density is low

Answer: 1

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38. 3.2 molal aqueous solution will have mole fraction of solute equal to

A. 0.1

B. 0.054

C. 0.3

D. 0.044

Answer: 2

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39. Depression in freezing point for 1 M urea, 1 M NaCl and 1 M $CaCl_2$ are in the ratio of

A. $1:2:3$

B. $1:1:1$

C. $3:2:1$

D. Data insufficient

Answer: 1

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40. The molal elevation constant of water =$0.52Km^{-1}$. The boiling point of $1.0molal$ aqueous KCl solution (assuming complete dissociation of KCl) should be

A. $-0.53^{\circ}C$

B. $-0.1^{\circ}C$

C. $-1^{\circ} C$

D. $0.53^{\circ} C$

Answer: 3

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41. For a solvent $\Delta_{vez} H^{\circ} = 5355 \text{ cal mole}^{-1}$, molar mass is 150 and freezing point is $80^{\circ} C$ is $80^{\circ} C$, its K_f will be

A. $3.6 \text{ K kg mole}^{-1}$

B. $0.12 \text{ K kg mole}^{-1}$

C. $0.18 Kkgmo \leq ^{-1}$

D. $4.8 Kkgmo \leq ^{-1}$

Answer: 4

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42. Antifreeze are the substances which

A. Stop freezing

B. Decreases freezing point

C. Increases freezing point

D. Melt the ice

Answer: 2

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43. On freezing dilute aq. NaCl which crystallise out first

A. Both together

B. Water

C. NaCl

D. (NaOH+HCl)

Answer: 2

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44. What should be the mass of glucose to be added to 900 g water to decrease vapour pressure by 1% ?

A. 181.8 g

B. 90.9 g

C. 46 g

D. 136.36 g

Answer: 2

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45. In 100 g naphthalene 2.56 g sulphur is added boiling point of solution (solid) decreases by $0.68^{\circ} C$, atomicity of sulphur is

(K_f of naphthalene=6.8 Km^{-1})

A. 2

B. 4

C. 6

D. 8

Answer: 4

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46. Correct increasing order of osmotic pressure for the following is

A. Sucrose (0.1 M) $<$ glucose (0.5 M) $<$ urea(1M) $<$ NaCl(2M)

B. Glucose(0.5 M) $<$ urea (1M) $<$ NaCl(2M) $<$ Sucrose(0.1 M)`

C. Urea(1 M) $<$ NaCl(2M) $<$ glucose(0.5 M) $<$ $Sucrose(0.1M)$

D. NaCl(2M) $<$ sucrose(0.1 M) $<$ glucose(0.5 M) $<$ urea(1M)

Answer: 1

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47. Which among the following has highest boiling point ?

A. 1 M glucose

B. 1 M KCl

C. 1 M Al$(NO_3)_3$

D. 1 M Na_2SO_4

Answer: 3

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48. Solution with highest freezing point is

A. 0.1 M urea

B. 0.1 M $Ba_2(PO_4)_3$

C. $0.1MK_2SO_4$

D. 0.1 NaCl

Answer: 1

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49. Osmotic pressure of a 0.01 M solution is 0.7 atm at $27^{\circ}C$, its van't Hoff factor will be

A. 2.76

B. 2.7

C. 2.84

D. 2.6

Answer: 3

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50. On a hill station water boils at $98^{\circ}C$. Amount of salt (NaCl) which should be addedto make its boilings point $100^{\circ}C$ is ($K_b = 0.52 \ \ \mathrm{K\ kg\ mole}$)

A. 112.5 g/L

B. 281.2 g/L

C. 225 g/L

D. 140.6 g/L

Answer: 1

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Assigment Section B

1. The molality of 1M $NaNO_3$ solution is (d=1.25 g/ml)

A. 0.8 m

B. 0.858 m

C. 1.6 m

D. 1 M Na_2SO_4

Answer: 2

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2. If relative decrease in vapour pressure is 0.4 for a solution containing 1 mol NaCl in 3 mol of H_2O, then % ionization NaCl is

A. 0.6

B. 0.8

C. 0.4

D. 1

Answer: 0.04

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3. Which of the following pair of solutions can be expected to be isotonic at the same temperature ?

A. $0.1 Murea$ and $0.1 MNaCl$

B. 0.1 M NaCl and 0.1 M Na_2SO_4

C. 0.1 M $Ca(NO_3)_2$ and 0.1 M Na_2SO_4

D. 0.1 M glucose and 0.2 M $MgCl_2$

Answer: 3

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4. 2.56 f of suphur in 100 g of CS_2 has depression in freezing point of 0.010^(@) K_(f)=0.1^(@)$(molal)^{-1}$. Hence atomicity of sulphurin the solution is

A. 2

B. 4

C. 6

D. 8

Answer: 4

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5. Acetic acid dimerises in benzene solution.The van't Hoff factor for the dimerisation of acetic acid is 0.8. The % of dimerisation of acetic acid is

A. 0.2

B. 0.4

C. 0.6

D. 0.8

Answer: 0.4

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6. When 20 g of napthanoic acid $(C_{11}H_8O_2)$ is dissolved in 50 g of benzene $\left(K_f = 1.72Kk\frac{g}{m}ol\right)$ a freezing point depression of 2 K is observed. The van't Hoff factor (i) is

A. 0.5

B. 2.0

C. 1.0

D. 3.0

Answer: 1

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7. A 0.2 molal aqueous solution of a weak acid HX is $20\,\%$ ionized. The freezing point of the solution is $\left(k_f = 1.86Kkg\text{mole}^{-1}\right.$ for water):

A. $-0.45^\circ C$

B. $-0.9^{\circ}C$

C. $-0.31^{\circ}C$

D. $-0.53^{\circ}C$

Answer: 1

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8. If a solute undergoes dimerisation and trimerisation, the minimum values of the van't Hoff factors are

A. 0.5 and 1.50

B. 1.5 and 1.33

C. 0.5 and 0.33

D. 0.25 and 0.67

Answer: 3

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9. A water sample contains 9.5% $MgCl_2$ and 11.7% NaCl (by weight).Assuming 80% ionisation of each salt boiling point of water will be $(K_b = 0.52)$

A. $110.01^\circ C$

B. $376.22K$

C. 277.25 K

D. $102.5^\circ C$

Answer: 2

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10. A complex is written as $M(en)_yBr$. Its 0.05 molar solution shows 2.46 atm osmotic pressure at $27^\circ C$. Assuming 100% ionisation and coordination number of metal (III) is six, complex may be

A. $\left[M(en)_2Br_2\right]Br$

B. $\left[M(en)_3\right]Br_3$

C. $\left[M(en)_2Br_2\right]^+$

D. $\left[M(en)_3\right]^+Br_2$

Answer: 1

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11. 20 g of non-electrolyte, non-volatile solute $(C_xH_{2x}O_6)$ when dissolved in 100 gm water at $100^\circ C$, lowers the vapour pressure of solution by $\frac{1}{100}$th of the vapour pressure of pure water at this temperature. What is formula of the compound ?

A. $C_6H_{12}O_6$

B. $C_{12}H_{24}O_{12}$

C. $C_{44}H_{88}O_{44}$

D. $C_3H_6O_3$

Answer: 2

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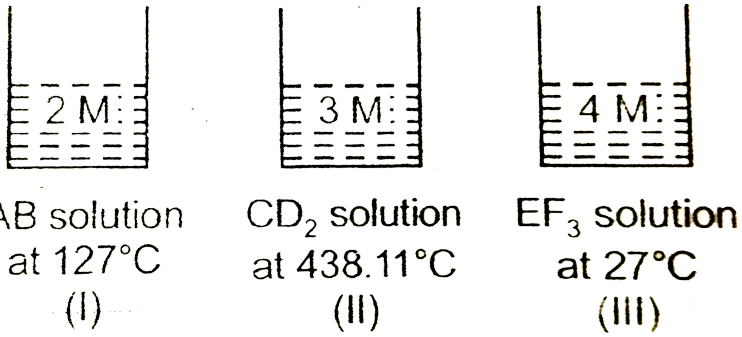
12. Consider threee solutions of 3 strong electrolytes.AB, CD_2 and EF_3



The osmotic pressure ratio of I,II, and III is

A. $1:4:3$

B. $1:2:3$

C. $2:3:4$

D. $2:4:3$

Answer: 1

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13. At $27^{\circ}C$,3.92 gm H_2SO_4 is present in 250 ml solution. The osmotic pressure of this solution is 1.5 atm. If the osmotic pressure of solution of NaOH is 2 atm at same temperature, then concentration of NaOH solution is

A. 0.32 M

B. 12.183 M

C. $72.3gm/lit$

D. 1 M Na_2SO_4

Answer: 1

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14. Degree of dissociation of three binary electrolytes AB, CD and EF are 60%.20% and 100% in the solution having same mole fraction of

water.Ratio of lowering in vapour pressure of their solution is

A. $0.8:06:1$

B. $0.2:0.4:0.1$

C. $0.3:0.5:0.2$

D. $1:2:0.5$

Answer: 1

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15. 0.067 molar aqueous solution of a binary electrolyte A^+B^- shows 2.46 atm osmotic pressure at $27^\circ C$. What fraction of A^+B^- remains unionised ?

A. 0.1

B. 0.15

C. 0.5

D. Zero

Answer: 0.03

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16. A' gram of non-volatile, non-electrolyte (molar mass M) is dissolved in 200 ml of unknown solvent (density $= 1.25gm/ml$ molal elevation constant is K_b) .Elevation in boiling point of this solution can be given by

A. $\frac{M}{K_b}$

B. $\frac{4K_bA}{M}$

C. $\frac{K_bA}{4M}$

D. $\frac{K_bM}{4A}$

Answer: 2

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17. The vapour pressure of a solvent decreases by 5.4 torr when a non-volatile solute is added. In this solution, mole fraction of solute is 0.2. What would be mole fraction of the solvent if decreases in vapour pressure is 16.2 torr ?

A. 0.6

B. 0.4

C. 0.2

D. 0.8

Answer: 2

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18. 75 g ethylene glycol is dissolved in 500 gram water. The solution is placed in a refrigerator maintained at a temperature of 263.7 K. What amount of ice will separate out at this temperature ?

