CHEMISTRY

FOR IIT JEE ASPIRANTS OF CLASS 12 FOR CHEMISTRY

SOLUTIONS

Illustration

1. A storage battery contains a solution of H_2SO_4 30% by weight. Find out

(i) Molality

(ii) Molarity

(iii) Normality

(iv) Mole fraction of H_2SO_4

(Given density of solution $= 1.2gm/cm^3$)

A. Molality

B. Molarity

C. Normality

D. Mole fraction of H_2SO_4

Answer:

Watch Video Solution

2. If N_2 gas is bubbled through water at $293K$, how many millimoles of N_2 gas would dissolve in$1L$ of water. Assume thatN_2 exerts a partial pressure of 0.987 bar. Given that Henry law constant for N_2 at $293K$ is 76.48 kbar.

Watch Video Solution

3. At 25° C, the vapour pressure of methyl alcohol is 96.0 torr. What is the mole fraction of CH_3OH in a solution in which the (partial) vapor pressure of CH_3OH is 23.0 torr art 25° C ?

Watch Video Solution

4. The vapour pressure of pure liquid solvent A is $0.80atm$. When a non-volatile substance B is added to the solvent, its vapour pressure drops to $0.60atm$, the mole fraction of component B in the solution is

Watch Video Solution

5. The vapour pressure of ethanol and methanol ate $44.5mmHg$ and $88.7mmHg$, respectively. An ideal solution is formed at the same temperature by mixing $60g$ of ethanol and $40g$ of methanol. Calculate the total vapour pressure of the solution and the mole fraction of methanol in the vapour.

Watch Video Solution

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

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

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

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

D. 3/2`

Answer:

Watch Video Solution

7. An aqueous solution of glucose boils at $100.01^{\circ}C$.The molal elevation constant for water is $0.5kmol^{-1}kg$. The number of molecules of glucose in the solution containing $100g$ of water is

A. 6.023×10^{23}

B. 6.023×10^{22}

C. 12.046×10^{20}

D. 12.046×10^{23}

Answer: C

Watch Video Solution

8. What is the percent by mass of iodine needed to reduce the freezing point of benzene to $3.5^{\circ}\mathrm{C}$? The freezing point and Cryoscopic constant of pure benzene are $5.5^{\circ}\mathrm{C}$ and $5.12K/m$ respectively.

Watch Video Solution

9. The solute A is a ternary electrolyte and solute B is a non- electrolyte. If 0.1 M solution of solute B produces an osmotic pressure of $2P$, then, 0.05 M solution of A at the same temperature will produce an osmotic pressure equal to

A. P

B. 1.5P

C. 2P

D. 3P

Answer: D

Watch Video Solution

10. Osmotic pressur of blood is 7.65 atm at 310K. An aqueous solution of glucose that will be isotonic with blood is .....wt./vol.

A. 5.41

B. 3.54

C. 4.53

D. 53.4

Answer: A

Watch Video Solution

11. Molal elevation constant K_b for water is $0.52K/m$. 0.1 molal solution of $NaCl$ will boil at

A. $100.52^\circ \mathrm{C}$

B. $100.052^\circ \mathrm{C}$

C. $101.04^\circ \mathrm{C}$

D. $100.104^\circ \mathrm{C}$

Answer: D

Watch Video Solution

12. A solution is prepared by dissolving 26.3 g of $CdSO_4$ in 1000 g water. The depression in freezing point of solution was found to be 0.284 K. Calculate the Van't Hoff factor. The Cryoscopic constant of water is 1.86 K kg solvent mol^{-1} – solute.

Watch Video Solution

Solved Examples

1. 214.2 gram of sugar syrup contains 34.2 gram of sugar. Calculate (i) molality of the solution and (ii) mole fraction of the sugar in the syrup

A. 0.555 m, 0.0099

B. 0.4565 m, 0.0110

C. 0.355 m, 0.0199

D. None of these

Answer: A

Watch Video Solution

2. Calculate the amount of oxalic acid $(H_2C_2O_4.2H_2O)$ required to obtain $250m$ of deci-molar solution.

A. 15.75g

B. 1.575g

C. 157.5g

D. None

Answer: A

Watch Video Solution

3. $15 grams$ of methyl alcohol is dissolved in $35 grams$of water . What is the mass percentage of methyle alcohol in solution?

A. 0.3

B. 0.5

C. 0.7

D. 0.75

Answer: A

Watch Video Solution

4. 1.82 g of a metal required 32.5 mL of N-HCl to dissolve it what is the equivalent weight of metal?

A. 65

B. 75

C. 56

D. 90

Answer: C

Watch Video Solution

5. The vapour pressure of pure liquid A at 310°C is 120 torr. The vapour pressure of this liquid in solution with liquid B is 72 torr. Calculate the mole of fraction of A in solution if the mixture obeys Raoult's law.

A. 0.06

B. 0.9

C. 0.2

D. 0.6

Answer: D

Watch Video Solution

6. The degree of dissociation of $Ca(NO_3)_2$ in dilute aqueous solution containing 7.0g of salt per 100.0g of water at $100^\circ C$ is 70 % . If the vapour pressure of water at $100^\circ C$ is 760mm Hg, the vapour pressure of the solution is

A. 748.3mm Hg

B. 1492.6mm Hg

C. 373.2mm Hg

D. 74.03mm Hg

Answer: A

Watch Video Solution

7. The vapour pressure of solvent is 20 torr, while that of its dilute solution is 17 torr , the mole-fraction of the solvent is

A. 0.6

B. 0.4

C. 0.85

D. 0.7

Answer: C

Watch Video Solution

8. Methyl alcohol and ethyl alcohol have vapour pressure equal to 88.5 mm and 42.0 mm respectively 45°C. If 16.0 g of methanol and 46.0 g

ethanol are mixed at 45° C, the mole fraction of methanol in the vapour is .....(the mixture may be taken as ideal solution).

A. 0.467

B. 0.502

C. 0.513

D. 0.556

Answer: C

Watch Video Solution

9. The vapour pressure of benzene at$80^\circ C$ is lowered by $10mm$ by dissoving $2g$of a non-volatile substance in$78g$of benzene .The vapour pressure of pure benzene at $80^\circ C$is $750mm$.The molecular weight of the substance will be:

A. 150

B. 1050

C. 1500

D. 1550

Answer: A

Watch Video Solution

10. Calculate the molal elevation constant of water evaporates at $100^\circ \mathrm{C}$ with the absorption of 536 calories per gm $(R = 2\mathrm{cals})$

A. $0.519^\circ \mathrm{C}$

B. $0.0519^\circ \mathrm{C}$

C. $1.519^\circ \mathrm{C}$

D. $2.519^\circ \mathrm{C}$

Answer: A

Watch Video Solution

11. 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. 216

B. 100

C. 178

D. None of these

Answer: B

Watch Video Solution

12. If latent heat of fusion of ice is 80 cals per g at 0°, calculate molal depression constant for water.

A. 18.36

B. 186.3

C. 1.863

D. 0.1863

Answer: C

Watch Video Solution

13. Osmotic pressure of a sugar solution at $24^{\circ}C$ is 2.5 atmosphere .Determine the concentration of the solution in gram mole per litre.

A. $0.0821 \text{moles/litre}$

B. 1.082moles/litre

C. $0.1025 \text{moles/litre}$

D. $0.0827 \text{moles/litre}$

Answer: C

Watch Video Solution

14. Twenty grams of a substance were dissolved in 500ml. Of water and the osmotic pressure of the solution was found to be 600mm of mercury at $15^{\circ}\mathrm{C}$. Determine the molecular weight of the substance.

