Q-1 - 11043221

Henry law constant for oxygen dissolved in water is$4.34 \times 10^4 atm$ at $25C$. If the partial pressure of oxygen in air is 0.4 atm.Calculate the concentration (in moles per litre) of the dissolved oxygen in equilbrium with air at 25^C.

SOLUTION:

Given :

Henry's law constant,$K_H = 4.34 \times 10^4 atm$

$P_{O_2} = 0.4 atm$

According to Henry's law'

$p = K_H \chi$

$\therefore pO_2 = K_H \chi o_2$

or

$$\chi \frac{o_2}{K_H} = \frac{0.4}{4.34} \times 10^4$$
$$= 9.2 \times 10^{-6}$$

Moles of water

$$(n_{H_2O}) = \frac{1000}{18}$$
$$= 55.5 mol$$

Mole fraction of oxygen

(χO_2)

$$= \frac{n_{O_2}}{(n_{O_2}) + n_{H_2O}}$$

Since n_{O_2} is very small in comparison to n_{H_2O},

$$\therefore \chi_{O2} = \frac{n_{O_2}}{n_{H_2O}}$$

or $\chi_{O_2} \times n_{H_2O} = n_{O_2}$

$9.2 \times 10^{-6} \times 55.5$

$= n_{O_2}$

or $n_{O_2} = 5.11 \times 10^{-4} mol$

Since $5.11 \times 10^{-4} mol$ are present in $1000 mL$ of

solution, therefore , molarity = $5.11 \times 10^{-4} M$.

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Q-2 - 11043234

Vapour pressure of pure $A(p_A) = 100$ mm Hg

Vapour pressure of pure $B(p_B) = 150$ mm Hg

2 mol of liquid A and 3 mol of liquid B are mixed to form an ideal solution. The vapour pressure of solution will be:

(A) $a.\ )185 mm$

(B) $b.\ )130 mm$

(C) $c.\ )148 mm$

(D) $d.\ )145 mm$

CORRECT ANSWER: B

SOLUTION:

$$\chi_A = \frac{2}{5}, \chi_B = \frac{3}{5},$$

Using Raoult's law equation,

$$P_{\text{total}} = p_A \cdot \chi_A + p_B \cdot \chi_B$$

$$= 100 \times \frac{2}{5} + 150 \times \frac{3}{5} = 40 + 90 = 130$$

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Q-3 - 11043235

The vapour pressure of pure benzene at $88C$ is $957mm$ and that of toluene at the same temperature is $379.5mm$. The composition of benzene-toluene misture boiling at $88C$ will be

(A)

$\chi_{\text{benzene}} = 0.66, \chi_{\text{toluene}} = 0.34$

(B)

$\chi_{\text{benzene}} = 0.34, \chi_{\text{toluene}} = 0.66$

(C)

$\chi_{\text{benzene}} = \chi_{\text{toluene}} = 0.5$

(D)

$\chi_{\text{benzene}} = 0.75, \chi_{\text{toluene}} = 0.25$

CORRECT ANSWER: A

SOLUTION:

$$p = p_{\text{benzene}} \cdot \chi_{\text{benzene}} + p_{\text{toluence}} \cdot \chi_{\text{toluence}}$$

760= 957

Q-4 - 11043237

$100mL$ of liquid A and $25mL$ of liquid B are mixed to form a solution of volume $125mL$. Then the solution is

(A) a.) Ideal

(B) b.) Non-ideal with positive deviation

(C) c.) Non-ideal with negative deviation

(D) d.) Cannot be predicted

CORRECT ANSWER: A

SOLUTION:

$\Delta_{mix}V = 0$, hence the solution is ideal.

Q-5 - 11043242

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

(A) $p_A^\circ \dfrac{\chi_2}{\chi_1}$

(B) $p_A^\circ \dfrac{\chi_1}{\chi_2}$

(C) $p_B^\circ \dfrac{\chi_1}{\chi_2}$

(D) $p_B \dfrac{{}^\circ\chi_2}{\chi_1}$

CORRECT ANSWER: A

SOLUTION:

$p_A = p_A^\chi - (2)$, vapour pressure of A.