$(K_f \text{ water} = 1.86 K \text{mollality}^{-1})$

A. 300 g

B. 200 g

C. 178 g

D. 258 g

Answer: 4

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19. When mercuric iodide is added to aqueous KI solution:

A. Boiling point increases

B. Boiling point decreases

C. Freezing point decreases

D. Osmotic pressure increases

Answer: 2

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20. When a saturated solution of sodium chloride is heated it

A. Remains saturated

B. becomes unsaturated

C. Becomes supersaturated

D. Achieves equilibrium state

Answer: 2

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21. The solubility of a gas in a liquid generally generally increases with

A. Increase in temperature

B. Amount of liquid taken

C. Decrease in temperature

D. Reduction of gas pressure

Answer: 3

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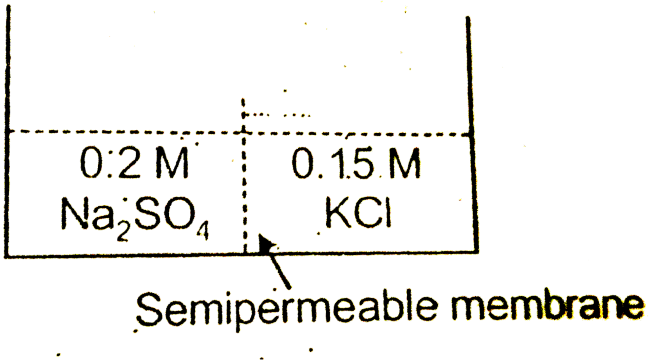
Assigment Section C

1. Consider the following arrangement and choose the correct options



A. O.P. of $NaSO_4$ solution is lesser than the O.P. of KCl solution

B. Water will flow from KCl solution to Na_2SO_4 solution

C. Water will flow Na_2SO_4 solution to KCl solution

D. O.P. of Na_2SO_4 solution is higher than the O.P. of KCl solution

Answer: 2,4

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2. Choose the pairs having identical value of van't Hoff factor

A. 0.05 M $K_4[Fe(CN_6]$ (50% degree of dissociation)and 0.05 M Mohar salt (80% degree of dissociation)

B. 0.2 M NaCl (80% degree of digree of dissociation) and $0.2MBaCl_2$ (40% degree of dissociation)

C. 0.05 M $NaPO_4$ (60% degree of dissocition) and 0.05 M $K_4\left[Fe(CN)_6\right]$ (45% degree of dissociation)

D. 0.01 M $NaNO_3$ (90% degree of dissociation) and 0.01 M FeCl (30% degree of dissociation

Answer: 2,3,4

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3. A compound X undergoes 100% pentamerisation in a given solvent Y. Correct statements are

A. van't Hoff factor of compound is 0.20

B. Experimental elevation in boiling point

$$= \frac{\text{Calculated elevation in boiling point}}{5}$$

C. Observed molar mass of solute $= \frac{\text{Normal molar mass}}{5}$

D. Observed freezing pointxx5=Normal freezing point

Answer: 1,2

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4. At 300 K, the vapour pressure of an ideal solution containing 1 mole of A and 3 moles of B is 500 mm Hg. At the same temperature, 2 moles of B are added to this solution. The vapour pressure of solution increases by

10% of the original vapour pressure. Correct statements about the vapour pressure are

A. Vapour pressure of A in the pure state is 50 mm Hg

B. Vapour pressure of B in the pure state is 650 mm Hg

C. Ratio of final pressure to the initial vapour pressure is 1:0.5

D. Ratio of vapour pressure of pure B to the vapour pressure of pure A is $13:1$

Answer: 1,2,4

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5. V litre decinormal solution of NaCl is prepared. Half of the solution is converted into centionormal and added to the left decinormal solution. Then

A. Number of millimoles of NaCl are reduced by $\frac{1}{5}$

B. Number of milliequivalents of NaCl do not change

C. Normality of the final solution becomes 0.01 N

D. Molarity of the final solution becomes 0.018 M

Answer: 2,4

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6. Which are the correct statements

A. $CHCl_3 + CCl_4$ - Endothermic solution

B. Acetic acid +Pyridine - Hot solution

C. HNO_3+Water - Endothermic solution

D. Water+HCl - Minimum azeotrope

Answer: 1,2

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7. 100 ml 20% (by mass) H_(2)SO_(4) $\left(density = 1.2g\frac{m}{m}l\right)$ and $100ml40\,\%\,(bymass)$H_(2)SO_(4)` (density=1.4 gm/ml) are mixed together. Which are the correct concentration terms for this mixture ?

A. Molality=2.54

B. Molarity=2.04

C. Molality=4.54

D. Malarity=4.08

Answer: 3,4

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8. Chosse the correct statements

A. 1 M H_2SO_4 (d=1 gm/ml) is more concentrated than 1 m H_2SO_4 (d=1 gm/ml)

B. Molality of solution is 1.136 if 2 gram-equivalents of $H_2SO_4$is dissolved into 90.2 gm water

C. Vapour pressure of solution becomes higher than ideal solution if there is a positive deviation (according to Roult's low)

D. When 0.1 M $K_4\left[Fe(CN)_6\right]$ solution and 0.1 M $FeCl_3$ solution is separated by a semipermeable membrane , water flows from $K_4\left[Fe(CN)_6\right]$ solution to $FeCl_3$ solution

Answer: 1,3

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9. Dimer acetic acid in benzene is in equilibrium with acetic acid at a particular condition of temperature and pressure. If half of the dimer molecules are hypothetically separated out then

A. Osmotic pressure of the solution reduces

B. Freezing point of the solution reduces

C. Boiling point of the solution reduces

D. Vapour pressure of the solution reduces

Answer: 1,3

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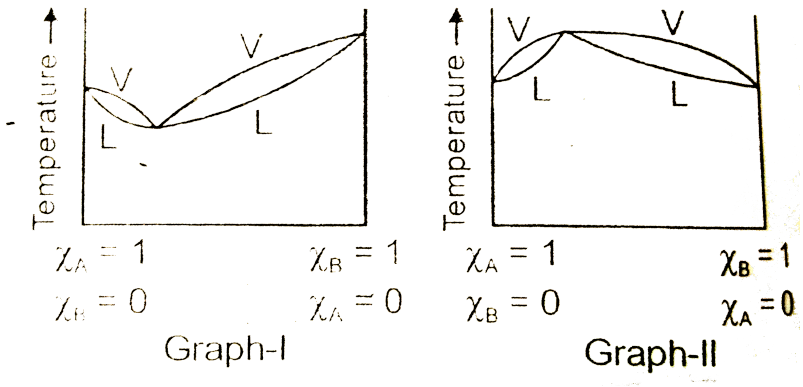
10. Consider the following graphs



Choose the correct statements

A. According to both graphs mole fraction of A $>$ mole fraction of B in condensate

B. Graph I belongs to minimum boiling azenotrope

C. Graph II belongs to maximum boiling azeotrope

D. Graph II belongs to minimum boilings azeotrope whil graph I belongs to minimum boiling azeotrope

Answer: 1,2,3

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11. A binary liqiud (AB) shows positive deviation from Raoult's law when

A. $P_A > P_A^\circ X_A^{\text{liquid}}$ and $P_B > P_B^\circ X_B^{\text{liquid}}$

B. Intermolecular forces

$A - A, B - B > A - B$

C. $\Delta V_{\text{mix}} > 0$

D. $\Delta H_{\text{mix}} > 0$

Answer: 1,2,3,4

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Assigment Section D Linked Compreshension Type Questions

1. Compreshension -I

The experimental values of colligative properties of many solutes in solution resembles calculated value of colligative properties.

However in same cases, the experimental value of colligative property differ widely than those obtained by calculation. Such experimental values of colligative properties are known as Abnormal values of colligative properties are :

(i) Dissociation of solute : It increases the colligative properties.

(ii) Association of solute : It decreases the colligative properties

e.g. : Dimerisation of acetic acid in benzene

If degree of dissociation of an electrolyte A_2B_3 is 25% in a solvent, then

A. Normal boiling point =Experimental boiling point

B. Normal freezing point $>$ Experimental freezing point

C. Normal osmotic pressure $= \frac{1}{2}$ Experimental osmotic pressure

D. Normal molecular weight $= \frac{1}{4}$ Experimental molecular weight

Answer: 3

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2. Compreshension -I

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(ii) Association of solute : It decreases the colligative properties

e.g. : Dimerisation of acetic acid in benzene

4 different 100 ml solutions are prepared by mixing 1 mole each of NaCl $(NH_2)_2CO$. Na_2SO_4 and $K_4\left[Fe(CN)_6\right]$ at temperature T. Correct order of osmotic pressure is

A. $(NH_2)_2CO$ solution $>$ NaCl solution $> Na_2SO_4$ solution $> K_4[Fe(CN)_6]$ solution

B. NaCl solution $> Na_2SO_4$ solution $> (NH_2)_2CO$ solution $> K_4[Fe(CN)_6]$ solution

C. $K_4[Fe(CN)_6]$ solution $> Na_2SO_4$ solution $>$ NaCl solution $> (NH_2)_2CO$ solution

D. Na_2SO_4 solution $> (NH_2)_2CO$ solution $>$ NaCl solution $> K_4[Fe(CN)_6]$ solution

Answer: 3

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3. Compreshension -I

The experimental values of colligative properties of many solutes in solution resembles calculated value of colligative properties.

However in same cases, the experimental value of colligative property

differ widely than those obtained by calculation. Such experimental values of colligative properties are known as Abnormal values of colligative properties are :

(i) Dissociation of solute : It increases the colligative properties.

(ii) Association of solute : It decreases the colligative properties

e.g. : Dimerisation of acetic acid in benzene

One mole I_2 (solid) is added in 1 M, 1 litre Kl solution . Then

A. Osmostic pressure of solution increases

B. Freezing point of solution increases

C. Relative lowering in vapour pressure decreases

D. No change in boiling point of solution

Answer: 4

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4. Compreshension-II

In non-ideal solutions, at one of the intermediate compostions, the total

vapour pressure is highest and the boiling point is lowest. At this point, the composition of the liquid and vapour phase is same. So, if liquid mixture vapouriese at this point and vapours are condensed, teh condensate contains same compositon as present in original liquid mixture. it means at this point liquid behaves like a pure liquid and is called an Azeotropic mixture.

Choose the correct answer :

A. Ideal solutions cannot be separated into their components by fractional distillation

B. For ideal solutions enthalpy of mixing is always greater than zero

C. Only non-ideal solution showing positive deviation cannot be separated out by fraction distillation

D. Non-ideal solution showing both positive and negative deviation cannot be separated out by fractional distillation

Answer: 4

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5. Compreshension-II

In non-ideal solutions, at one of the intermediate compostions, the total vapour pressure is highest and the boiling point is lowest. At this point, the composition of the liquid and vapour phase is same. So, if liquid mixture vapouriese at this point and vapours are condensed, the condensate contains same compositon as present in original liquid mixture. it means at this point liquid behaves like a pure liquid and is called an Azeotropic mixture.

A and B forms non-ideal solution showing positive deviation. Boiling point of pure A and B is 350 K and 380 K respectively. The solution will bpoil at (approximate)

A. 250 K

B. 380 K

C. $> 380K$

D. $< 350K$

Answer: 4

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6. Compreshension-II

In non-ideal solutions, at one of the intermediate compostions, the total vapour pressure is highest and the boiling point is lowest. At this point, the composition of the liquid and vapour phase is same. So, if liquid mixture vapouriese at this point and vapours are condensed, teh condensate contains same compositon as present in original liquid mixture. it means at this point liquid behaves like a pure liquid and is called an Azeotropic mixture.