A. 1120

B. 1198

C. 1200

D. None of these

Answer: B

Watch Video Solution

15. What weight of $NaCl$ is added to one litre of water so that $\Delta \mathrm{T}/\mathrm{K_f} = \frac{1}{500}$?

A. 5.85g

B. 0.585g

C. 0.0585g

D. 0.0855g

Answer: C

Watch Video Solution

16. The addition of $3g$ of a substance to $100gCCI_4\left(M=154gmol^{-1}\right)$ raise the boiling point of CCI_4 by $0.60^\circ C$ of $K_b(CCI_4)$ is $5.03kgmol^{-1}K$. Calculate:

(a) the freezing point depression

(b) the relative lowering of vapour pressure

(c) the osmotic pressure at $298K$

the molar mass of the substance

Given $K_f(CCI_4)=31.8kgmol^{-1}K$ and ρ (density) of solution $=1.64g/cm^3$

Watch Video Solution

17. Vapour pressure of C_6H_6 and C_7H_8 mixture at 50°C is given by P (mm Hg) $= 180\chi_B + 90$, where χ_B is the mole fraction of C_6H_6. A solution is prepared by mixing 936 g benzene and 736 g toluene and if the vapour over this solution is removed and condensed into liquid and again brought to the temperature of 50°C. What would be the new mole fraction of C_6H_6 in the vapour state ?

Watch Video Solution

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

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

b.The total pressure when this drop is formed.

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

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

e. Composition of the last bubble.

Watch Video Solution

19. When the mixture of two immiscible liquids (water and nitrobenzene) boils at 372 K and the vapour pressure at this temperature are $97.7\text{k Pa}(\text{H}_2\text{O})$ and $3.6\text{ k Pa}(\text{C}_6\text{H}_5\text{NO}_2)$. Calculate the weight $\%$ of nitrobenzene in the vapour.

Watch Video Solution

20. A very dilute saturated solution of a sparingly soluble salt A_3B_4 has a vapour pressure of $20mm$ of Hg at temperature T, while pure water exerts a pressure of $20.0126mmHg$ at the same temperature. Calculate the solubility product constant of A_3B_4 at the same temperature.

Watch Video Solution

21. If the apparent degree of ionization of KCl in water at 290 K is 0.86. Calculate the mass of KCl which must be made up to $1\ \mathrm{dm}^3$ of aqueous solution to the same osmotic pressure as the $4.0\ \%$ solution of glucose at that temperature.

Watch Video Solution

22. The specific conductivity of a 0.5 M aq. solution of monobasic acid HA at $27^\circ\ \mathrm{C}$ is $0.006\ \mathrm{Scm}^1$. It's molar conductivity at infinite dilution is 200 S $\mathrm{cm}^2\mathrm{mol}^{-1}$. Calculate osmotic pressure (in atm) of 0.5 M HA(aq) solution at $27^\circ\ \mathrm{C}$. Given $R = 0.08\mathrm{L\text{-}atm}/\mathrm{K\text{-}mol}$

Watch Video Solution

23. The freezing point of $0.02mol$ fraction solution of acetic acid (A) in benzene (B) is $277.4K$. Acetic acid exists partly as a dimer $2A = A_2$. Calculate equilibrium constant for the dimerisation. Freezing point of benzene is $278.4K$ and its heat of fusion ΔH_f is $10.042kJmol^{-1}$.

Watch Video Solution

24. 1 Kg of an aqueous solution of sucrose is cooled and maintained at $-4^{\circ}\mathrm{C}$. How much ice will be separated out if the molality of the solution is 0.75 m ? $\mathrm{K_F(H_2O)} = 1.86\mathrm{Kg\,mol^{-1}K}$

Watch Video Solution

25. River water is found to contain $11.7\,\%$ $NaCl$, $9.5\,\%$ $MgCl_2$, and $8.4\,\%$. $NaHCO_3$, by weight of solution. Calculate its normal boiling point assuming $90\,\%$ ionization of $NaCl$, $70\,\%$ ionization of $MgCl_2$ and $50\,\%$ ionization of $NaHCO_3(K_b$ for water $= 0.52)$

Watch Video Solution

26. An aqueous solution containing 288gm of a non-volatile compound having the stochiometric composition $\mathrm{C_XH_{2X}O_X}$ in 90gm water boils at

$101.24^{\circ}\mathrm{C}$ at 1.00 atmospheric pressure. What is the molecular formula?

$\mathrm{K_b(H_2O)} = 0.512\ \mathrm{K\,mol^{-1}kg}\quad \mathrm{T_b(H_2O)} = 100^{\circ}\mathrm{C}$

Watch Video Solution

27. $30mL$ of $CH_3OH\left(d = 0.780gcm^{-3}\right)$ and $70mL$ of $H_2O\left(d = 0.9984gcm^{-3}\right)$ are mixed at $25^{\circ}C$ to form a solution of density $0.9575gcm^{-3}$. Calculate the freezing point of the solution. $K_f(H_2O)$ is $1.86kgmol^{-1}K$. Also calculate its molarity.

Watch Video Solution

28. Find $\mathrm{K_a}$, the ionization constant of tartaric acid if a 0.100 molal aqueous solution of tartaric acid freezes at $0.205^{\circ}\mathrm{C}$. Assume that only the first ionization is of importance and that $0.1\mathrm{m} = 0.1\mathrm{M}$. $\mathrm{K_f} = 1.86\mathrm{kg\,mol^{-1}K}$.

Watch Video Solution

Exercise

1. In s solution mole fraction of solute is 0.2. Find out molality of solution. (Given molar mass of solute 40 gm mole^{-1})

Watch Video Solution

2. 14.2gm $\mathrm{Na_2SO_4}$ is dissolved in 400 mL water. Find out (i) formality (ii) Normalityof solution.

View Text Solution

3. Henry's law constant for oxygen and nitrogen dissolved in water at 298 K are 2.0×10^9 Pa and5.0×10^9 Pa , respectively . A sample of water at a temperature just above 273 K was equilibrated with air (20% oxygen and 80% nitrogen) at 1 atm. The dissolved gas was separated from a sample of this water and the dried. Determine the composition of this gas.

Watch Video Solution

4. The vapour pressure of ethanol and methanol ate $44.5mmHg$ and $88.7mmHg$, respectively. An ideal solution is formed at the same temperature by mixing $60g$ of ethanol and $40g$ of methanol. Calculate the total vapour pressure of the solution and the mole fraction of methanol in the vapour.

Watch Video Solution

5. Two liquid A and B form an ideal solution at temperature T. When the total vapour pressure above the solution is 400 torr , the mole fraction of A in the vapour phase is 0.40 and in the liquid phase 0.75. What are the vapour pressure of pure A and pure B at temperature T ?

Watch Video Solution

6. The vapour pressure of pure water at $25^{\circ}\mathrm{C}$ is 23.76 torr. The vapour pressure of a solution containing 5.10 g of a nonvolatile substance in

90.0 g water is 23.32 torr. Compute the molecular weight of the solute.

Watch Video Solution

7. What weight of the non-volatile urea $(NH_2 - CO - NH_2)$ needs to be dissolved in 100 g of water in order to decrease the vapour pressure of water by $25\ \%$? What will be molality of the solution ?

Watch Video Solution

8. At 90° C, the vapour pressure of toluene is 400 torr and that of $\sigma -$ xylene is 150 torr. What is the composition of the liquid mixture that boils at 90° C, when the pressure is 0.50 atm ? What is the composition of vapour produced ?

Watch Video Solution

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

A. $\mathrm{Y_A} < \mathrm{Y_B}$

B. $\mathrm{X_A} > \mathrm{X_B}$

C. $\frac{\mathrm{Y_A}}{\mathrm{Y_B}} > \frac{\mathrm{X_A}}{\mathrm{X_B}}$

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

Answer: C

Watch Video Solution

10. The vapour pressure of water is 17.54 mm Hg at 293 K. Calculate vapour pressure of 0.5 molal solution of a solute in it.

Watch Video Solution

11. Pressure over ideal binary liquid mixture containing 10 moles each of liquid A and B is gradually decreased isothermally. If $\mathrm{P}_{\mathrm{A}}^{\circ} = 200\mathrm{mm\ Hg}$ and $\mathrm{P}_{\mathrm{B}}^{\circ} = 100mmHg$. Find the pressure at which half of the liquid is converted into vapour.

A. 150 mm Hg

B. 166.5 mmHg

C. 133 mmHg

D. 141.4 mmHg

Answer: D

Watch Video Solution

12. Estimate the boiling point of a solution of 25.0 g of urea NH_2CONH_2 plus 25.0 g of thiourea NH_2CSNH_2 in 500 g of chloroform, $CHCl_3$. The boiling point of pure chloroform is $61.2^{\circ}\mathrm{C}$, $\mathrm{K_b}$ of chloroform $= 3.63$"Km"^("-1")`

Watch Video Solution

13. Calculate the molal elevation constant, K_b for water and the boiling point of 0.1 molal urea solution. Latent heat of vaporisation of water is 9.72 kcal mol^{-1} at 373.15 K.