Mole fraction of A in vapour = $\dfrac{p_A}{p_{\text{total}}}$

$$\chi_1 = \frac{p_A^\chi - (2)}{p}$$

$$p_{\text{total}} = \frac{p_A^{\chi} \_ (2)}{\chi_1}$$

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Q-6 - 11043247

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

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

SOLUTION:

$$P_M = p_A^{\chi} \_ (A) + p_B^{\chi} \_ (B)$$

$$P_M = p_A^{\chi} \_ (A) + p_B^{1 - \chi_A}$$

$$760 = 520\chi_A + 1000 - 1000\chi_A$$

$$\chi_A = \frac{240}{480} = 0.5$$

Therefore, $mol\ \% = 50$

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Q-7 - 11043261

Two liquids $A$and B have vapour pressures in the ratio of p_A, p_B = 1 : 2 at a certain temperature. Suppose we have an ideal solution of A and B in the mole fraction ratio $A : B = 1 : 2$. What would be the mole fraction of A in the vapour in equilibrium with the solution at a given temperature?

a.0.25 , b.0.2 , c.0.5 d.0.33

SOLUTION:

b. $p_A : p_B = 1 : 2$

$p_A : \chi_A \times p_A = A$
$\times \chi_A$

$p_B : \chi_B \times p_B = 2A$
$\times 2\chi_A$

$p_{\text{total}} = A\chi_A + 4A\chi_A$
$= 5A\chi_A$

$\chi_A(\text{ vapour phase })$

$$= \frac{P_A}{P_{\text{total}}} = \frac{A\chi_A}{5A\chi_A}$$
$$= \frac{1}{5} = 0.2$$

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Q-8 - 11043297

Lowering of vapour pressure due to a solute in 1 molal aqueous solution at $100C$ is

a.$13.44mmHg$,b. $14.14mmHg$,c.$13.2mmHg$,d. $35.2mmHg$

SOLUTION:

a.

$$Mw_B = \frac{\chi_B \times 1000}{(1 - \chi_B) Mw_A}$$

$$\left[\begin{array}{c} \chi_B \\ = \text{mole fraction of solute} \\ Mw_A \\ = \text{molar mass of solvent} \end{array} \right]$$

$$1 = \frac{\chi_B \times 1000}{(1 - \chi_B) \times 18}$$

$$\chi_B = 0.0176$$

$$\chi_A = 1 - 0.0176 = 0.9824$$

$$P = P\chi_A = 760 \times 0.9824 = 746.62$$

$$\Delta P = P - P = 760 - 746.62 \approx 13.41$$

Q-9 - 11043300

The relative lowering of the vapour pressure of an aqueous solution containing a non-volatile solute is 0.0125. The molality of the solution is

a. 0.80 , b.0.50 , c.0.70 , d.0.40

SOLUTION:

c. As we know

$$\frac{P - P}{P} = \chi_2$$ = mole fraction of solute

The ration $(P - P) / P$ is the relative lowering of vapour pressure, which is equal to 0.0125 here.

$$\therefore \chi_2 = 0.0125$$

The relation between m and χ is:

$$m = \frac{\chi_2 \times 1000}{\chi_1 \times Mw_1}$$

$$= \frac{0.0125 \times 1000}{(1 - 0.0125 \times 18)}$$

$$\left[\begin{matrix} & Mw_{(H_2O)} \\ = & 18gmol^{-1} \end{matrix} \right]$$

$$= \frac{0.0125 \times 1000}{0.9875 \times 18}$$

=0.70

$$\therefore m = 0.70$$

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Q-10 - 11043303

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

a. $Mw_A = Mw_B$, b. $Mw_A = Mw_B/2$,

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

SOLUTION:

d. Let solute (i) is added to solvents A and B.