Which of the following cannot form low boiling point azeotrope ?

A. n-heptane & n-hexane

B. Acetone & aniline

C. Both (1) & (2)

D. $CHCl_3 \& C_2H_5OH$

Answer: 3

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Assigment Section E Assertion Reason Type Questions

1. STATEMENT-1 : On cooling a mixture of ideal gases, an ideal solution can be obtained.

and

STATEMENT-2 : Ideal solution do not form azeotropes.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: 4

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2. STATEMENT-1 : Relative lowering of vapour pressure is equal to mole fraction of the solute.

and

STATEMENT-2 : Relative lowering of vapour pressure is a colligative property.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-2

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-2

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: 2

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3. STATEMENT-1 : When Hgl_(2)` is added to the aqueous solution of Kl, the freezing point is raised.

and

STATEMENT-2 : Freezing p[oint genarally increases by adding non volatile solute in solvent.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-3

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-3

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: 3

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4. STATEMENT-1 : At low concentration benzene and toluene forms ideal solution.

and

STATEMENT-2 : Components with structural similarities form ideal solution.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-4

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-4

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: 1

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5. STATEMENT-1 : Molality and mole fraction are temperature independent quantity.

and

STATEMENT-2 : Molality and mole fraction are unit less quantity.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-5

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-5

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: C

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6. STATEMENT-1 : 0.1 M solution of Na_2SO_4 has greater osmotic pressure than 0.1 M solution of urea at same temperature.

and

STATEMENT-2 : The value of van't Hoff factor for Na_2SO_4 is less than urea.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-6

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-6

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: 3

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7. STATEMENT-1 : The equivalent mass of Mohr's salt is $\frac{M}{4}$ [If M is molecular mass of Mohr's salt]

and

STATEMENT-2: The normality of Mohr's salt is higher than molarity for same amount and volume at constant temperature.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-7

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-7

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: 2

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8. STATEMENT-1 : One molar solution is always more concentration than one molal solution.

and

STATEMENT-2 : amount of solvent in 1 M and 1 m aqueous solution is not equal.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-8

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-8

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: 4

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9. STATEMENT-1 : Iodine is more soluble in $\mathbb{C}l_4$ than in water.

and

STATEMENT-2 : Non-polar solutes are more soluble in non-polar solvents

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-9

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-9

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: 1

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10. STATEMENT-1 : Henry's law and Raoult's law are not independent, i.e., one can be derived from the other

and

STATEMENT-2 : The partial pressure is directly proportional to the mole fraction of concerned species for ideal solutions.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-10

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-10

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: 2

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Assigment Section F Matrix Matchtype Questions

1. Match the following

Column-I	Column-II
(A) Acetone + Carbon disulphide	(p) Vapour pressure measurement
(B) Acetone + Aniline	(q) Osmotic pressure measurement
(C) Berkely and Hartley's method	(r) Maximum boiling azeotrope
(D) Ostwald-Walker's method	(s) Minimum boiling azeotrope

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2. Match the following

Column-I	Column-II
(A) Azeotropic mixture	(p) Obey Raoult's law
(B) H_2O & H_3PO_4	(q) Deviation from Raoult's law
(C) Ideal solution	(r) $P_A = p^\circ_A \chi_A$
(D) CH_2Cl_2 and CH_2Br_2	(s) Constant boiling mixture

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3. Let , solute - solvent intermolecular attraction force $= F_A$

solute - solute intermolecular attraction force $= F_B$

solvent - solvent intermolecular attraction force $= F_C$

Match the following

Column I (Solution of)	Column II
(A) CCl_4 & $CHCl_3$	(p) $F_A > F_B$; $F_A > F_C$
(B) HCl & H_2O	(q) $F_A < F_B$; $F_A < F_C$
(C) CH_3COCH_3 & C_2H_5OH	(r) Ideal solution
(D) $C_6H_5CH_3$ & C_6H_6	(s) Positive deviation
	(t) Negative deviation

A. A(q,r,s) , B(p) , C(r,s) , D(s,t)

B. A(s,t) B(p,q) C(r,q,p) D(s.q)

C. A(q,r), B(p,t), C(q,s), D(r)

D. A(r),B(p,t) ,C(q,r,s) ,D(s,t)

Answer: A(q,r), B(p,t), C(q,s), D(r)

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4. Match the following

Column I	Column II
(A) Solubility of gases with respect to temperature	(p) Directly proportional
(B) Solubility of gases with respect to pressure	(q) Inversely proportional
(C) Relative lowering of V.P. w.r.t. total no. of moles	(r) Follows Henry's law
(D) Osmotic pressure w.r.t. temperature	(s) Follows Raoult's Law
	(t) $p = k_H.X$

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Assigment Section G Integer Answer Type Questions

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

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3. The vapour pressure of two pure liquids, A and B that form an ideal solution are 300 and 800 torr respectively, at temperature T. A mixture of the vapour 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 condesate,

(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, and

(e) the composition of the last bubble.

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4. A compound X undergoes tetremerisation in a given organic solvent. The Van't Hoff factor I is calculated as 0.05Y.

Find Y (Assuming 100% association).

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5. If $K_3[Fe(CN)_6]$ gets ionized completely in a solution, number of particles in the solution from 1 molecule solute is .....

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Assigment Section G True False Type Questions

1. STATEMENT-1 : Solubility of a gas in a liquid solution is a function of the partial pressure of the gas.

STATEMENT-2 : Mole fraction of the gas in a solution is proportional to the partial pressure of the gas.

STATEMENT-2 : Higher the value of k_H at a given pressure, the lower is the solubility of the gas in the liquid.

A. T T T

B. F T T

C. F T F

D. T F F

Answer: 1

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2. STATEMENT-1 : For solution of volatile liquids, the partial vapour pressure of each component in the solution is directly proportional to its mole fraction.

STATEMENT-2 : Always there will be lowering of vapour pressure on addition of non-volatile solute to a solvent.

STATEMENT-3 : If there is dissociation of non-volatile then the V.P. of solution increases.

A. T F T

B. F F T

C. T T F

D. F T F

Answer: 3

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3. STATEMENT-1 : Effect of adding a non-volatile solute to a solvent is to increases its freezing point.

STATEMENT-2 : Molality is a dimensionless quantity.

STATEMENT-3 : The hard shell of an egg was dissolved in HCl solution, and then egg was placed in concentrated solution of NaCl. Then egg will shrink.

A. T F T

B. F F T

C. T T F

D. F T F

Answer: 2

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4. STATEMENT-1 : At definite temperature, the solubility of a solute is fixed.

STATEMENT-2 : When azeotropic mixture is distilled, its composition remains same.

STATEMENT-3 : Vapour pressure is a colligative property.

A. F F T

B. T T F

C. F T F

D. T T T

Answer: 2

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5. STATEMENT-1 : 1M H_2SO_4 is also 1 N.

STATEMENT-2 : Water glycol mixture is used in car radiators in winter because its freezing point is less than $0^\circ C$

STATEMENT-3 : A saturated solution will remain saturated at all temperatures.

A. T F T

B. F T T

C. F T F

D. T F F

Answer: 3

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Assigment Section I Subjective Type Questions

1. Vapour pressure of mixture of liquid A and liquid B at $70^{\circ}C$ is given by $P_T = 180X_B + 90(\in mm)$. Where X_B is the mole fraction of B, in the liquid mixture. Calculate

(a) Vapour pressure of pure A and pure B

(b) Vapour pressure of mixture of A and B by mixing 4 g and 12 g B. (If

molar mass of A and B are 2 g and 3 g respectively)

(c) From (b) ratio of moles of A and B in vapour at $70^\circ C$

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2. Two elements x and y form two types of molecules like xy_3 and xy. 1 gm of xy_3 lowers the freezing by $1^\circ C$ when dissolved in 100 gram solvent whereas for the same lowering in freezing point for same amount of solvent 0.5 gram xy is required. Calculate atomic mass of x and y . (Gram : k_f for solvent is $5 \ \ \mathrm{K\ molal}^{-1}$)

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3. 17.6 gram of unknown solute is dissolved in 100 gram of a solvent $\left(K_b = 2 \ \ \mathrm{K\ molality}^{-1}\right)$ to prepare a solution. Boiling point of pure solvent is $225^\circ C$ where as boiling point of this solution is $229^\circ C$. Predict molecular formula of solute if it contains 54.54% C and 9.09% H (by weight).

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4. What weight of 60% pure NaOH is required to neutralise 100 ml $\frac{M}{1o}H_2SO_4$ solution ?

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5. A 0.5% (by weight) solution of A_2B in solvent C was found to freeze at $-3.25^\circ C$. Calculate the degree of dissociation of A_2B in solvent C into A_2^- and B_2^-. (Given freezing point of pure C is $-3^\circ C$, molar weight of A_2B is 60 and K_f of C is 2 K^{-1} "molality"^(-1)`).

A. 0.3

B. 0.2

C. 0.25

D. 0.8

Answer:

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6. If boiling point of an aqueous solution is $100.1^{\circ}C$. What is its freezing point? Given latent heat of fusion and vaporization of water are $80calg^{-1}$ and $540calg^{-1}$ respectively.

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7. Osmotic pressure of an aqueous solution at $27^{\circ}C$ is found to be 1900 mm Hg. What will be the freezing point of solution (Assuming, molality =molarity xx1.5) ? $\left(K_f \equiv 1.86\right)$

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8. In Ostwald and Walker's appratus, dry air is passed through a solution containing 20 gram of an organic non-volatile solute in 250 ml of water. Then the air was passed through pure water and then through a U-tube containing anhydroous $CaCl_2$. The mass lost in solution is 26 gram and

the mass gained in the U-tube is 26.48 gram. Calculate the molecular mass of organic solute.

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9. Two liquids A and B are mixed to form an ideal solution. The totol vapour pressure of the solution is 800 mm Hg. Now the mole fractions of liquid A and B are interchanged and the total vapour pressure becomes 600 mm of Hg. Calculate the vapour pressure of A and B in pure form. (Given :$p_A^\circ - p_B^\circ = 100$)

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10. 180 ml of pure water at $4^\circ C$ is saturated with NH_3 gas, yielding a solution of density 0.8 gram/ml and containing NH_3 (40% by weight).

(a) Volume of NH_3 solution.

(b) Volume of NH_3 gas present in saturated solution.

(c) Volume of NH_3 gas at 115^(@)C` and 950 mm of Hg in saturated solution.

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Assigment Section J Aakash Challengers Questions

1. An aqueous solution of H_2SO_4 has density $1.84\ \mathrm{g/ml}$. Solution contains 98% H_2SO_4 by mass.Calculate

(i) Molarity of solution

(ii) Molar volume of solution

(iii) Relative lowering of vapour pressure w.r.t. water, assuming H_2SO_4 as non-electrolyte at this high concentration.