Watch Video Solution

14. The element X and Y form compounds having molecular formula XY_2 and XY_4. When dissolved in 20gm of benzene, 1gm XY_2 lower the freezing point by 2.3°, whereas 1gm of XY_4 lower the freezing point by $1.3^\circ C$. The molal depression constant for benzene is 5.1. Calculated the atomic masses of X and Y.

View Text Solution

15. Calculate the amount of ice that will separate out on cooling containing $50g$ of ethylene glycol in $200g$ of water to $-9.3^\circ C$ (K_f for

water $=1.86 K mol^{-1} kg$)

Watch Video Solution

16. A 250 mL water solution containing 48g of sucrose (molecular mass = 342) at 300K is separated from pure water by means of a semipermeable membrane. What pressure must be applied on solution as to prevent osmosis ?

Watch Video Solution

17. A 5% solution of cane sugar is isotonic with 0.877% solution of urea. Calculate the molecular mass of urea if the molecular mass of cane sugar is 342.

Watch Video Solution

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

Watch Video Solution

19. A $1.2\,\%$ solution $\left(\frac{w}{v}\right)$ of $NaCl$ is isotonic with $7.2\,\%$ solution $\left(\frac{w}{v}\right)$ of glucose. Calculate degree of ionization and Van't Hoff factor of $NaCl$.

Watch Video Solution

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

A. $[MA_8]$

B. $[MA_7]A$

C. $[MA_6]A_2$

D. $[MA_5]A_3$

Answer: C

Watch Video Solution

Exercise 1

1. Molal fraction of A vapours above te solution in mixture of A and B $[MA_5]A_3$ will be

$[\text{Given} \quad : P_A^\circ = 100\text{mm Hg and} \quad P_B^\circ = 200\text{mm Hg}]$

A. 0.4

B. 0.8

C. 0.25

D. None of these

Answer: C

Watch Video Solution

2. The exact mathematical expression of Raoult's law is $[n = n_{solute}, \quad N = N_{solvent}]$

A. $\frac{P^0 - P_s}{P^0} = \frac{n}{N}$

B. $\frac{P^0 - P_s}{P^0} = \frac{N}{n}$

C. $\frac{P^0 - P_s}{P_s} = \frac{n}{N}$

D. $\frac{P^0 - P_s}{P_s} = \frac{n}{N}$

Answer: C

Watch Video Solution

3. A mixture contains 1 mole of volatile liquid A $\left(P_A^0 = 80\text{mm Hg}\right)$. and 3 moles of volatile liquid B $\left(P_A^0 = 80\text{mm Hg}\right)$. If solution behaves

ideally, the total vapour pressure of the distillate is

A. 85 mm Hg

B. 85.88 mm Hg

C. 90 mmHg

D. 92 mm Hg

Answer: B

Watch Video Solution

4. Which of the following aqueous solution will show maximum vapour pressur at 300 K?

A. 1 M NaCl

B. 1 M $CaCl_2$

C. 1 M $AlCl_3$

D. 1 M $C_{12}H_{22}O_{11}$

Answer: D

Watch Video Solution

5. The Van't Hoff factor for a dillute aqueous solution of glucose is

A. Zero

B. 1

C. 1.5

D. 2

Answer: B

Watch Video Solution

6. The correct relationship between the boiling point f very dilute solution of $AlCl_3(T_1K)$ and $CaCl_2(T_2K)$ having the same molar concentration is

A. $T_1 = T_2$

B. $T_1 > T_2$

C. $T_2 > T_1$

D. $T_2 \leq T_1$

Answer: B

Watch Video Solution

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

A. 0.15

B. 5.7

C. 0.2

D. 4

Answer: B

Watch Video Solution

8. At a given temperature , total vapour pressure (in Torr) of a mixture of volatile components A and B is given by

$P_{total} = 120 - 785X_B$

hence, vapour pressure of pure A and B respectively (in Torr) are

A. 120,75

B. 120195

C. 120,45

D. 75,45

Answer: C

Watch Video Solution

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

A. Decimolar $\mathrm{Al}_2(\mathrm{SO}_4)_3$

B. Decimolar BaCl_2

C. Decimolar$\mathrm{Na}_2\mathrm{SO}_4$

D. A solution obtained by mixing equal volumes of (b) and (c

Answer: A

Watch Video Solution

10. 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. 0.2

B. 0.4

C. 0.6

D. 0.8

Answer: C

Watch Video Solution

11. Elevation of boiling point of 1 molar aqueous glucose solution $(\text{density} = 1.2g/ml)$ is

A. K_b

B. 1.20 K_b

C. 1.02K_b

D. 0.98K_b

Answer: D

Watch Video Solution

12. What will be the molecular weight of $CaCl_2$ determined in its aq. Solution experimentally from depression of freezing point?

A. 111

B. less than 111

C. greater than 111

D. data insufficient

Answer: B

Watch Video Solution

13. 1.0 molal aqueous solution of an electrolyte A_2B_3 is 60% ionised. The boiling point of the solution at 1 atm is $\left(K_{b\,(H_2O)} = 0.52K\ kg\ mol^{-1}\right)$

A. 274.76K

B. 377K

C. 376.4K

D. 374.76K

Answer: D

Watch Video Solution

14. Which of the following plots represents an ideal binary mixture?

A. Plot of P_{total} v/s $1/X_B$ is linear (X_B= mole fraction of 'B' in liquid phase).

B. Plot of P_{total} v/s $1/X_B$ is linear (Y_B= mole fraction of 'A' in vapour phase)

C. Plot of $\frac{1}{P_{total}}$ v/s Y_A is linear

D. Plot of $\frac{1}{P_{total}}$ v/s Y_B is non linear

Answer: C

View Text Solution

15. Two liquid A & B form an ideal solution. What is the vapour pressure of solution containing 2 moles of A and 3 moles at B at 300K? [Given: At 300K, Vapour pr. Of pure liquid A(P_A°)=100 torr, Vapour pr. Of pure liquid B(P_B°)= 300 torr]

A. 200 torr

B. 140 torr

C. 180 torr

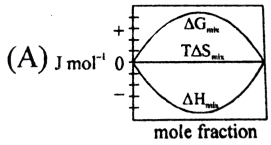
D. None of these

Answer: D

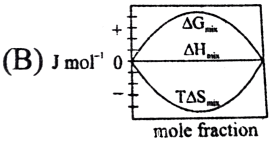
Watch Video Solution

16. Which of the following represents correcty the changes in thermodynamic properties during the formation of 1 mole of an ideal binary solution :

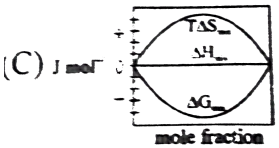
A.



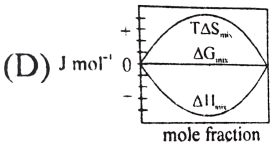
B.



C.



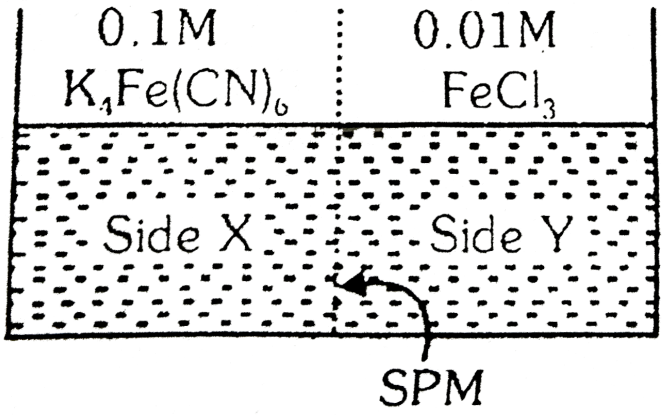
D.



Answer: C

Watch Video Solution

17. $FeCI_3$ on reaction with $K_4\left[Fe(CN)_6\right]$ in aqueous solution gives blue colour.