For A

$$\frac{P_i - P_S}{P_i} = \chi_i$$

$$\approx \frac{Mw_A}{Mw_i}$$

For B

$$\frac{P_i - P_S}{P_i} = \chi_i$$

$$\approx \frac{Mw_B}{Mw_i}$$

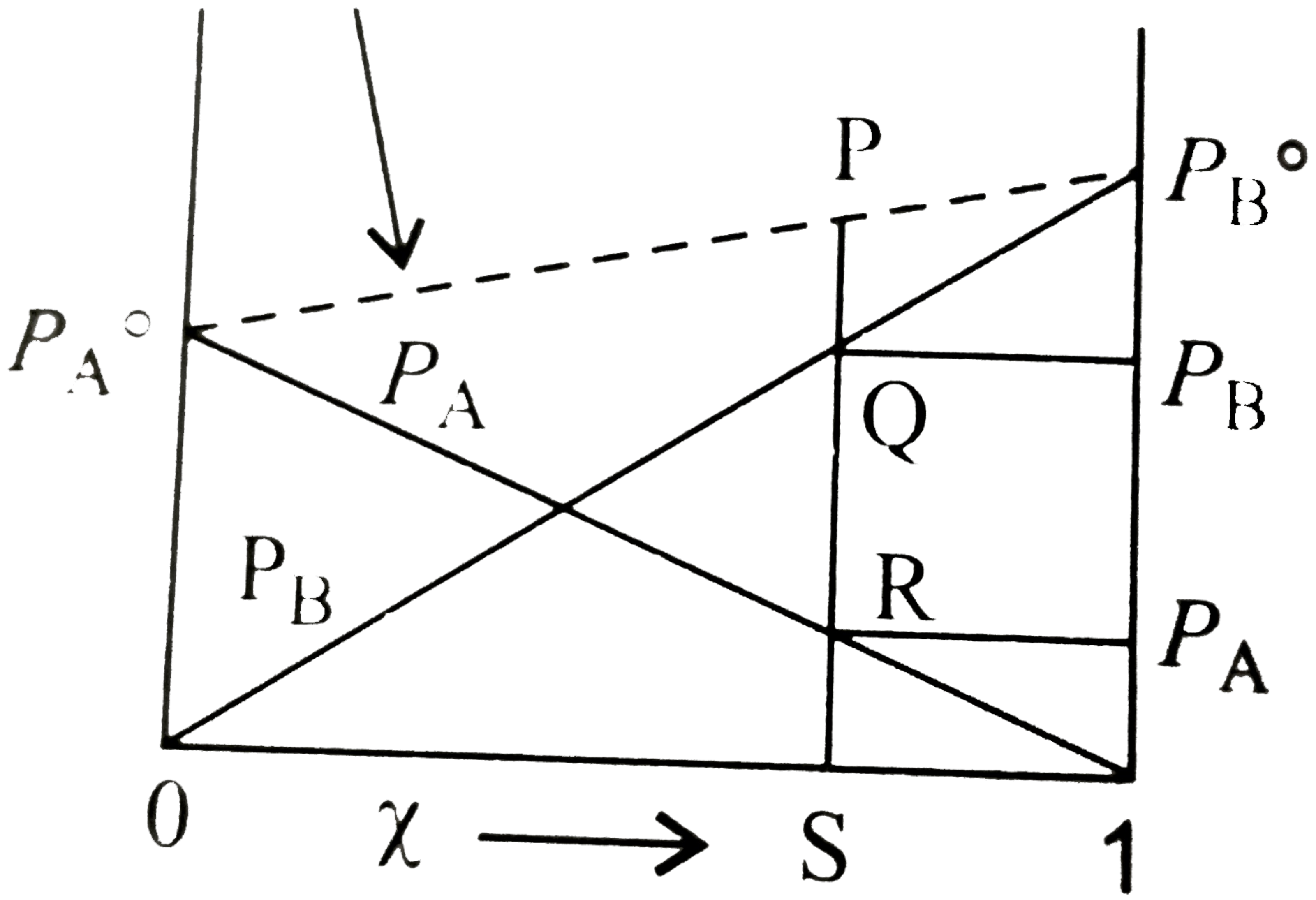
Given that lowering for solution A is twice to B.

$$\therefore \frac{Mw_A}{Mw_i} = 2\left(\frac{Mw_B}{Mw_i}\right) \Rightarrow Mw_A = 2Mw_B$$

Q-11 - 11043304

Consider the follwing vapour pressure composition graph. SP is equal to:

a. $PQ + RS$m , b. $PQ + QR$, c. $SR + SQ$, d. PQ + QR + RS



SOLUTION:

c. According to Dalton's rule: Total pressure of a gaseous solution is equal to the sum of partial pressure.

$$\therefore P_{\text{total}} = P_A + P_B$$

=$SR + SQ$

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Q-12 - 11043353

A liquid possessing which of the following characteristics will be most suitable for determining the molecular mass of a compound by cryoscopic measurements?