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2. Benzene and toluene forms nearly an ideal solution. At 300 K, $P^{\circ}_{\text{toluene}} = 32.06\ \ \mathrm{mm}$ and $P^{\circ}_{\text{benzene}} = 103.01\ \ \mathrm{mm}$ (of Hg)

(i) A liquid mixture is conposed of 3 mole of tolune and 2 mole of benzene. If the pressure over the mixture at 300 K is reduced, at what pressure does the first vapour form ?

(ii) What is the composition of the first trace of vapour formed ?

(iii) If the pressure is reduced futher,at what pressure does the last trace of liquid dissappear ?

(iv) What is the composition of last trace of liquid ?

A. (i)50.44mmg

(ii)x_("toluene")=0.3181

(iii) P=46.28mmhg

(iv) x_("toluene")=0.852

B. (i)P=42.44mmhg

(ii)x_("toluene")=0.786

(iii) P=38.23mmhg

(iv) x_("toluene")=0.879

C. (i) 60.44 mm Hg

(ii) $x_{\text{toluene}} = 0.3181$

(iii) P=44.25 mmHg

(iv)$x_{\text{toluene}} = 0.8281$

D. (i) 74.44 mm Hg

(ii) $x_{\text{toluene}} = 0.218$

(iii) P=32.33 mmHg

(iv)$x_{\text{toluene}} = 0.9281$

Answer: (i) 60.44 mm Hg

(ii) $x_{\text{toluene}} = 0.3181$

(iii) P=44.25 mmHg

(iv)$x_{\text{toluene}} = 0.8281$

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3. When 45 g of an unknown compound was dissolved in 500 g of water, the solution has freezing point of $-0.93^{\circ}C$

(i) What is the molecular weight of compound ? $\left(K_f = 1.86\right)$

(ii) If empirical formula is CH_2O, what is the molecular formula of compound ?

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4. A complex is represented as $CoCl_3Xnh_3$. Its 0.1 molal solution in water $\Delta T_f = 0.588K$. K_f for H_2O is $1.86K$ molality^{-1}. Assuming $100\,\%$ ionisation of complex and co $-$ ordination number of Co is six calculate formula of complex.

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5. A certain mass of substance in 10 g of benzene lowers the freezing point by $1.28^\circ C$ and in 100 g of water lowers the freezing point by $1.395^\circ C$ separately. If the substance has normal molecular weight in benzene and completely dissociated in water, calculate number of moles of ions formed by its 1 mole dissociation in water $\left(K_{f_{\text{water}}} = 1.86, K_{f_{\text{benzene}}} = 5.00\right)$

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6. The freezing point of nitrobenzene is $3^\circ C$. When 1.2 g of chloroform (mol. Wt. =120) is dissolved in 100 g of nitrobenzene, freezing point will be

$2.3^{\circ}C$. When 0.6 g of acetic acid is dissolved in 100 g of nitrobenzene, freezing point of solution is $2.64^{\circ}C$. If the formula of acetic acid is $(CH_2O)_n$, find the value of n.

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7. The amount of ice that will separate out from a solution containing 25 g of ethylene glycol in 100 g of water that is cooled to $-10^{\circ}C$, will be [Given : $K_f \text{for} H_2O = 1.86 K mol^{-1} kg$]

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8. A 0.075 molar solution of monobasic acid has a freezing point of $-0.18^{\circ}C$. Calculate K_a for the acid , $\left(k_f = 1.86\right)$

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9. The freezing point of an aqueous solution of KCN containing $0.1892\ \text{mole}/\text{kg} H_2O$ was $-0.704^\circ C$. On adding 0.095 mole of $Hg(CN)_2$, the freezing point of solution was $-0.53^\circ C$. Assuming that complex is formed according to the reaction

$$Hg(CN)_2 + xCN^- \rightarrow Hg(CN)_{x+2}^{x-}$$

and also $Hg(CN)_2$ is limiting reagent, find x.

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10. 0.01 molal aqueous solution of $K_3\left[Fe(CN)_6\right]$ freezes at $-0.062^\circ C$. Calculate percentage dissociation $\left(k_f = 1.86\right)$

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Exercise 1

1. The example of solid solution is

A. Glucose in water

B. Copper in gold

C. Camphor in nitrogen

D. Oxygen in nitrogen

Answer: B

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2. The composition of gaseous mixture used by scuba divers is :-

A. 56.2% N_2 and 32.1 % O_2

B. 56.2 % O_2 and 32.1 % N_2

C. 50.2 % N_2 and 38.1O_2

D. 50.2 % O_2 and 38.1 % N_2

Answer: A

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3. The blocking of capilaries due to sudden release of bubbles of N_2 gas in blood is known as

A. Bends

B. Blends

C. Mends

D. All of these

Answer: A

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4. Which of the following gas should have maximum value for k_H?

A. He

B. H_2

C. N_2

D. CO_2

Answer: A

Watch Video Solution

5. The increase in the temperature of the aqueous solution will result in its

A. Molarity to increase

B. Molarity to decrease

C. Mole fraction to increase

D. Mass % to increase

Answer: B

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6. In a binary solution

A. Solvent may be liquid

B. Solvent may be solid

C. Solute may be gas

D. Any of these

Answer: D

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7. The temperature at which the vapour pressure of a liquid equals external pressure is called

A. Freezing point

B. Boiling point

C. Melting point

D. Critical temperature

Answer: B

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8. Solubility of gas decreases in a liquid by

A. Increase of temperature

B. Cooling

C. Increasing pH

D. Decreasing pH

Answer: A

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9. Vapour pressure is the pressure exerted by vapours

A. In equilibrium with liquid

B. In any condition

C. In an open system

D. In atmospheric conditions

Answer: A

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10. A sample of toothpaste weighing 500g. On analysis was found to certain 0.2 g of fluorine. The concentration of fluorine in ppm is

A. 4×10^3

B. 4×10^2

C. 4×10

D. 2×10^2

Answer: B

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11. 18% (w/V) solution of urea (Mol. Mass=60) is

A. 1M

B. 2M

C. 0.3M

D. 3M

Answer: D

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12. If an ideal solution is made by mixing 2 moles of benzene $(p^{\circ} = 266mm)$ and 3 moles of another liquid $(p^{\circ} = 236mm)$. The total vapour pressure of the solution at the same temperature would be

A. 502 mm-Hg

B. 248mm-Hg

C. 600 mm-Hg

D. 250.6 mm -Hg

Answer: B

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13. 100 ml of liquid A and 25 ml of liquid B is mixed to give a solution which does not obey Raoult's law. The volume of the solution

A. Will be 125 ml

B. Can be $>$ or $<$ than 125 ml

C. Can be $>$, $=$ or $<$ 125 ml

D. Will be less than 125 ml

Answer: B

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14. Pure water boils at 373 K and pure nitric acid boils at 359 K. The azeotropic mixture of water and nitric acid boils at T.K.

A. $T < 359K$

B. $T > 359K$

C. $T < 373Kbut > 359K$

D. Unpredictable

Answer: B

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15. A solution with osmotic pressure π_1 is separated from another solution of osmotic pressure π_2 by SPM solvent flows from $\pi_1 \rightarrow \pi_2$, then

A. $\pi_1 > \pi_2$

B. $\pi_1 < \pi_2$

C. Solutions are isotonic

D. Solutions are ideal

Answer: B

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16. Correct statement among the following regarding osmosis is

A. Solvent flows from high concentration of solute to low concentration of solute

B. Solvent flows from low concentration of solute of high concentration of solute

C. Solute flows from high concentration to low concentration

D. Solute flows frow low concentration to high concentration

Answer: B

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17. 1 mole glucose is added to 1 L of water $K_b(H_2O) = 0.512 \text{ K kg mole}^{-1}$ boiling point of solution will be

A. $373.512^\circ C$

B. $100.512^\circ C$

C. $99.488^\circ C$

D. $372.488^\circ C$

Answer: B

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18. Liquids A$\left(p_A^\circ = 360 \text{ mm Hg}\right)$ and $B\left(p_B^\circ = 320 \text{ mm Hg}\right)$ are mixed. If solution has vapour pressure 340 mm Hg, then mole fraction of B will be

A. $\frac{33}{34}$

B. $\frac{1}{34}$

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

D. $\frac{1}{4}$

Answer: C

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19. The value of ebullioscopic constant depend upon

A. $\Delta H_{solution}$

B. Nature of solvent

C. Nature of solute

D. Freezing point of solution

Answer: B

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20. 3% solution of glucose is isotonic with 1% solution of a non-volatile non-electrolyte substance. The molecular mass of the substance would be

A. 180

B. 360

C. 420

D. 60

Answer: D

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21. For associative solutes

A. $I < 1$ and $a < 1$

B. $I > 1$ and $a > 1$

C. $I < 1$ and $a > 1$

D. $I > 1$ and $a < 1$

Answer: A

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22. van't Hoff factor for $SrCl_2$ at 0.01 M is 1.6. Percent dissociation of $SrCl_2$ is

A. 70

B. 55

C. 40

D. 30

Answer: D

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23. Depression in freezing point for 1 M urea, 1 M NaCl and 1 M $CaCl_2$ are in the ratio of

A. $1:2:3$

B. $1:1:1$

C. $3:2:1$

D. Data insufficient

Answer: A

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24. Correct increasing order of osmotic pressure for the following is

A. Sucrose (0.1M) $<$ glucose (0.5M) $<$ urea (1M) $<$ NaCl(2M)

B. Glucose (0.5 M) $<$ urea (1M) $<$ NaCl (2M) $<$ Sucrose (0.1 M)

C. Urea (1M) $<$ NaCl (2M) $<$ glucose (0.5 M) $<$ Sucrose (0.1M)

D. NaCl (2M) $<$ sucrose (0.1 M) $<$ glucose (0.5M) $<$ urea (1M)

Answer: A

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25. Which among the following has highest boiling point ?