These are separated by a semipermeable membrane AB as shown. Due to osmosis there is:

A. blue color formation in side X

B. Blue colour formation is side Y

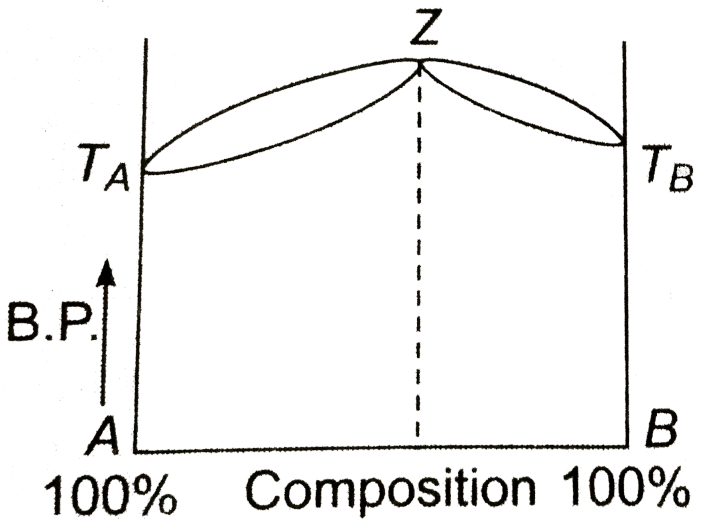
C. Blue colour formation in both of the side X and Y

D. No blue colour formation.

Answer: D

Watch Video Solution

18. A liquid mixture ohaving composition corresponding to point Z in the figure shown is subjected to distillation at constant pressure. Which of the following statements is correct about the process?



A. the composition of distillate differs from the mixture

B. The boiling point goes on changing

C. The mixture has highest vapour pressure than for any other composition.

D. Composition of an azeotrope alters on changing the external pressure.

Answer: C

Watch Video Solution

19. The vapour pressure of a saturated solution of sparingly soluble salt (XCl_3) was 17.20mm Hg at $27^\circ C$. If the vapour pressure of pure H_2O is 17.25 mm Hg at 300K, what is the solubility of sparingly soluble salt XCl_3 in $mole/Litre$.

A. 4.04×10^{-2}

B. 8.08×10^{-2}

C. 2.032×10^{-2}

D. 4.04×10^{-2}

Answer: A

Watch Video Solution

20. At 300K, the vapour pressure of an ideal solution containing 3 mole of A and 2 mole of B is 600 torr. At the same temperature, if 1.5 mole of A & 0.5 mole of C (non-volatile) are added to this solution the vapour pressure of solution increased by 30 torr. What is the value of P_B°?

A. 940

B. 405

C. 90

D. None of these

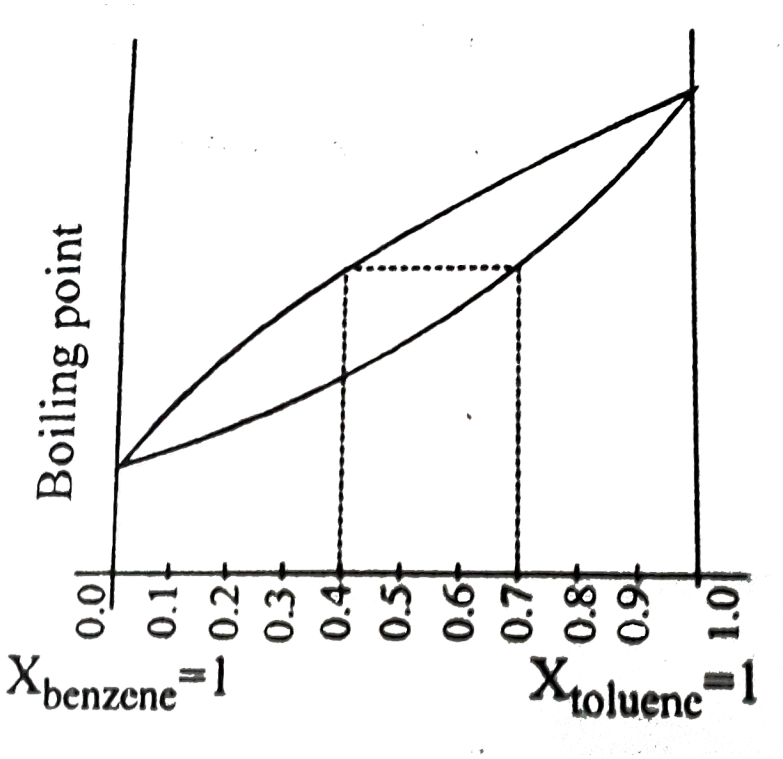
Answer: C

Watch Video Solution

21. The following graph represents variation of boiling point with composition of liquid and vapours of binary liquid mixture. The graph is plotted at constant pressure.

Which of the following statement(s) is incorrect. Here X & Y stands for

mole fraction in liquid and vapour phase respectively.



A. $X_{benzene} = 0.5$ and $Y_{toluene} = 0.2$

B. $X_{toluene} = 0.3$ and $Y_{benzene} = 0.6$

C. $X_{benzene} = 0.3$ and $Y_{toluene} = 0.4$

D. if $X_{benzene} = 0.7$ than $Y_{toluene} < 0.3$

Answer: B

Watch Video Solution

22. The freezing point depression of a 0.1 M aq. Solution of weak acid (HX) is $-0.20^{\circ}\mathrm{C}$. What is the value of equilibrium constant for the reaction:

$\mathrm{HX(aq)} \Leftrightarrow \mathrm{H^{+}(aq)} + \mathrm{X^{-1}(aq)}$

[Given: $\mathrm{K_f}$ for water$=1.8\,\mathrm{Kg\,mol^{-1}K}$. & Molality=Molarity]

A. 1.46×10^{-4}

B. 1.35×10^{-3}

C. 1.21×10^{-2}

D. 1.35×10^{-4}

Answer: B

Watch Video Solution

23. The vapour pressure of an aqueous solution is found to be 750 torr at cetain temperature.'T'. If 'T' is the temperature at which pure water boils under atmospheric pressure and same solution show elevation in boiling

point $\Delta T_b = 1.04K$, find the atmopheric pressure $\left(K_b = 0.52 Kg\ mol^{-1}\right)$

A. 777

B. 779

C. 782

D. 746

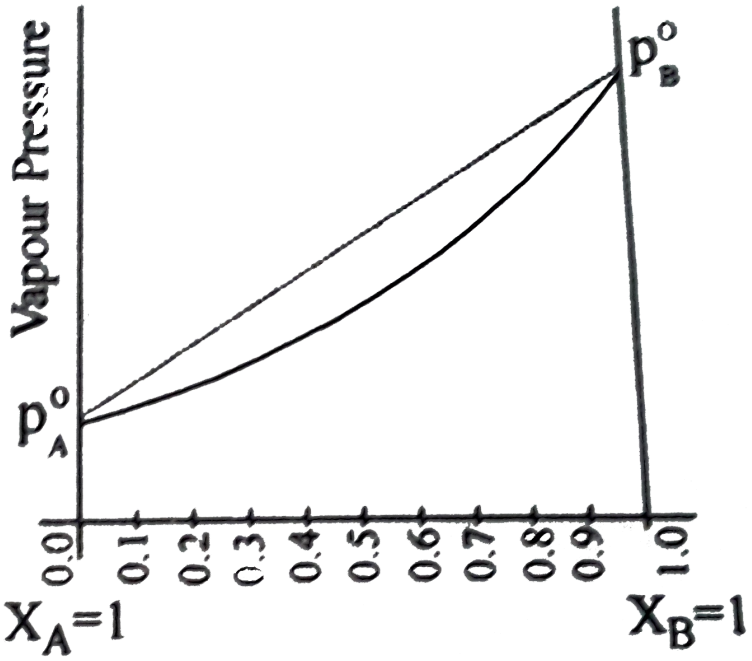
Answer: A

Watch Video Solution

24. The following graph represents variation of vapour pressre with composition of liquid and vapours of binary liquid mixture. The graph is plotted at constant temperature.

Which of the following statements(s) is correct. Here X & Y stands for

mole fraction in liquid and vapour phase respectively



A. $X_B > Y_B$

B. $X_A < Y_A$

C. $\frac{X_B Y_A}{X_A Y_B} > 1$

D. $X_A > Y_A$

Answer: D

Watch Video Solution

Exercise 2

1. 1 mole of liquid A and 9 moles of liquid B are mixed to form a solution. If $P_B^\circ = 400\text{mm}$ of Hg and $P_A^\circ = 20\text{mm}$ of Hg at a temperature 'T' and normal boiling point of liquid B is 300K then answer the questions that follow.