a.That having low freezing point and small enthalpy of fusion

b.That having high freezing point and small enthalpy of fusion

c.That having hifh freezing point and small enthalpy of vapourization d.That having large surface tension

SOLUTION:

b. $K_f$should be high so as to get a high value of ΔT_f

Now $K_f \propto \dfrac{T_f^2}{\Delta_{vap} H}$

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Q-13 - 11043844

$10.0g$ of glucose (π_1), $10.0g$ of (urea(π_2), and $10.0g$ of sucrose (π_3) are dissolved in $250.0mL$ of water at $273K(\pi = \text{osmotic pressure of a solution})$. The relationship between the osmotic pressure pressure of the solutions is

(A) $\pi_1 > \pi_2 > \pi_3$

(B) $\pi_3 > \pi_1 > \pi_2$

(C) $\pi_2 > \pi_1 > \pi_3$

(D) $\pi_2 > \pi_3 > \pi_1$

CORRECT ANSWER: C

SOLUTION:

$\pi = C_{\text{effective}} RT$,

Check yourself that

$$\underset{(Mw = 342)}{n_{\text{sucrose}}} < \underset{(Mw = 180)}{n_{\text{glucose}}} < \underset{(Mw = 60)}{n_{\text{urea}}}$$

$$(\pi_3 \langle \pi_1 \langle \pi_2) \text{ or } (\pi_2 \rangle \pi_1 \rangle \pi_3)$$

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Q-14 - 11043845

$0.6 g$ of a solute is dissolved in 0.1 litre of a solvent which develops an osmotic pressure of 1.23 at m at $27 C$. The molecular mass of the substance is

(A) $149.5 gmol^{-1}$

(B) $120.0 gmol^{-1}$

(C) $430.0 gmol^{-1}$

(D) None of these

CORRECT ANSWER: B

SOLUTION:

$$\pi = CRT$$

$$\Rightarrow 1.23 = \frac{0.6 / Mw_B}{0.1} \times 0.0821 \times 300$$

$$\Rightarrow Mw_B = 120.15 \text{gmol}^{-1}$$

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Q-15 - 11043846

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) 342

(B) 171.12

(C) 65.6

(D) 136.8

CORRECT ANSWER: C

SOLUTION:

Isotonic solutions: Same osmotic pressure (i.e., same $C_{\text{effective}}$ and assume $c \approx m$)

$$\Rightarrow \frac{5/342}{95/1000}$$

$$= \frac{1/Mw_2}{99/1000} \Rightarrow Mw_2$$

$$= 65.64 g\text{mol}^{-1}$$

Q-16 - 11043847

What mass of urea be dissolved in $171g$ of water so as to decrease the vapour pressure of water by $5\ \%$?

(A) $15g$

(B) $20g$

(C) $25g$

(D) $30g$

CORRECT ANSWER: D

SOLUTION:

$$\frac{\Delta P}{P_A} = \chi_B = 0.05 \text{ (given)}$$

$$0.05 = \frac{n_B}{n_B + n_A}$$
$$= \frac{n_B}{n_B + \left(\frac{171}{18}\right)}$$

$$\Rightarrow n_B = 0.5 \Rightarrow W_{\text{urea}}$$
$$= 0.5 \times 60 = 30g$$

[Urea: NH_2CONH_2]

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Q-17 - 11043848

The vapour pressure at a given temperature of an ideal solution containing $0.2 mol$ of non-volatile solute and $0.8 mol$ of a solvent is $60 mm$ of Hg. The vapour pressure of the pure solvent at the same temperature will be

(A) $120 mmHg$

(B) $150 mmHg$

(C) $60mmHg$

(D) $75mmHg$

CORRECT ANSWER: D

SOLUTION:

$$\frac{P_A - 60}{P} = \chi_B = 0.2$$
$$\Rightarrow P_A = 75mmHg$$

Q-18 - 11043849

Vapour pressure of a solution of $5g$of non-electrolyte in $100g$water at a particular temperature is$2985N/m^2$.The vapour pressure of pure water is$3000N/m^2$.The molecular weight of the solute is

(A) 60. 0

(B) 120. 0

(C) 180. 0

(D) 380. 0

CORRECT ANSWER: C

SOLUTION:

$$\frac{\Delta P}{P} = \chi_B = \Rightarrow \frac{\Delta P}{P}$$
$$= \chi_B$$
$$= \frac{5 / Mw_B}{5 / Mw_B + 100 / 18}$$

$$\Rightarrow Mw_B$$
$$= 179.28 g\text{mol}^{-1}$$

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Q-19 - 11043850

The molal boiling point constant for water is$0.513 Ckgmol^{-1}$.