A. 1M glucose

B. 1M KCl

C. $1MAl(NO_3)_3$

D. $1MNa_2SO_4$

Answer: C

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26. Which of the following has maximum freezing point is

A. Pure H_2O

B. 0.1 M NaCl (aq)

C. 0.01 M NaCl (aq)

D. 0.5M NaCl (aq)

Answer: A

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27. The solution having maximum boiling point is

A. 0.1 M $C_6H_{12}O_6$

B. 0.1 M $CaCl_2$

C. 0.1 M $NaCl$

D. 0.5 M $AlCl_3$

Answer: A

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28. IF a=50% for $Al_2(SO_4)_3$ then van't hoff factor would be

A. 1.5

B. 0.5

C. 3

D. 2

Answer: C

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29. What is the boiling point of 1 molal aqueous solution of NaCl $(K_b) = 0.52 K molal^{-1}]$

A. $99.48^\circ C$

B. $98.96^\circ C$

C. $100.52^\circ C$

D. $101.04^\circ C$

Answer: D

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30. For a non-electrolytic solution, van't Hoff factor is equal to

A. i=+ve

B. i=-ve

C. i=0

D. i=1

Answer: D

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Assignment Section A

1. The normality of 10% (weight /volume) acetic acid is

A. 1N

B. 10N

C. 1.66 N

D. 0.83 N

Answer: C

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2. 20 mL of 0.5 M HCl is mixed with 30 mL of 0.3 M HCl, the molarity of the resulting solution is :

A. 0.8 M

B. 0.53 M

C. 0.38 M

D. 0.83 M

Answer: C

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3. 20 ml of 0.2M $Al_2(SO_4)_3$ is mixed with 20 ml of 6.6 M $BaCl_2$ the concentration of Cl^- ion in solution is

A. 0.2M

B. 6.6M

C. 0.02 M

D. 0.06 M

Answer: B

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4. The expression relating molarity (M) of a solution with its molarity (m) is

A. $m = \frac{1000M}{1000d + MM_B}$

B. $m = \frac{1000M}{1000d - MM_a}$

C. $m = \frac{1000d + MM_a}{1000M}$

D. $m = \frac{1000d - MM_B}{1000M}$

Answer: B

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5. If solubility of any gas in the liquid at 1 bar pressure is 0.05 mol/L. What will be its solubility at 3 bar pressure, keeping the temperature constant?

`

A. $\frac{0.05}{3} mol / L$

B. $0.15 mol / L$

C. $0.05 mol / L$

D. $1.0 mol / L$

Answer: B

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6. The boiling points 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 of the following will have highest vapour pressure at room temperature ?

A. C_6H_6

B. CH_3OH

C. $C_6H_5NH_2$

D. $C_6H_5NO_2$

Answer: B

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7. The highest temperature at which vapour pressure of any liquid can be measured is

A. Critical temperature

B. Boyle's temperature

C. Boiling point of the liquid

D. Kraft temperature

Answer: C

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8. If solute and solvent interactions are more than solute- solute and solvent -solvent interactions then

A. It is ideal solution

B. It is non-ideal solution with positive deviation

C. It is non-ideal solution with negative deviation

D. Can't predicted

Answer: C

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9. Which of the following is correct about a solution showing positive deviation?

A. Vapour pressure observed will be less than calculated from Raoult's law

B. Minimum boiling azeotrope will be formed

C. $\Delta H_{mix} < 0$

D. $\Delta V_{mix} < 0$

Answer: B

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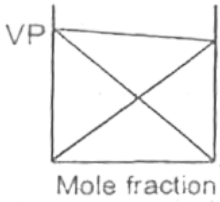
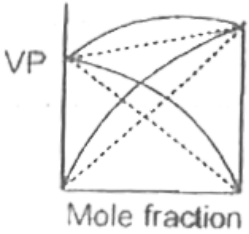
10. IF C_2H_5OH and H_2O solution is example of non-ideal solution then which graphically representation is correct?

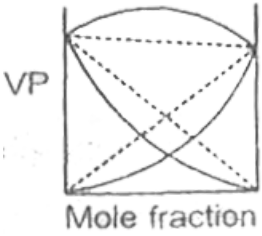
A.



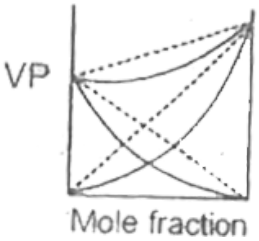
B.



C.



D.



Answer: B

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11. 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. $P^0 = P\left(\frac{n_2}{n_1 + n_2}\right)$

B. $P = P^0\left(\frac{n_2}{n_1 + n_2}\right)$

C. $P^0 = P\left(\frac{n_1}{n_1 + n_2}\right)$

D. $P^0 = P \times n_1$

Answer: B

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12. Which of the following is true

A. Molarity of solution is independent of temperature

B. Molarity of solution is dependent of temperature

C. Mole fraction of solute is dependent on temperature

D. The unit of molarity is mol dm^{-3}

Answer: B

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13. Among the following mixiture dipole-dipole as the mojor interaction is present is

A. Benzene and $\mathbb{C}l_4$

B. Benzene and C_2H_5OH

C. CH_3COCH_3 and CH_3CN

D. KCL and water

Answer: C

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14. For an ideal solution with $P_A > P_B$, which of the following is true ?

A. $X_{A(l)} = X_{A(V)}$

B. $X_{AI} > X_{AV}$

C. $X_{Al} < X_{Al}$

D. No relationship in their mole fraction

Answer: C

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15. An azeotropic solution of two liquids has a boiling point lower than either of them when it:

A. Shows negative deviation

B. Shows positive deviation

C. Shows no deviation

D. Is unsaturated

Answer: B

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16. 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 $S = 32$).

A. X

B. X_2

C. X_4

D. X_8

Answer: D

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17. Two solutions of a substance (non-electrolyte) are mixed in the following manner. $480mL$ of $1.5M$ first solution $+520mL$ of $1.2M$ second solution. What is the molarity of the final mixture?

A. 1.344 M

B. 2.70 M

C. 1.20 M

D. 1.50 M

Answer: A

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18. A pressure cooker reduces cooking time because

A. Cooking involves chemical changes helped by a rise in temperature

B. Heat is more evenly distributed in the cooking space

C. Boiling point of water involved in cooking is increased

D. The higher pressure inside the cooker crushes the food material

Answer: C

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19. Equal moles of benzene and toluene are mixed. The vapour pressure of benzene and toluene in pure state are 700 and 600 mm Hg respectively. The mole fraction of benzene in vapour state is :-

A. 0.7

B. 0.47

C. 0.5

D. 0.54

Answer: D

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20. What would be the osmotic pressure at $25^{\circ}C$ of an aqueous solution containing 1.95 g of sucrose $(C_{12}H_{22}O_{11})$ present in 150 ml of solution?

A. 0.81 atm

B. 0.93 atm

C. 0.65 atm

D. 0.76 atm

Answer: B

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21. The mole fraction of toluene in vapour phase which is in equlibrium with a solution of benzene and toluene having a mole fraction of toluene 0.500 is (vapour pressure of pure benzene and pure toluene are 119 torr and 37.0 torr respectively at the same temperature).

A. 0.5

B. 0.75

C. 0.625

D. 0.237

Answer: D

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22. An ideal solution was obtained by mixing methanol and ethanol. If the partial vapour pressure of methanol and ethanol are $2.619kPa$ and $4.556kPa$, respectively, the composition of vapour (in terms of mole fraction) will be

A. 0.635 Me OH, 0.365 EtOH

B. 0.365 MeOH,0.635 EtOH

C. 0.574 MeOH,0.326 EtOH

D. 0.173 MeOH,0.827 EtOH

Answer: B

Watch Video Solution

23. The vapour pressure of a dilute aqueous solution of glucose is 750 mm of mercury at 373 K . The mole fraction of solute is :

A. 0.013

B. 1.3

C. 0.13

D. 1.1

Answer: A

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24. Two liquids having vapour pressure P_1^0 and P_2^0 in pure state in the ratio of $2:1$ are mixed in the molar ratio $1:2$ The ratio of their moles in the vapour state would be

A. $1:1$

B. $1:2$

C. $2:1$

D. $3:2$

Answer: A

Watch Video Solution

25. In ideal solutions of non volatile solute B in solvent A in $2:5$ molar ratio has vapour pressure 250 mm, if a another solution in ratio $3:4$ prepared then vapour pressure above this solution?

A. 200mm

B. 250 mm

C. 350 mm

D. 400mm

Answer: A

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26. In the case of osmosis, solvent molecules move from :

A. Higher vapour pressure to lower vapour pressure

B. Higher concentration to lower concentration

C. Lower vapour pressure to higher vapour pressure

D. Higher osmotic pressure to lower osmotic pressure

Answer: A

Watch Video Solution

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

A. Same boiling point and same freezing point

B. Different boiling point and different freezing point

C. Same boiling point but different freezing point

D. Same freezing point but different boiling point

Answer: A

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28. In the phenomenon of osmosis through the semipermeable membrane

A. Solvent molecules pass from solution to solvent

B. Solvent molecules pass from solvent to solution

C. Solute molecules pass from solution to solvent

D. Solute molecules pass from solvent to solution

Answer: B

Watch Video Solution

29. The osmotic pressure of 0.1 M sodium chloride solution at $27^{\circ}C$ is

A. 4.0 atm

B. 2.46 atm

C. 4.92 atm

D. 1.23 atm

Answer: C

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30. A solution of urea contains 8.6 g per litre. It is isotonic with 5% solution of a non-volatile solute. The molecular mass of the solute will be :

A. $348.9gmol^{-1}$

B. $174.5gmol^{-1}$

C. $87.3gmol^{-1}$

D. $34.89 gmol^{-1}$

Answer: A

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31. Which of the following colligative properties of colloidal solutions is used to determine the molecular mass?

A. Relative lowering of vapour pressure

B. Elevation in boiling point

C. Depression in freezing point

D. Osmotic pressure

Answer: D

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32. In a 0.2 molal aqueous solution of a weak acid HX the degree of ionization is 0.3. Taking k_f for water as 1.85 the freezing point of the solution will be nearest to-

A. $0.48^\circ C$

B. $-0.48^\circ C$

C. $-0.36^\circ C$

D. $-0.26^\circ C$

Answer: B

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33. The boiling point of water of 735 torr is $99.07^\circ C$ The mass of NaCl added in 100g water to make its boiling point $100^\circ C$ is

A. 10.68 g

B. 5.34g

C. 2.67g

D. 26.7g

Answer: B

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34. If van't Hoff factor i=1,then

A. it is dissociation

B. It is association

C. Both 1 and 2

D. Neither dissociation nor association

Answer: D

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35. Which of the following equimolar solution have highest vapour pressure?

A. Glucose

B. NaCl

C. K_2SO_4

D. $K_4Fe(CN)_6$

Answer: A

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36. When NaCl is added to aqueous solution of glucose

A. Freezing point is lowered

B. Freezing point is raised

C. Freezing point does not change

D. Variation is freezing point can't be predicted

Answer: A

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37. If α is the degree of dissociation of Na_2SO_4 the van't Hoff's factor (i) used for calculating the molecular mass is

A. 1+2a

B. 1-2a

C. 1+a

D. 1-a

Answer: A

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38. The relationship between the values of osmotic pressures of$0.1M$ solutionsof$KNO_3(P_1)$and$CH_3COOH(P_2)$is

A. $P_1 > P_2$

B. $P_2 > P_1$

C. $P_1 = P_2$

D. $\frac{P_1}{P_1 + P_2} = \frac{P_2}{P_1 + 2P_2}$

Answer: A

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39. 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. $P_1 > P_2 > P_3$

B. $P_2 > P_1 > P_3$

C. $P_2 > P_3 > P_1$

D. $P_3 > P_2 > P_1$

Answer: B

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40. What is the molality of C_2H_5OH in water solution which will freeze at $-10^\circ C$?