Given data: $K_b = 2.7\text{K kg mol}^{-1}$, Molar mass of B=100

It is observed that pressure of vapour above the solution at 'T' Kelvin is 350 mm Hg. The true statement is :

A. The liquids form ideal solution.

B. The solute- solvent interactions are weaker than solvent- solvent or solute- solute interactions.

C. The volume of final solution will be lower than sum of individual volumes

D. The enthalpy change due to mixing will be zero.

Answer: C

Watch Video Solution

2. 1 mole of liquid A and 9 moles of liquid B are mixed to form a solution. If $P_B^\circ = 400\text{mm}$ of Hg and $P_A^\circ = 20\text{mm}$ of Hg at a temperature 'T' and normal boiling point of liquid B is 300K then answer the questions that follow.

Given data: $K_b = 2.7\text{K kg mol}^{-1}$, Molar mass of B=100

If 'A' is assumed to be perfectly non volatile then what will be normal boiling point of the solution.

A. 300

B. 300.3

C. 303

D. 300.003

Answer: C

Watch Video Solution

3. 1 mole of liquid A and 9 moles of liquid B are mixed to form a solution. If $P_B^\circ = 400\text{mm}$ of Hg and $P_A^\circ = 20\text{mm}$ of Hg at a temperature 'T' and normal boiling point of liquid B is 300K then answer the questions that follow.

Given data: $K_b = 2.7\text{K kg mol}^{-1}$, Molar mass of B=100

If 'A' is perfectly non volatile and it dimerises to and extent of 60% then what will be the vapour pressure of the solution.

A. $360mmHg$

B. $\frac{3600}{9.7}$ mm Hg

C. $\frac{4000}{9.7}$mm Hg

D. $36mmHg$

Answer: B

Watch Video Solution

4. An isotope of hydrogen atom is represented as X which follows Bohr'r model and exists as diatomic gaseous molecule X_2. Also the normal boiling point of a compound X_2O liquid is found to be $101^\circ C$ and that of a solution obtained on dissolved 0.1 moles of NaCl in 1 Kg of X_2O liquid is $101.4^\circ C$. It is also known that the ionization energy of X is equal to 14eV

The value of ebullioscopic constant of X_2O is given by:

A. $4K\ kg\ mol^{-1}$

B. $2K\ kg\ mol^{-1}$

C. $0.4K\ kg\ mol^{-1}$

D. $1K\ kg\ mol^{-1}$

Answer: B

Watch Video Solution

5. An isotope of hydrogen atom is represented as X which follows Bohr's model and exists as diatomic gaseous molecule X_2. Also the normal boiling point of a compound X_2O liquid is found to be 101° C and that of solution obtaind on dissolving 0.1 moles of $NaCl$ in 1 kg of X_2Oliquid is $101.4^\circ C$. It is also known that the ionization energy of X is equal to $14eV$.

The energy required to excite electron from ground state of IInd excited state is given by :

A. $10.2\text{e V}/\text{atm}$

B. $12.1\text{e V}/\text{atm}$

C. $12.44\text{e V}/\text{atm}$

D. $10.5\text{e V}/\text{atm}$

Answer: C

Watch Video Solution

6. An isotope of hydrogen atom is represented as X which follows Bohr'r model and exists as diatomic gaseous molecule X_2. Also the normal boiling point of a compound X_2O liquid is found to be $101^\circ C$ and that of a solution obtained on dissolved 0.1 moles of NaCl in 1 Kg of X_2O liquid is $101.4^\circ C$. It is also known that the ionization energy of X is equal to 14eV

What amount of charge will be required to deposit 10 moles of X_2 if electrolysis of very dilute solution of NaCl is done with X_2O as the solvent?

A. 20 col.

B. 10 col.

C. 20F

D. 10F

Answer: C

Watch Video Solution

7. These questions consists of two statements each, printed as Statement-I and Statement-II. While answering these Questions you are required to choose any one of the following four responses.

Statement-I: The freezing of water is and endothermic process.

Statement-II: Heat must be removed from the water to make it freeze.

A. If both Statement-I & Statement-II are True & the Statement-II is a correct explanation of the Statement-I

B. If both Statement-I & Statementl-II are True but Statement-II is not a correct explanation of the Statement-I

C. If Statement-I is True but the Statement-II is false.

D. If Statement-I is false but the Statement-II is True.

Answer: D

 Watch Video Solution

8. These questions consists of two statements each, printed as Statement-I and Statement-II. While answering these Questions you are required to choose any one of the following four responses.

Statement-I: Addition of ethylene glycol(non-volatile)to water lowers the freezing point of water hence used as antifreeze.

Statement-II: Addition of any substance to water lowers its freezing point.

A. If both Statement-I & Statement-II are True & the Statement-II is a correct explanation of the Statement-I

B. If both Statement-I & Statementl-II are True but Statement-II is not a correct explanation of the Statement-I

C. If Statement-I is True but the Statement-II is false.

D. If Statement-I is false but the Statement-II is True.

Answer: C

 Watch Video Solution

9. Acetone and carbon disulphide form binary liquid solution showing positive deviation from Raoult's law. The normal boiling point (T_b) of pure acetone is less than that of pure CS_2. Pick out the incorrect statement among the following :

A. Boiling temperature of mixture is always less than boiling temperature of acetone.

B. Boiling temperature of Azeotropic mixture is always less than boiling temperature of pure CS_2

C. When a small amount of CS_2(less volatile component) is added to excess of acetone boiling point of resulting mixture increases.

D. A mixture of CS_2 and $\mathrm{CH}_3\mathrm{COCH}_3$ can be completely seperated by simple fractional distillation.

Answer: A,C,D

Watch Video Solution

10. Which of the following solution are isotonic with respect to 0.5 M NaCl solution having degree of dissociation=0.8.

A. 153.9gm of sucrose dissolved in 500ml of solution.

B. $0.3\mathrm{m}\ \mathrm{aQ}.\ \mathrm{Na_2SO_4}$ solution undergoing 100% ionization.

C. $1.8\ \%\ \mathrm{w/w}\ \mathrm{aQ}.$ NaOH solution undergoing 100% ionization.

D. 1.2M benzoic acid in a solution of benzene where the acid dimerzes to an extent of 50%

Answer: A,B,C,D

Watch Video Solution

11. As a gas (insoluable in liquid) is bubbled throuogh a liquid part of the liquid vapories and these vapours are carried off with the gas. As a sample of dry nitrogen gas is bubble through a liquid, it is found that under identical conditions of temperature and pressure, definite volume of wet nitrogen gas weighs more than the equal volume of dry nitrogen

gas. Hence, the liquid through which dry nitrogen gas was passed, may be:

A. water

B. Benzene

C. CCl_4

D. Heavy water

Answer: B

Watch Video Solution

12. Two liquid A and B form an ideal solution. The solution has a vapour pressure of 700 torr at $90^\circ C$. It is distilled till $2/\left(3^{rd}\right)$ of the solution is collected condensate. The composition of the condensate is $X'_A = 0.75$ and that of the residue is $X'_A = 0.3$. If the vapour pressure of the residue at $90^\circ C$ is 600 torr, Which of the following option is correct.

A. The composition of the original liquid was $X_A = 0.6$.

B. The composition of the original liquid was $X_A = 0.4$

C. $P_A^0 = \frac{2500}{3}\text{torr}$

D. The composition of the original liquid was $X_B = 0.4$

Answer: A,C,D

Watch Video Solution

13. A cylinder fitted with a movable piston contains liquid water in equilibrium with water vapour at 25°C.

Which of the following operation result will not in a decrease in the equilibrium vapour pressure at 25°C?

A. Moving the piston downward a short distance

B. Removing a small amount of vapour

C. Removing a small amount of liquid water

D. Dissolving some salt in the water.

Answer: A,B,C,

Watch Video Solution

14.