When 0.1mole of sugar is dissolved in 200ml of water , the solution boils under a pressure of one atmosphere at

(A) $100.513^\circ C$

(B) $100.0513^\circ C$

(C) $100.256^\circ C$

(D) $101.025^\circ C$

CORRECT ANSWER: C

SOLUTION:

$$\Delta T_b = K_b . m = 0.513 \times \frac{0.1}{200/1000} = 0.256C$$

rArr T_(b) = 100 + 0.256 =100.256^()C`

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Q-20 - 11043851

What should be the boiling point of $1.0 molal$ aqueous KCl solution (assuming complete dissociation of KCl) if $K_b^{H_2O}$ is $0.52 K m^{-1}$?

(A) $100.52^\circ C$

(B) $101.04^\circ C$

(C) $99.48^\circ C$

(D) $98.96^\circ C$

CORRECT ANSWER: B

SOLUTION:

$$\Delta T_b = iK_b m = 2$$
$$\times 0.52 \times 1 = 1.04()C$$

rArr T_(b) = 100 + DeltaT_(b) =101.04^()C`

Q-21 - 11043852

The ratio of freezing point depression values of $0.01M$ solutions of urea, common salt, and Na_2SO_4 are

(A) $1:1:1$

(B) $1:2:1$

(C) $1:2:3$

(D) $2:2:3$

CORRECT ANSWER: C

SOLUTION:

ΔT_f depends of on m_{eff} and $\Delta T_f = iK_f m$

$\text{Urea}, i = 1, NaCl : i = 2, Na_2SO_4 : i = 3$

Q-22 - 11043853

From a measurement of the freezing point depression of benzene, the molecular weight of acetic acid in a benzene solution was determined to be 100. The percentage association of acetic acid is

(A) $79\ \%$

(B) $93\ \%$

(C) $80\ \%$

(D) $100\ \%$

CORRECT ANSWER: C

SOLUTION:

$$i = \frac{60}{100} = 1 - \frac{\alpha}{2}$$
$$\Rightarrow \alpha = 80\ \%$$

Q-23 - 11043855

An aqueous solution containing an ionic salt having molality equal to 0.19 freezes at $-0.704C$. The Van't Hoff factor of the ionic salt is (K_f for water=$1.86Km^{-1}$)

(A) 3

(B) 2

(C) 4

(D) 5

CORRECT ANSWER: B

SOLUTION:

$$\Delta T_f = iK_f m \Rightarrow 0.704$$
$$= I \times 1.86 \times 0.19$$
$$\Rightarrow i = 2$$

Q-24 - 11043856

The Van't Hoff factor of a $0.1 M Al_2(SO_4)_3$ solution is 4.20. The degree of dissociation is

(A) $80\ \%$

(B) $90\ \%$

(C) $78\ \%$

(D) $83\ \%$

CORRECT ANSWER: A

SOLUTION:

$$Al_2(SO_4)_3 \Leftrightarrow 2Al^{3+} + 3SO_4^{2-}$$

$$\begin{matrix} 1 & 0 & 0 \\ 1-\alpha & 2\alpha & 3\alpha \end{matrix}$$

$$i = 1 - \alpha + 2\alpha + 3\alpha$$
$$= 1 + 4\alpha = 4.2 \Rightarrow \alpha$$
$$= 0.8$$

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Q-25 - 11043857

The degree of dissociation α of a week electrolyte is

where n is the number of ions given by $1 mol$ of electrolyte.