A. 6.315m

B. 63.15m

C. 3.540m

D. 5.3m

Answer: D

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41. Which one of the following pairs of solution can we expect to be isotonic at the same temperature

A. 0.1 M NaCl and 0.1M Na_2SO_4

B. 0.1 M urea and 0.1 M NaCl

C. 0.1 M urea and $0.2MMgCl_2$

D. 0.1 M $Ca(NO_3)_2$ and 0.1 M Na_2SO_4

Answer: D

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42. Which of the following aqueous solution has minium freezing point?

A. 0.01 M NaCl

B. 0.005 M C_2H_5OH

C. 0.005 M Mgl_2

D. 0.01 M $MgSO_4$

Answer: B

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43. 0.1 M aqueous solution of $K_4\left[Fe(CN)_6\right]$ will have the same freezing point as 0.1 M aqueous solution of

A. $Fe(SO_4)_3$

B. $Al_2(SO_4)_3$

C. $AlCl_3$

D. K_3PO_4

Answer: B

Watch Video Solution

44. Assuming each salt to be $90\,\%$ dissociated which of the following will have highest osmotic pressure ?

A. Decimolar $Al_2(SO_4)_3$

B. Decimolar $BaCl_2$

C. Decimolar Na_2SO_4

D. A solution obtained by mixing equal volumes of (2) & (3) are filtering

Answer: A

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45. When $CuSO_4$ is added to a solution of ammonia

A. Freezing point is lowered

B. Freezing point is raised

C. Boiling point is raised

D. Both (1) & (3)

Answer: B

Watch Video Solution

46. An aqueous solution freezes on $0.36^\circ C K_f$ and K_b for water are 1.8 and 0.52 k kg mol^{-1} respectively then value of boiling point of solution as 1 atm pressure is

A. $101.04^\circ C$

B. $100.104^\circ C$

C. $0.104^\circ C$

D. $100^\circ C$

Answer: B

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47. The osmotic pressure of decimolar solution of urea at $27^\circ C$ is a.2.49 bar, b.5 bar, c.3.4 bar, d.1.25 bar

A. 2.49 bar

B. 5.0 bar

C. 3.4 bar

D. 1.25 bar

Answer: A

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48. Arrange the following aqueous solution in the order of their increasing boiling points

(i) $10^{-4}MNaCl$ (ii) $10^{-3}MUrea$ (iii) $10^{-3}MMgCl_2$ (iv) $10^{-3}MNaCl$

A. $I < ii < iv < iii$

B. $ii < I = iii < iv$

C. $I < ii < iii < iv$

D. $iv < iii < I = ii$

Answer: A

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49. When a saturated solution of KCl is heated it becomes

A. Unsaturated

B. Supensaturated

C. Remains saturated

D. Attains equilibrium

Answer: A

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50. Molal elevation constant.

A. The elevation in b.p. which would be produced by dissolving one g of solute in 100 g of solvent

B. The elevation in b.p. which would be produced by dissolving 1 g solute in 100g of solvent

C. Elevation in b.p. which would be produced by dissolving 1gm of solute in 1000g of solvent

D. Elevation in b.p. which would be produced by dissolving 1 mole of solute is 1000g of solvent

Answer: D

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Assignment Section B

1. 100 ml of 1M NaOH is mixed with 50ml of 1N KOH solution. Normality of mixture is

A. 1N

B. 0.5 N

C. 0.25 N

D. 2 N

Answer: A

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2. Mass of NaCl required to prepare 0.01 m aqueous solution in 1kg water is

A. 0.01 g

B. 0.584 g

C. 58.8 g

D. 5.88g

Answer: B

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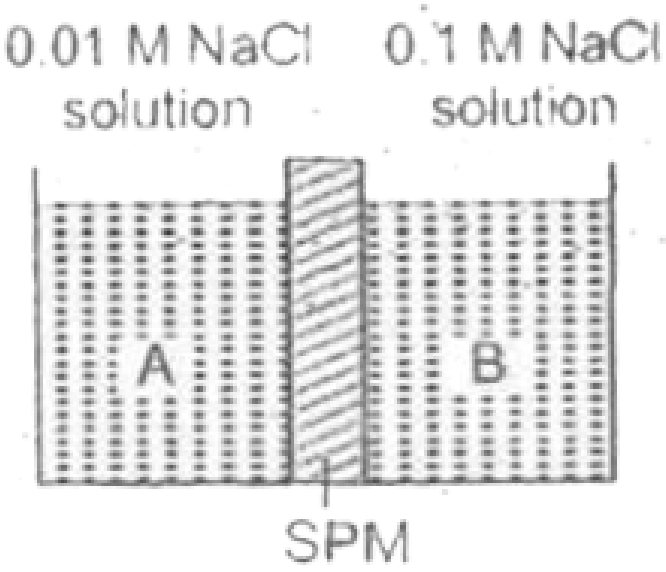
3. Two solutions marked as A and B are separated through semipermeable membrane as below. The phenomenon undergoing



A. Na^+ moves from solution A to solution B

B. Both Na^+ and Cl^- moves from solution (A) to solution (B)

C. Both Na^+ and Cl^- moves from solution (B) to (A)

D. Solvent molecules moves from solution (A) to (B)

Answer: D

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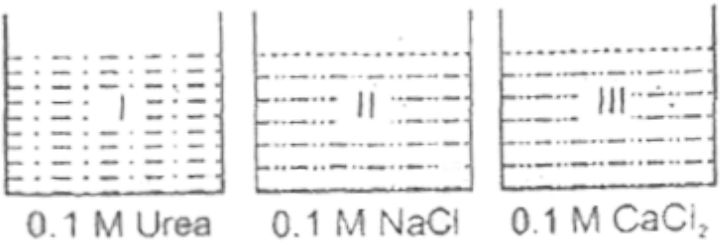
4. Correct observation



A. Vapour presssure of solution I is lowest

B. Relative lowering of vapour pressure is maximum in III

C. Freezing point is maximum for III

D. Boiling point is minimum for II

Answer: B

Watch Video Solution

5. An aqueous solution of sugar is taken in a beaker. At freezing point of solution

A. Crystals of sugar separated

B. Crystals of glucose and fructose are separated

C. Crystals of ice separated

D. Mixture of ice and some sugar crystals separated

Answer: C

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6. 15g urea and 20g NaOH dissolved in water. Total mass in solution is 250g. Mole fraction of NaOH in the mixture.

A. 0.039

B. 0.62

C. 0.5

D. 0.4

Answer: A

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7. Which of the following concentration terms is temperature independent?

I. Molarity II. Molarity III. Normally IV. Mole fraction

A. I & II

B. I & III

C. II only

D. II % IV

Answer: D

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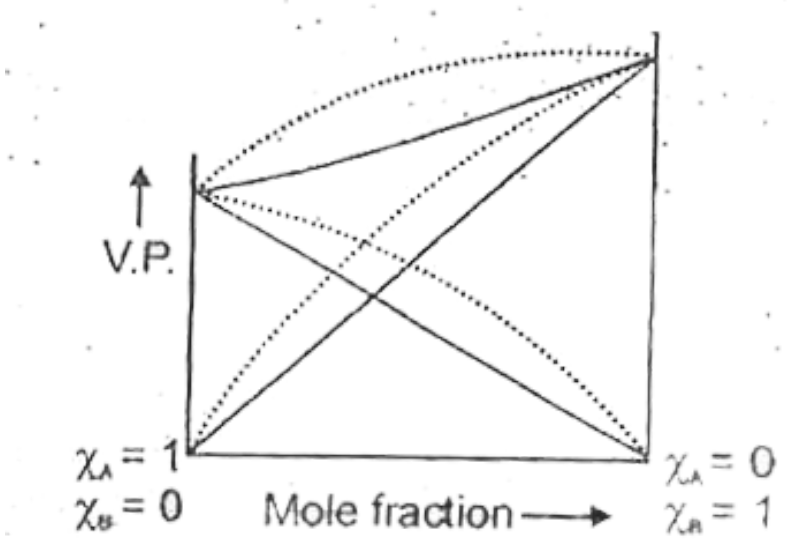
8. Vapour phase difference for a solution is given below if dotted line represents deviation



Correct observation for this solution

A. $\Delta H_{mix}, \ +ve$

B. $\Delta S_{mix}, \ +ve$

C. $\Delta V_{mix} : ve$

D. All of these

Answer: D

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9. A mixture of two liquids A and B having boiling points of A is $70^\circ C$ and boiling point of B is $100^\circ C$ distills at $101.2^\circ C$ as single liquid, hence this mixture is

A. Ideal solution

B. Non ideal solution showing +ve deviation

C. Non ideal solution showing -ve deviation

D. Immiscible solution

Answer: C

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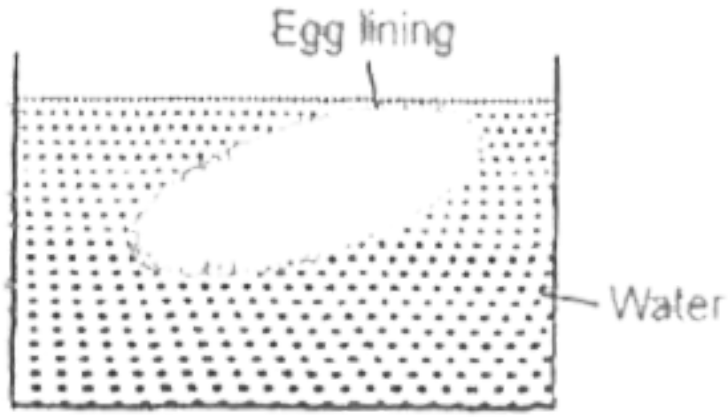
10. The phenomenon taking place



A. Exo-osmosis

B. Endo-osmosis

C. Reverse- osmosis

D. All of these

Answer: B

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11. Which aqueous solution has higher concentration : 1 molar or 1 molal solution of the same solute ?

A. More

B. Less

C. Equally

D. Very less

Answer: A

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12. Osmotic pressure of solution containing 0.6 g urea and 3.42 g sugar in 100 ml at $27^{\circ} C$

A. 492 atm

B. 4.92 atm

C. 49.2 atm

D. 28.1 atm

Answer: B

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13. Which gas is most soluble in water?