ColumnI (Colligative properties)	ColumnII (Auueous solution) (Assume m = M)
$(A)\Delta T_f = 0.3 \times K_f$	$(P)0.1m - ca(NO_3)_2$
$(B)\Delta T_b = 0.28 \times K_b$	$(Q)0.14m - NaBr$
$(C)\pi = 0.19 \times RT$	$(R)0.1m - MgCl_2(\alpha = 0.9)$
$(D)\frac{P^0 - P}{P^0} = \frac{\left(\frac{\Delta T_f}{K_f}\right)}{\left(\frac{1000}{18}\right) + \left(\frac{\Delta T_f}{K_f}\right)}$	$(S)0.28m - \text{Urea}$
	$(T)0.1m - \text{HA}(\text{monobasic acid}), K_a = 0.81$

View Text Solution

Exercise 3

1. The vapour pressure of pure water at $26^\circ C$ is 25.21 torr. What is the vapour pressure of a solution which contains 20.0 g glucose, $C_6H_{12}O_6$, in

70 g water?

Watch Video Solution

2. Calculate the mole fraction of toluence in the vapour phase which is in equilibrium with a solution of benzene and toluene having a mole fraction of toluene 0.50. The vapour pressure of pure benzene is 199 torr, that of toluene is 37 torr at the same temperature.

Watch Video Solution

3. What is the composition of the vapour which is in equilibrium at $30^\circ \mathrm{C}$ with benzene-toluene solution with a mole fraction of benzene of 0.40? With a mole fraction of benzene of 0.60?

$P_b^\circ = 119\text{torr and } P_t^\circ = 37 \to rr$

Watch Video Solution

4. Calculate the relative lowering in vapour pressure if 100 g of a nonvolatile solute.(mol.wt.100) are dissolved in 432 g watere.

Watch Video Solution

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

Watch Video Solution

6. The vapour pressure of pure benzene is $639.7mmHg$ and the vapour pressure of solution of a solute in benzene at the temperature is $631.9mmHg$. Calculate the molality of the solution.

Watch Video Solution

7. The vapour pressure of pure benzene at a certain temperature is 640 mm of Hg. A non volatile nonelectrolyte solid weight 0.175 g is added to 39.0 benzene. The Vapour pressure of the solution is 600 mm of Hg. What is molecular weight of solid substance?

Watch Video Solution

8. Benzene and toluene form two ideal solution A and B at 313 K, Solution A(total pressure $\mathrm{P_A}$) contains equal mole fo toluene and benzene. Solution B contains equal masse of both(total pressure $\mathrm{P_B}$). The vapour pressure of benzene and toluene are 160 and 60 mm of Hg respectively at 313 K. Calculate the value of $\mathrm{P_A}/\mathrm{P}_B$.

Watch Video Solution

9. When 10.6 g of a nonvolatile substance is dissolved in 740 f of ether, its boiling point is raised $0.284^\circ\mathrm{C}$. What is the molecular weight of the substance? Molal boiling point costant of ether is $2.11^\circ\mathrm{C\,kg/mol}$.

Watch Video Solution

10. A solution containing 3.24 g of a nonvolatile nonelectrolyte and 200 g of water boils at 100. $130^{\circ}\mathrm{C}$ at 1atm. What is the molecular weight of the solute?$(\mathrm{K_b}\text{for water } 0.513^{\circ}\mathrm{C}/\mathrm{m})$

Watch Video Solution

11. The molecular weight of an organic compound is 58.0g/mol. Compute the boiling point of a solution containing 24.0 g of the solute and 600 g of water, when the barometric pressure is such that pure water boils at $99.725^{\circ}\mathrm{C}$. $(\mathrm{K_b} \quad \text{for water} \quad 0.513^{\circ}\mathrm{C}/\mathrm{m})$

Watch Video Solution

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

Watch Video Solution

13. Pure benzene freeze at $5.45^\circ \mathrm{C}$. A solution containing 7.24g of $\mathrm{C_2H_2}Cl_4$ in 115.3 g of benzene was observed to freeze at $3.55^\circ \mathrm{C}$. What is the molal freezing point constant of benzene?

Watch Video Solution

14. A solution containing 6.35g of a non electrolyte dissolved in 500 g of wate freezes at $-0.465^\circ \mathrm{C}$. Determine the molecular weight of the solute. $[\mathrm{K_f for\ water}\ 1.86^\circ)\mathrm{C/m}]$

Watch Video Solution

15. The freezing point of a solution containing 2.40 g of a compound in 60.0g of benzene is $0.10^\circ \mathrm{C}$ lower than that of pure benzene. What is the molecular weight of the compound?$(\mathrm{K_f}\ \ \mathrm{is}\ \ 5.12^\circ \mathrm{C/m\ for\ benzene}$

Watch Video Solution

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

Watch Video Solution

17. The cryoscopic constant for acetic acid is 3.6 K kg/mol. A solution of 1g of a hydrocarbon in 100 g of acetic acid freeze at 16.14° C instead of the usual 16.60° C. The hydrocarbon contains 92.3% carbon. What is the molecular formula?

Watch Video Solution

18. Find the freezing point of a glucose solution whose osmotic pressure at $25^\circ C$ is found to be 30 atm. K_f (water) $= 1.86kgmol^{-1}K$.

Watch Video Solution

19. At $300K$, two solutions of glucose in water of concentration $0.01M$ and $0.001M$ are separated by semipermeable membrane. Pressure needs to be applied on which solution, to prevent osmosis? Calculate the megitude of this applied pressure?

Watch Video Solution

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

Watch Video Solution

21. The osmotic pressure of blood is 7.65 atm at 37° C. How much glucose should be used per L for

Watch Video Solution

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

Watch Video Solution

23. A solution of crab hemocyanin, a pigmented protein extracted from crabs,was prepared by dissolving 0.750 g in $125\mathrm{cm}^3$ of an aqueous medium . At $4^{\circ}\mathrm{C}$ an osmotic pressure rise of 2.6 mm of the solution was observed. The solution had a density of $1.00\mathrm{g}/\mathrm{m}^3$. Determine the molecular weight of the protein.

Watch Video Solution

24. The osmotic pressure of a solution of a synthetic polyisobutylene in benzene was determined at $25^{\circ}\mathrm{C}$. A sample containing 0.20 g of solute/$100\mathrm{cm}^3$ of solution developed a rise of 2.4 mm at osmotic

equilibrium. The density of the solution was$0.88 \mathrm{g} / \mathrm{cm}^3$. What is the molecular weight of the polyisobutylene?

Watch Video Solution

25. 10 g of solute A and 20gm of solute B are both dissolved in 500ml water. The solution has the same osmotic pressure as 6.67 gm of A and 30 gm of B dissolved in the same amount of water at the same temperature. What is the ratio of molar masses of A and B?

Watch Video Solution

26. A storage battery contains a solution of $H_2SO_4 38\ \%$ by weight. What will be the Van't Hoff factor if the $\Delta \mathrm{T}_{\mathrm{f(experiment)}}$ in 29.08. $\left[\text{Given } \mathrm{K_f} = 1.86 \ \ \mathrm{mol}^{-1} \ \ \mathrm{Kg}\right]$

Watch Video Solution

27. A certain mass of a substance when dissolved in $100gC_6H_6$ lowers the freezing point by $1.28^\circ C$. The same mass of solute dissolved in $100g$ of water lowers of the freezing point by $1.40^\circ C$. If the substance has normal molecular weight in benzene and is completely dissocited in water, into how many ions does it dissocite in water ? K_f for H_2O and C_6H_6 are 1.86 and $5.12Kmol^{-1}kg$ respectively.

Watch Video Solution

28. Two grams of benzoic acid (C_6H_5COOH) dissolved in $25.0g$ of benzene shows a depression in freezing point equal to $1.62K$. Molal depression constant for benzene is $4.9Kkg^{-1}mol^{-1}$. What is the percentage association of acid if it forms dimer in solution?

Watch Video Solution

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

acetic acid in benzene.

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

Watch Video Solution

30. $0.85\,\%$ aqueous solution of $NaNO_3$ is apparently $90\,\%$ dissociated at $27^\circ C$. Calculate its osmotic pressure. $\left(R = 0.0821 atm K^{-1} mol^{-1}\right)$

Watch Video Solution

31. An aqueous solution containing 288 gm of a non-volatile compound having the stoichiometric composition $C_{\mathrm{x}}H_{2\mathrm{x}}O_{\mathrm{x}}$ in 90 gm water boils at $101.24^\circ\,\mathrm{C}$ at 1.00 atmospheric pressure. What is the molecular formula ?