(A) $\dfrac{i-1}{n+1}$
(B) $\dfrac{i-1}{n-1}$
(C) $\dfrac{n-1}{i-1}$
(D) $\dfrac{n+1}{i-1}$

CORRECT ANSWER: B

SOLUTION:

$nA \Leftrightarrow A_n \quad A_n \Leftrightarrow nA$

$1, \quad 1$
$(1-\alpha, \alpha/n) \quad (1$
$-\alpha, n\alpha)$

$i = 1 - \alpha + \alpha/n \quad i$
$= 1 - \alpha + n\alpha$

$$\Rightarrow \alpha = \frac{i-1}{n-1}$$

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Q-26 - 11043860

Equimolal solutions KCl and compound X in water show depression in freezing point in the ratio of $4:1$, Assuming KCl to be completely ionized, the compound X in solution must

(A) Dissociate to the extent of $50\ \%$

(B) Hydrolyze to the extent of $80\ \%$

(C) Dimerize to the extent of $50\ \%$

(D) Trimerize to the extent of $75\ \%$

CORRECT ANSWER: D

SOLUTION:

$$\underset{(\text{p moles})}{KCl} \quad \text{and} \quad \underset{(\text{p moles})}{X}$$
$$\Delta T_f(KCl) = iK_f m$$
$$= 2K_f m$$

$$\Delta T_{f(X)} = iK_f.\, m$$
$$= \frac{1}{2}\left(2K_f m\right) \Rightarrow i$$
$$= \frac{1}{2}(<1)$$

$$2X \Leftrightarrow X_2$$
$$1 \qquad 0$$
$$1-\alpha \quad a/2$$

$$i = 1 + \alpha + \frac{\alpha}{3} = 1$$

$$- \frac{2\alpha}{3} = \frac{1}{2} \Rightarrow \alpha$$

$$= \frac{3}{4} = 75\,\%$$

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Q-27 - 11043477

The freezing point of a $3\,\%$ (by weight) aqueous solution of A is equal to the freezing point of $9\,\%$ (by weight) aqueous solution of B. If the molecular weight of A is 60, then the molecular weight of B will be

a191 ,b.90 , c.45 , d.20

SOLUTION:

a. Freezing point of aqueous solution of A =Freezing point of water -ΔT_f of solution A

Freezing point of aqueous solution of B =Freezing point of water -ΔT_f of solution B

As freezing point of aqueous solution of A

=Freezing point of aqueous solution of B

$\therefore$ ΔT_f of solution A =ΔT_f of solution B

$$K_f m = K_f m'$$

$$\frac{3/60}{97} \times 1000$$

$$= \frac{9/Mw_B \times 1000}{91}$$

$$\therefore Mw_B = 191$$

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Q-28 - 11043480

Which has maximum osmotic pressure at temperature T?

a. $100mL$ of $1M$ urea solution

b. $300mL$ of $1M$ glucose solution

c. Misture of $100mL$ of $1M$ urea solution and $300mL$ of $1M$

glucose solution

d. All are isotonic

SOLUTION:

d. All are isotonic

Osmotic pressure (π) depends upon the concentration of solution, i.e., $\pi = C_{\text{effective}} RT$

For (a), $C_{\text{effective}} = 1M$ (since it is non-electrolytic solution)

For (b), $C_{\text{effective}} = 1M$ (since it is non-electrolytic solution)

For c,

$$C_{\text{effective}} = \left[\frac{100}{100+300} \times 1 + \frac{300}{100+300} \times 1\right] = 1M$$

Q-29 - 11043482

At $17C$, the osmotic pressure of sugar solution is 580 torr. The solution is diluted and the temperature is raised to $57C$, when the osmotic pressure is found to be 165 torr. The extent of dilution is

a.2 times ,b.3 times ,c.4 times ,d.5 times

SOLUTION:

c.Given

$$T_i = 17C = 290K, T_f$$
$$= 57C = 330K$$

$$\pi(i) = 580\text{torr}$$
$$= \frac{580}{760} mmHg$$

$$\pi(f) = 165\text{torr}$$
$$= \frac{165}{760} mmHg$$

Using equation

$$\pi = CRT$$

$$\frac{580}{760} = C_i \times R \times 290 \text{ .(i)}$$

$$\frac{165}{760} = C_f \times R \times 330 \text{ .(ii)}$$

Dividing Eq. (i) by Eq. (ii), we get

$$\frac{C_i}{C_f} = \frac{2}{1} / 2 = 4 \Rightarrow \text{ Dilution = 4 times}$$

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Q-30 - 11043484

Among the following the solution which shows the lowest osmotic pressure is

a. 0.14 M NaCl , b. 0.05 M $CaCl_2$,

c. 0.04 M $K_3[Fe(CN)_6]$, d. 0.03 M $FeCl_3$

SOLUTION:

$$\pi = C_{\text{effective}} RT$$

a.