A. He

B. H_2

C. NH_3

D. CO_2

Answer: C

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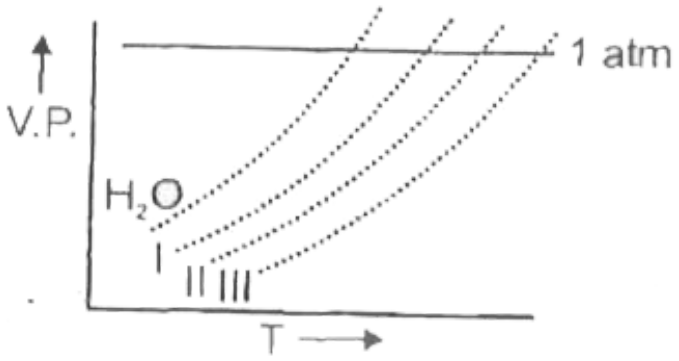

14.

Which is having highest elevation in boiling point?

A. H_2O

B. Solution I

C. Solution II

D. Solution III

Answer: D

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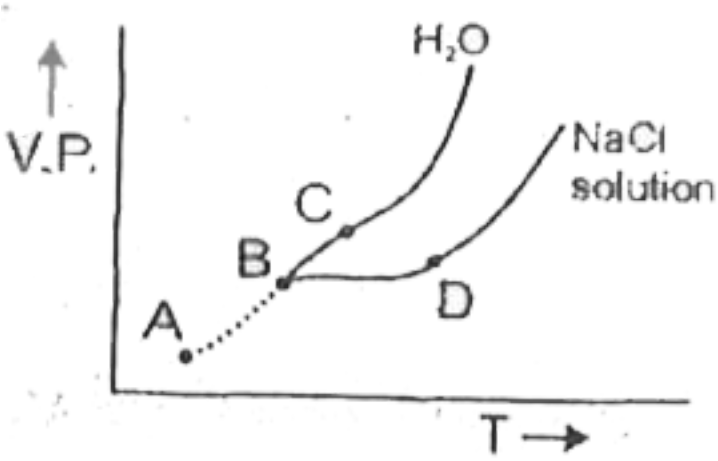

15.

Freezing point of solution is marked as

A. A

B. B

C. C

D. D

Answer: B

Watch Video Solution

16. van't Hoffer factor for acetic acid in aqueos medium at infinite dilution is

A. 2

B. 1

C. $1/2$

D. 3

Answer: A

Watch Video Solution

17. Correct order of freezing point of given solution

I. 0.1 M glucose II. 0.2 M urea III.0.1 M NaCl IV. $0.05MCaCl_2$

A. $I < II < III < IV$

B. $I > II > III > IV$

C. $III = II < IV < I$

D. $IV > II > III > I$

Answer: C

Watch Video Solution

18. Boiling order of 0.01 M AB_2 which is 10% dissociated in aqueous medium $(K_{bH_2O} = 0.52)$ as A^+ and B^-

A. 273.006 K

B. 373.006 K

C. 0.006 K

D. 272.006

Answer: B

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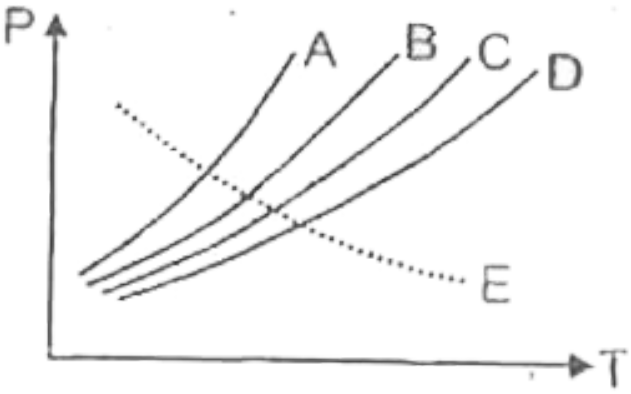
19. Vapour pressure diagram of some liquids plotted against temperature are shown below



Most volatile liquid

A. A

B. B

C. C

D. D

Answer: A

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20. At the higher altitudes the boiling point of water lowers because

A. Atmosphere pressure is low

B. Temperature is low

C. Atmospheric pressure increases

D. Water solidfies to ice

Answer: A

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21. During the evaporation of liquid

A. The temperature of liquid rises

B. The temperature of liquid falls

C. The temperature of liquid remains uneffected

D. The liquid molecules becomes inert

Answer: B

Watch Video Solution

22. What is the concentration of nitrate ions if equal volumes of $0.1MAgNO_3$ and $0.1MNaCl$ are mixed together?

A. 0.1 N

B. 0.25 M

C. 0.05 M

D. 0.2 M

Answer: C

Watch Video Solution

23. IF any solution 'A' dimerises in water at 1 atm pressure and the boiling point of this solution is $100.52^{\circ}C$. IF 2 moles of A is added to 1kg of

water and k_b of water is $0.52^\circ C/molal$, calculate the percentage association of A

A. 0.5

B. 0.3

C. 0.25

D. 1

Answer: D

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24. A certain substance A tetramerizes in water to the extent of 80%. A solution of $2.5g$ of A in $100g$ of water lowers the freezing point by $0.3^\circ C$. The molar mass of A is

a.120 , b.61 ,c.60 ,d.62

A. 122

B. 31

C. 244

D. 62

Answer: D

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25. $K_4\left[Fe(CN)_6\right]$ is supposed to be 40% dissociated when 1M solution prepared. Its boiling point is equal to another 20% mass by volume of non-electrolytic solution A. Considering motality= molarity. The molecular weight of A is

A. 77

B. 67

C. 57

D. 47

Answer: A

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Assignment Section C

1. Which of the following is dependent on temperature?

A. Molality

B. Molarity

C. Mole fraction

D. Weight percentage

Answer: B

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2. If molarity of the dilute solutions is doubled ,the value of molal depression constant $\left(K_f\right)$ will be:

A. Doubled

B. Halved

C. Tripled

D. Unchanged

Answer: D

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3. The van't hoff factor (i) for a dilute aqueous solution of the strong electrolyte barium hydroxide is

A. 0

B. 1

C. 2

D. 3

Answer: D

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4. Which one of the following is incorrect for ideal solution?

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

B. $\Delta U_{mix} = 0$

C. $\Delta P = P_{obs} - P_{calcatedbyRaot'slaw} = 0$

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

Answer: D

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5. At $100^\circ C$ the vapour pressure of a solution of $6.5g$ of an solute in $100g$ water is $732mm$.If $K_b = 0.52$, the boiling point of this solution will be :

A. $103^\circ C$

B. $101^\circ C$

C. $100^\circ C$

D. $102^\circ C$

Answer: B

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6. Which of the following statements about the composition of the vapour over an ideal $1:1$ mol mixture of benzene and toluene is correct? Assume that the temperature is constant at $25^\circ C$. (Given: vapour pressure Date at $25^\circ C$, benzene=12.8 kP, toluene=3.85 kPa)

A. Not enough information is given to make a prediction

B. The vapour will contain a higher percentage of benzene

C. The vapour will contain a higher percentage of toluene

D. The vapour will contain equal amounts of benzene and toulene

Answer: B

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7. What is the fraction of the solute in a 1.00 m aqueous solution ?

A. 0.0354

B. 0.0177

C. 0.177

D. 1.77

Answer: B

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8. Which one is not equal to zero for an ideal solution?

A. $\Delta P = P_{observed} - P_{Raot}$

B. ΔH_{mix}

C. ΔS_{mix}

D. ΔV_{mix}

Answer: C

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9. The boiling point of $0.2 molkg^{-1}$ solution of X in water is greater than equimolal solution of Y in water. Which of the following statements is true in this case?

A. Y is undergoing dissociation in water while X undergoes no change

B. x is undergoing dissociation in water

C. Molecular mass of X is greater than the molecular mass of Y

D. Molecular mass of X is less than then molecular mass of Y

Answer: B

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10. Which of the following electrolytes has the same value of van't Hoff factor (i)is that of $Al_2(SO_4)_3$(if all are $100\ \%$ ionised?

A. $K_4\left[Fe(CN)_6\right]$

B. K_2SO_4

C. $K_3\left[Fe(CN)_6\right]$

D. $Al(NO_3)_3$

Answer: A

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11. Among the following 0.10 m aqueous solutions, which one will exhibit the largest freezing point depression?

A. KCl

B. $C_6H_{12}O_6$

C. $Al_2(SO_4)_3$

D. K_2SO_4

Answer: C

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12. P_A and P_B are the vapour pressure of pure liquid components ,Aand B respectively of an ideal binary solution,If x_A represents the mole fraction of component A, the total pressure of the solution will be

A. $p_B + p_x(p_B - p_A)$

B. $p_B + p_x(p_A - p_B)$

C. $p_A + x_A(p_B + p_A)$

D. $p_A + x_A(p_A - p_B)$

Answer: B

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13. The van't Hoff factor i for a compound which undergoes dissociation in one solvent and association in other solvent is respectively.

A. Greater than one and greater than one

B. Less than one and greater than one

C. Less than one and less than one

D. Greater than one and less than one

Answer: D

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14. The freezing point depression constant for water is $1.86^{\circ} Cm^{-1}$. If $5.00 gNaSO_4$ is dissolved in $45.0 gH_2O$ the freezing point is changed by $-3.82^{\circ} C$. Calculate the van't Hoff factor for Na_2SO_4.

A. 0.381

B. 2.05

C. 2.63

D. 3.11

Answer: C

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15. A 0.1 molal aqueous solution of a weak acid is 30% ionized. If K_f for water is $1.86^\circ C/m$, the freezing point of the solution will be.

A. $-0.36^\circ C$

B. $-24^\circ C$

C. $-0.18^\circ C$

D. $-0.54^\circ C$

Answer: B

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16. 200 mL of an aqueous solution of a protein contains its 1.26g. The osmotic pressure of this solution at 300K is found to be 2.57×10^{-3} bar. The molar mass of protein will be $\left(R = 0.083 L \overline{m} ol^{-1} K^{-1}\right)$

A. $31011 g mol^{-1}$

B. $61038 g mol^{-1}$

C. $51022 g mol^{-1}$

D. $122044 g mol^{-1}$

Answer: B

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17. A solution of sucrose (molar mass $= 342 g mol^{-1}$) has been prepared by dissolving 68.5g of sucrose in 1000g of water. The freezing point of the solution obtained will be: (K_f for water $= 1.86 K kg mol^{-1}$)

A. $-0.372^{\circ} C$

B. $-0.520^{\circ}C$

C. $+0.372^{\circ}C$

D. $-0.570^{\circ}C$

Answer: A

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18. An aqueous solution is 1.00 molal in KI. Which change will cause the vapor pressure of the solution to increase?