$\mathrm{K}_b(\mathrm{H}_2O) = 0.512 \mathrm{K\ mol}^{-1}\mathrm{kg}$

$\mathrm{T}_b(\mathrm{H}_2O) = 100^\circ\,\mathrm{C}$

Watch Video Solution

32. At $100^\circ C$, benzene & toluene have vapour pressure of 1375 & 558 torr respectively. Assuming these two form an ideal binary solution, calculate the composition of the solution that boils at 1 atm & $100^\circ C$. What is the composition of vapour issuing at these conditions?

Watch Video Solution

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

Watch Video Solution

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

Watch Video Solution

35. Dry air was drawn through bulbs containing a solution of 40 grams of urea in 300 gram of water, then through bulbs containing pure water at the same temperature and finally through a tube in which pumice moistened with strong.H_2SO_4 was kept. The water bulbs lost 0.0870 grams and the sulphide acid tube gained 2.036 grams. Calculate the molecular weight of urea.

Watch Video Solution

36. The degree of dissociation of $Ca(NO_3)_2$ in a dilute aqueous solution, containing $7.0g$ of the salt per $100g$ of water at $100^\circ C$ is 70%. If the vapour pressure of water at $100^\circ C$ is $760mm$, calculate the vapour pressure of the solution.

Watch Video Solution

37. A $10\ \%\ (\mathrm{w/w})$ solution of cane sugar has undergone partial inversion according to the reaction:

$\mathrm{sucrose}+\mathrm{water}\rightarrow\mathrm{glucose}+\ \mathrm{fructose}$. If the boiling point of solution is $100.27^{\circ}\ \mathrm{C}$.

(a) What is the average mass of the dissolved materials?

(b) What fraction of the sugar has inverted?

$\mathrm{K_b(H_2O)}=0.512\ \ \mathrm{K\ mol^{-1}}\ \ \mathrm{kg}$

Watch Video Solution

38. $1.5g$ of monobasic acid when dissolved in $150g$ of water lowers the freezing point by $0.165^{\circ}C.0.5g$ of the same acid when titrated, after dissolution in water, requires $37.5mL$ of $N/10$ alkali. Calculate the degree of dissociation of the acid $\left(K_f\right.$ for water $\left.=1.86^{\circ}Cmol^{-1}\right)$.

Watch Video Solution

39. Sea water is found to contain $5.85\ \%\ NaCI$ and$9.50\ \%\ MgCI_2$ by weight of solution. Calculate its normal boiling point assuming $80\ \%$

ionisation for $NaCI$ and $50\,\%$ ionisation of $MgCI\left[K_b(H_2O) = 0.51 kgmol^{-1}K\right]$

Watch Video Solution

40. The latent heat of fusion of ice is 80 calories per gram at $0^\circ C$. What is the freezing point of a solution of KCl in water containing 7.45 grams of solute 500 grams of water, assuming that the salt is dissociated to the extent of $95\,\%$?

Watch Video Solution

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

Watch Video Solution

42. At $25^{\circ}C$, $1mol$ of A having a vapour pressure of 100 torr and 1 mole of B having a vapour pressure of 300 torr were mixed. The vapour at equilibrium is removed, condensed and the condensate is heated back to $25^{\circ}C$. The vapour now formed are again removed, recondensed and analyzed. what is the mole fraction of A in this condensate?

Watch Video Solution

43. Phenol associates in benzene to a certain extent to form a dimer. A solution containing 20×10^{-1} kg phenol in 1 kg of benzene has its freezing pint depressed by 0.69 K. Calculate the fraction of phenol that has dimerised. $\mathrm{K_f}$ for benzene $= 5.12$ kg $\mathrm{mol}^{-1}\mathrm{k}$.

Watch Video Solution

44. An ideal solution was prepared by dissolving some amount of cane sugar (non-volatile) in 0.9 moles of water. The solution was then cooled just below its freezing temperature $(271K)$, where some ice get

separated out. The remaining aqueous solution registered a vapour pressure of 700 torr at $373K$. Calculate the mass of ice separated out, if the molar heat of fusion of water is $96kJ$.

Watch Video Solution

45. Tritium, T(an isotope of H) combines with fluroine to form weak acid TF, which ionizes to give T^+. Tritium is radioactive and is a $\beta-\text{emitter}$. A freshly prepared aqueous solution of TF has p T (equivalent of pH) of 1.5 and freezes at -0.372°C. if 600 ml of freshly prepared solution were allowed to stand for 24.8 year. Calculate (i) ionization constant of TF. (ii) Number of β-particle emitted.

(Given K_f for water $= 1.86\ \text{kg mol K}^{-1}$, $t_{1/2}$ for tritium $= 12.4$ years)

View Text Solution

Exercise 4

1. The van't Hof factor for 0.1 M $Ba(NO_3)_2$ solution is 2.74 . The degree of dissociation is

A. 0.913

B. 0.87

C. 1

D. 0.74

Answer: B

Watch Video Solution

2. In the depression of freezing point experimet, it is found that:

I. The vapour pressure of the solution is less than that of pure solvent.

II. The vapour pressure of the solution is more than that of pure solvent.

III. Only solute molecules solidify at the freezing point.

IV. Only solvent molecules solidify at the freezing point.

A. I,II

B. II,III

C. I,IV

D. I,II,III

Answer: C

Watch Video Solution

3. To $500cm^3$ of water, $3 \times 10^{-3}kg$ of acetic acid is added. If 23% of axcetic acid is dissociated wha will be the depression in freezing point? K_f and density of water are $1.86Kkg^{-1}mol^{-1}$ and $0.997gcm^{-3}$ respectively.

Watch Video Solution

4. The vapour pressure of two miscible liquids (A) and (B) are 300 and $500mm$ of Hg respectively. In a flask 10 mole of (A) is mixed with 12 mole

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

Watch Video Solution

5. During depression of freezing point in a solution, the following are in equilibrium:

A. liquid solvent-solid solvent

B. liquid solvent- solid solute

C. liquid solute-solid solute

D. liquid solute-solid solvent

Answer: A

Watch Video Solution

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

	$b.pt.$	$\mathrm{K_b}$
x	100	0.68
y	27	0.53
z	253	0.98

Watch Video Solution

7. A 0.004 M solution of Na_2SO_4 is isotonic with a 0.010 M solution of glucose at same temperature. The apparent degree of dissociation fo Na_2SO_4 is

A. 0.25

B. 0.5

C. 0.75

D. 0.85

Answer: C

Watch Video Solution

8. $1.22g$ of benzoic acid is dissolved in (i) 100g acetone $(K_b$ for acetone $= 1.7)$ and (ii) 100 g benzene $(K_b$ for benzene $= 2.6)$. The elevation in boiling points T_b is $0.17^\circ C$ and $0.13^\circ C$ respectively.

(a) What are the molecular weights of benzoic acid in both the solutions?

(b) What do you deduce out of it in terms of structure of benzoic acid?

Watch Video Solution

9. The elevation in boiling point, when 13.44g of freshly prepared $CuCl_2$ are added to one kilogram of water, is [Some useful data, $K_b(H_2O) = 0.52\text{kg K mol}^{-1}$, mol.wt. of $\text{CuCl}_2 = 134.4gm$]

A. 0.05

B. 0.1

C. 0.16

D. 0.21

Answer: C

Watch Video Solution

10. 72.5g of phenol is dissolved in 1 kg of a solvent $\left(K_f = 14\right)$ which leads to dimerization of phenol and freezinfg point is lowered by 7 kelvin. What percentage of toal phenol is present in dimeric form?

Watch Video Solution

11. When 20g of naphtholic acid $\left(C_{11}H_8O_2\right)$ is dissolved in 50 g of benzene $\left(K_f = 1.72\text{K kg mol}^{-1}\right)$, a freezinf point depression of 2K is observed. The Van't Hoff factor (i) is

A. 0.5

B. 1

C. 2

D. 3

Answer: A

Watch Video Solution

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

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

Given: Freezing point depression constant of water

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

Freezing point depression constant of ethanol

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

Boiling point elevation constant of water

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

Boiling point elevation constant of ethanol

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

Standard freezing point of water $= 273K$

Standard freezing point of ethanol $= 155.7K$

Standard boiling point of water $= 373K$

Standard boiling point of ethanol $= 351.5K$

vapour pressure of pure water $= 32.8 mmHg$

Vapour pressure of pure ethanol $= 40 mmHg$

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

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

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

The freezing point of the solution M is :

A. 268.7K

B. 268.5K

C. 234.2K

D. 150.9K

Answer: D

Watch Video Solution

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

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

Given: Freezing point depression constant of water

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

Freezing point depression constant of ethanol

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

Boiling point elevation constant of water

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

Boiling point elevation constant of ethanol

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

Standard freezing point of water $= 273K$

Standard freezing point of ethanol $= 155.7K$

Standard boiling point of water $= 373K$

Standard boiling point of ethanol $= 351.5K$

vapour pressure of pure water $= 32.8mmHg$

Vapour pressure of pure ethanol $= 40mmHg$

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

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

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

The vapour pressure of the solution M is:

A. 39.3 mm of Hg

B. 36.0 mm of Hg

C. 29.5 mm of Hg

D. 28.8 mm of Hg

Answer: B

Watch Video Solution

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

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

Given : Freezing point depression constant of water $\left(K_f^{\text{water}}\right) = 1.86 K \text{mol}^{-1}$

Freezing point depression constant of ethanol $\left(K_f^{\text{ethonal}}\right) = 2.0 K kg \text{mol}^{-1}$

Boiling point elevation constant of water $\left(K_b^{\text{water}}\right) = 0.52 K kg \text{mol}^{-1}$

Boiling point elevation constant of ethanol $\left(K_b^{\text{ethonal}}\right) = 1.2 K kg mol^{-1}$

Standard freezing point of water $= 273K$

Standard freezing point of ethonal $= 155.7K$

Standard boiling point of water $= 373K$

Standard boiling point of ethanol $= 351.5K$

Vapour pressure of pure water $= 32.8 mmHg$

Vapour pressure of pure ethonal $= 40 mmHg$

Molecular weight of water $= 18 g \text{mol}^{-1}$

Molecular weight of ethonal $= 45 g \text{mol}^{-1}$

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

Water is added to the solution M such lthat the molecules fraction of water in t he solution becomes 0.9. The boiling point of this solution is :

A. 380.4 K

B. 376.2K

C. 375.5 K

D. 354.7K

Answer: B

Watch Video Solution

15. The Henry's law constant fo the solubility of N_2 gas in water at 298 K is 1.0×10^5 atm. The mole fraction of N_2 in air is 0.8. The number of moles of N_2 from air dissolved in 10 moles of water at 298K and 5 atm pressue is

A. 4.0×10^{-4}

B. 4.0×10^{-5}

C. 5.0×10^{-4}

D. 4.0×10^{-6}

Answer: A

Watch Video Solution

16. The freezing point $(\text{in}^{\circ}\text{C})$ of a solution containing 0.1 g of $K_3\left[Fe(CN)_6\right]$ (Mol. Wt. 329) in 100g of water $\left(K_f = 1.86\ \text{k kg mol}^{-1}\right)$ is

A. -2.3×10^{-2}

B. -5.7×10^{-2}

C. -5.7×10^{-3}

D. 4.0×10^{-6}

Answer: A

Watch Video Solution

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

is:

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

A. 724

B. 710

C. 736

D. 718

Answer: A

Watch Video Solution

18. Benzene and naphthalene from an ideal solution at room temperature. For this process, the true statement(s) is(are)

A. ΔG is positive

B. Δs_{System} is positive

C. $\Delta S_{\text{surrounding}} = 0$

D. $\Delta H = 0$

Answer: B,C,D

Watch Video Solution

19. MX_2 dissociates into M^{2+} and $X^{\ominus}$ ion in an aqueous solution, with a degree of dissociation (α) of 0.5. The ratio of the observed depression of freezing point of the aqueous solution to the value of the depression of freezing point in absence of ionic dissociation is

Watch Video Solution

20. If the freezing point of a 0.01 molal aqueous solution of a cobalt (III) chloride-ammonia complex (which behaves as a strong electrolyte) is $-0.0558^{\circ}C$, the number of chloride (s) in the coordination sphere of the complex if $\left[K_f \text{ of water } = 1.86 Kkgmol^{-1}\right]$

Watch Video Solution

21. At $80^\circ \mathrm{C}$, the vapour pressure of pure liquid 'A' is 250 mm Hg and that of pure liquid 'B' is 1000 mm Hg. If a mixture solution of 'A' and 'B' boils at $80^\circ \mathrm{C}$ and 1 atm pressure, the amount of 'A' in the mixture is : $(1\ \mathrm{atm}=760\ \mathrm{mm\ of\ Hg})$

A. 52 mol %

B. 34 mol%

C. 48 mol%

D. 50 mol%

Answer: D

Watch Video Solution

22. The vapour pressure of water at 20° is $17.5 mm Hg$. If $18g$ of glucose $(C_6H_{12}O_6)$ is added to $178.2g$ of water at $20^\circ C$, the vapour pressure of the resulting solution will be

A. 17.675 mm of Hg

B. 15.750 mm of Hg

C. 16.500 mm of Hg

D. 17.325 mm of Hg

Answer: D

Watch Video Solution

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

A. 200 and 300

B. 300 and 400

C. 400 and 600

D. 500 and 600

Answer: C

Watch Video Solution

24. A binary liquid solution is prepared by mixing n-heptane and ethanol. Which one of the following statements is correct regarding the behaviour of the solution?

A. The solution formed is an ideal solution

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

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

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

Answer: B

Watch Video Solution

25. If sodium sulphate is considered to be completely dissociated into cations and anions in aqueous solution , the change in freezing point of water $\left(\Delta T_f\right)$ when 0.01 mole of sodium sulphate is dissociated in 1 kg of water is : ($K_f = 1.86$ K kg mol^{-1})

A. 0.0744K

B. 0.0186

C. 0.0372

D. 0.0558

Answer: D

Watch Video Solution

26. On mixing, heptane and octane form an ideal solution. At $373K$ the vapour pressure of the two liquid components (heptane and octane) are $105kPa$ and kPa respectively. Vapour pressure of the solution obtained

by mixing 25.0 of heptane and $35g$ of octane will be (molar mass of heptane $= 100gmol^{-1}$ and of octane $= 114gmol^{-1}$):-

A. 96.2kPa

B. 144.5kPa

C. 72.0kPa

D. 36.1kPa

Answer: C

Watch Video Solution

27. Ethylene glycol is used as an antifreeze in a cold climate. Mass of ethylene glycol which should be added to 4 kg of water to prevent it from freezing at $-6^{\circ}C$ will be $\left(K_f \text{ for water } = 1.86Kkgmol^{-1}\right.$, and molar mass of ethylene glycol $\left. = 62gmol^{-1}\right)$

Watch Video Solution

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

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

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

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

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

Answer: A

Watch Video Solution

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

A. 39g

B. 27g

C. 72g

D. 93g

Answer: D

Watch Video Solution

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

A. 39g

B. 27g

C. 72g

D. 93g

Answer: D

Watch Video Solution

31. Consider separate solutions of $0.500MC_2H_5OH(aq)$, $0.100MMg_3(PO_4)(aq)$,$0.250MKBr(aq)$, and $0.125MNa_3PO_4(aq)$ at $25^\circ C$. Which statement is true about these solutions, assuming all salts to be strong electrolytes?

A. 0.100 M $Mg_3(PO_4)_2$(aq) has the highest osmotic pressure.

B. 0.125 M Na_3PO_4 (aq) has the highest osmotic pressure.

C. 0.500 M$C_2H_5OH(aq)$ has the highest osmotic pressure.

D. They all have the same osmotic pressure.

Answer: D

Watch Video Solution

32. The vapour pressure of acetone at $20^\circ C$ is 185 torr. When $1.2g$ of non-volatile substance was dissolved in $100g$ of acetone at $20^\circ C$ its vapour pressure was 183 torr. The moalr mass $\left(gmol^{-1}\right)$ of the substance is:

A. 128

B. 488

C. 32

D. 64

Answer: D

 Watch Video Solution