A. Addition of NaCl

B. Addition of Na_2SO_4

C. Addition of 1.00 molal Kl

D. Addition of water

Answer: D

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19. $0.002m$ 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 $\left(K_f = 1.86^\circ C/m\right)$

A. 3

B. 4

C. 1

D. 2

Answer: D

Watch Video Solution

20. 0.5 molal aqueous solution of a weak acid (HX) is 20% ionised. If K_f for water is $1.86Kkgmol^{-1}$, the lowering in freezing point of the solution is

A. $-0.56K$

B. $-1.12k$

C. $0.56k$

D. $1.12k$

Answer: D

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21. A solution containing 10 g per dm^3 of urea (molecular mass = 60 g mol^{-1}) is isotonic with a 5% solution of a nonvolatile solute. The molecular mass of this nonvolatile solution is:

A. $250gmol^{-1}$

B. $300gmol^{-1}$

C. $350gmol^{-1}$

D. $200gmol^{-1}$

Answer: B

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22. 1.00 g of a non-electrolyte solute (molar mass 250g mol^{-1}) was dissolved in 51.2 g of 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. 0.4k

B. 0.3k

C. 0.5k

D. 0.2k

Answer: A

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23. A solution of acetone in ethnol

A. Shows a negative deviation for Raoult's law

B. Shows a positive deviation from Raoult's law

C. Behaves like a near ideal solution

D. Obeys Raoult's law

Answer: B

Watch Video Solution

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

A. From solution having higher concentration only

B. From both sides of semi-permeable membrane with equal flow rates

C. From both sides of semi-permeable membrane with unequal flor rates

D. From solution having lower concentration only

Answer: C

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25. The vapour pressure of two liquids 'P' and 'Q' are 80 and 60 torr respectively. The total vapour pressure of solution obtained by mixing 3 mole of P and 2 mol of Q would be

A. 140 torr

B. 20 torr

C. 68 torr

D. 72 torr

Answer: D

Watch Video Solution

26. A solution of urea (mol. Mass $60gmol^{-1}$) boils of $100.18^{\circ}C$ at one one atmospheric pressure. If k_f and K_b for water are 1.86 and $0.512Kkgmol^{-1}$ 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: D

Watch Video Solution

27. 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. 0.549

B. 0.200

C. 0.786

D. 0.478

Answer: D

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28. The mole fraction of the solute in one molal aqueous solution is:

A. 0.027

B. 0.036

C. 0.016

D. 0.009

Answer: C

Watch Video Solution

29. Which of the following compounds can be used as antifreeze in automobile radiators?

A. Methyl alcohol

B. Glycol

C. Nitrophenol

D. Ethyl alcohol

Answer: B

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30. Mole fraction of the solute in a 1 molal aqueous solution is :

A. 1.7700

B. 0.1770

C. 0.0177

D. 0.0344

Answer: C

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31. 1×10^{-3} m solution of $Pt(NH_3)_4Cl_4$ in H_2O shows depression in freezing point of $0.0054^\circ C$. The formula of the compound will be [Given $K_f(H_2O) = 1.86^\circ Cm^{-1}$]

A. $\left[Pt(NH_3)_4\right]Cl_4$

B. $[PtNH_3)_3Cl]Cl_3$

C. $\left[Pt(NH_3)_4Cl_2\right]Cl_2$

D. $Pt(NH_3)Cl_3]Cl$

Answer: C

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32. Which of the following salt has the same value of Van't Hoff factor 'i' as that of $K_3[Fe(CN)_6]$?

A. Na_2SO_4

B. $Al(NO)_3$

C. $Al_2(SO_4)_3$

D. $NaCl$

Answer: B

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33. At $25^\circ C$, the highest osmotic pressure is exhibited by 0.1 M solution of :

A. Glucose

B. Urea

C. $CaCl_2$

D. KCL

Answer: C

Watch Video Solution

34. According to Raoult's law the relative lowering of vapour pressure for a solution is equal to

A. Mole fraction of solute

B. Mole fraction of solvent

C. Moles of solute

D. Moles of solvent

Answer: A

Watch Video Solution

35. The concentration units. Independent of temperature would be

A. Normality

B. weight volume percent

C. Molality

D. Molarity

Answer: C

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36. In liquid gas equilibrium, the pressure of vapours above the liquid is constant at

A. Constant temperature

B. Low temperature

C. High temperature

D. None of these

Answer: A

Watch Video Solution

37. The vapour pressure of $\mathbb{C}l_4$ at $25^\circ C$ is 143 mm Hg. If 0.5 gm of a non-volatile solute (mol.weight=65) is dissolved in 100g $\mathbb{C}l_4$, the vapour pressure of the solution will be

A. 199.34 mm Hg

B. 143.99 mm Hg

C. 141.43 mm Hg

D. 94.39 mm Hg

Answer: C

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38. What is the molarity of H_2SO_4 solution that has a density 1.84 g/c c at 35° C and contains 98% by weight?

A. 18.4M

B. 18M

C. 4.18M

D. 8.14M

Answer: A

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39. A $5\ \%$ solution of cane sugar (molecular weight =342) is isotonic with a $1\ \%$ solution of substance X. The molecular weight of X is

A. 68.4

B. 171.2

C. 34.2

D. 136.8

Answer: A

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40. The vapour pressure of a solvent decreased by $10mm$ of Hg when a non-volatile solute was added to the solvent. The mole fraction of solute is 0.2, what would be the mole fraction of solvent if the decrease in vapour pressure is $20mm$ of Hg.

A. 0.4

B. 0.6

C. 0.8

D. 0.2

Answer: B

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41. 0.15g of a subatance dissolved in 15g of solvent boiled at a temperature higher at 0.216° than that of the pure solvent. Calculate the molecular weight of the substance. Molal elecation constant for the solvent is $2.16^\circ C$

A. 10.1

B. 100

C. 1.01

D. 1000

Answer: B

Watch Video Solution

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

A. 69.45

B. 59.6

C. 49.5

D. 79.8

Answer: A

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43. From the colligative properties of solution which one is the best method for the determination of mol.wt of proteins & polymers:

A. Osmotic pressure

B. Lowering in vapour pressure

C. Lowering in freezing point

D. Elevation in boiling point

Answer: A

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44. Molarity of liquid HCl with density equal to 1.17g/cc is

A. 36.5

B. 18.25

C. 32.05

D. 42.1

Answer: C

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45. A solution contains non-volatile solute of molecular mass M_2 which of the following can be used to calculate the molecular mass of solute in terms of osmotic pressure?

(m_2 =mass of solute,V=volume of solution,π =osmotic pressure)

A. $M_2 = \left(\frac{m_2}{\pi}\right) VRT$

B. $M_2 = \left(\frac{m_2}{V}\right) \frac{RT}{\pi}$

C. $M_2 = \left(\frac{m_2}{V}\right) \pi RT$

D. $M_2 = \left(\frac{m_2}{V}\right) \frac{\pi}{RT}$

Answer: B

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46. A solution containing components A and B follows Raoult's law, when

A. A-B attraction force is greater than A-A and B-B

B. A-B attraction force is less than A-A and B-B

C. A-B attraction force remains same as A-A and B-B

D. Volume of solution is different from sum of volume of solute and solvent

Answer: C

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47. Formation of a solution from two componenets can be considered as :

(i) pure sovent $\rightarrow$ separated solvent molecules, $\triangle H_1$

(ii) Pure solute $\rightarrow$ separated molecules, $\triangle H_2$

(iii) separated sovent and solute molecules $\rightarrow$ solution, $\triangle H_3$

solution so formed will be ideal if :

A. $\Delta H_{so\in} = \Delta H_1 + \Delta H_2 + \Delta H_3$

B. $\Delta H_{so\in} = \Delta H_1 + \Delta H_2 - \Delta H_3$

C. $\Delta H_{so\in} = \Delta H_1 - \Delta H_2 - \Delta H_3$

D. $\Delta H_{so\in} = \Delta H_3 - \Delta H_1 - \Delta H_2$

Answer: A

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48. Camphor is often used in molecular mass determination because

A. It is readly available

B. It has very high cryoscopic constant

C. It is volatile

D. It is solvent for organic substances

Answer: B

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49. Which condition is not satisfied by an ideal solution?

A. $\Delta_{mix} = H = 0$

B. $\Delta_{mix} V = 0$

C. $\Delta_{mix} S = 0$

D. Obeyance to Reoult's law

Answer: B

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Assignment Section D

1. A: Solubility of NaCl increases with temperature.

R: Dissolution of NaCl is an endothermic process.

A. It both assertion & Reason are true and the reason is the correct explanation of the assertion, the mark (1)

B. If both assertion & Reason are true but the reason is not the correct explanation of the assertion then mark (2)

C. IF Assertion is true statement but Reason is false then mark (3)

D. IF both Assertion and Reason are false statements, then mark (4)

Answer: A

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2. A: 10ml of liquid A mixed with 20ml of liquid B total volume of solution is 30 ml.

R: A and B will ideal solution.

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3. A: Lowering of vapour pressure depends upon concentration of solute.

R: Relative lowering of vapour pressure is a colligative property

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4. A: Boiling point of 0.1 M solution of NaCl is higher than that of 0.1 M solution of urea.

R: Greater the value of Van't Hoff factor, greater the elevation in boiling point of solution containing non volatile solute.

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5. A: Hexane and heptane forms ideal solution.

R: $\Delta H, \Delta S$ and ΔG are zero for such type of solution.

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6. A: Solution containing 1 gram equivalent of solute per litre is known as 1N solution

R: N=M $\times$ n -factor

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7. A: Observed molecular mass of $CaCl_2$ determined by any colligative property is less than ideal molecular mass.

R: $CaCl_2$ ionised in water as it is strong electrolyte.

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8. A: Isotonic solutions must have same effective molarity.

R: Effective molarity = $M \times i$

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9. Assertion: The sum of mol fractions of all the components of a solution is unity.

Reason: Mole fraction is temperature dependent mode of concentrations.

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10. Assertion: ΔH_{mix} and ΔV_{mix} for an ideal solution is zero

Reason: A.....B interactions in an ideal solution are same as between A.....A and B.....B.

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11. A: An azeotropic solution of two liquids has boiling point lower than either of them.

R: Solution shows +ve deviation from ideal behaviour.

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12. A: On increasing temperature vapour pressure of solution increases.

R: Vapour pressure of ether is higher than alcohol.

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13. A: Solubility of gas increases on increasing pressure.

R: Solubility of gas decreases on decreasing the temperature.

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14. A: Raoult's law applicable for dilute solution only.

R: Henry's law is applicable for solution of gas in liquid.

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15. A: $CuSO_4 5H_2O$ is a solution of liquid in solid.

R: Solution is a homogeneous mixture.

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16. A: 1M solution and 1 molal solution contain same mass of solute.

R: 1M and 1m aqueous solution are equally concentrated.

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17. A: boiling point of water at higher altitude is lower than $100^\circ C$

R: Boiling point is a colligative property.

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18. A: Van't Hoff factor for benzoic acid in aqueous medium is 2 assuming complete ionisation.

R: van't Hoff factor for 100% ionised solute equal to the number of ions produces.

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