$$C_{\text{effective}} = 0.1 \times 2$$
$$= 0.2M$$

b.

$$C_{\text{effective}} = 0.05 \times 3$$
$$= 0.15M$$

c.

$$C_{\text{effective}} = 0.04 \times 4$$
$$= 0.16M$$

d.

$$C_{\text{effective}} = 0.03 \times 4$$
$$= 0.12M$$

$\Rightarrow C_{\text{effective}}$ is lowest for (d).

Q-31 - 11043485

A $0.1M$ solution of glucose (molecular weight $180 g mol^{-1}$) and a $0.1M$ solution of urea (molecular weight 60 g mol^{-1}) are placed on the two sides of a semi-permeable membrane to equal heights. In this context, which of the following statements is correct?

a. Glucose will flow across the membrane into the urea solution.

b. Urea will flow across the membrane into the glucose solution.

c. Water will flow across the membrane from the urea solution into the glucose solution.

d. There will be no net movement across the membrane.

SOLUTION:

$0.1M$ glucose and $0.01M$ urea

Since both the solutions have some concentrations, there will be no net movement of water molecules across the membrane.

Q-32 - 11043491

Phenol associates in water to double molecules. The values of observed and calculated molecular weight of phenol are 161.84 and 94 , repectively. The degree of association are 161.84 and 94 , repectively. The degree of association of phenol will be

a. 60% , b. 84% , c. 45% , d. 80%

SOLUTION:

b.

$$i = \frac{\text{Calculated molecular weight}}{\text{Observed molecular weight}} = \frac{94}{161.84} = 0.58$$

$$\alpha = \frac{1-i}{1-n}$$
$$= \frac{1-0.58}{1-0.5} = \frac{0.42}{0.5}$$

$$\% \alpha = \frac{0.42}{0.5} \times 100$$
$$= 84\ \%$$

Q-33 - 11043499

Which of the following solutions in H_2O will show maximum depression in freezing point?

a.$0.1 M K_2[Hgl_4]$, b. $0.2 M Ba(NO_3)_2$

c.$0.3 M$glucose , d.$0.4 M NaCl$

SOLUTION:

Depression in freezing point $\propto$ Number of moles

Therefore, greater the number of moles greater will be depression in freezing point.

$\therefore$ For 0.2 M $Ba(NO)_3)_2$, i=3

Q-34 - 11043500

Elevation in boiling point studies of $Ca(NO_3)_2$ gives molar mass as 131.2. The degree of dissociation of $Ca(NO_3)_2$ is

a.100 $\%$, b.75 $\%$, c.50 $\%$, d.12.5 $\%$,

SOLUTION:

$$i = 1 + 2\alpha$$

Calculate Mw of $Ca(NO_3)_2$ =164

Observed Mw of $Ca(NO_3)_2$ =131.2

$$\therefore i = \left(\frac{164}{131.2}\right) = 1 + 2\alpha$$

$$\therefore \alpha = 0.125 = 12.5\%$$

Q-35 - 11043600

The use of common salts, e.g., $NaCl$ or $CaCl_2$ anhydrous, is made to clear snow on the rods. This causes:

(A) A lowering in the freezing point of water.

(B) A lowering in the melting point of ice.

(C) Ice melts at the temperature of atmosphere present at that time.

(D) All of these

CORRECT ANSWER: D

SOLUTION:

Addition of salt lowers the freezing point of water and thus snow melts.

Q-36 - 11043602

Assuming each salt to be 90 % dissociated which of the following will have the highest osmotic pressure?

(A) Decinormal $Al_2(SO_4)_3$

(B) Decinormal $BaCl_2$

(C) Decinormal Na_2SO_4

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

CORRECT ANSWER: A

SOLUTION:

$Al_2(SO_4)_3$ furnishes maximum number of ions.

Q-37 - 11043604

If a thin slice of sugar beet is placed in concentrated solution of $NaCl$, then

(A) Sugar beet will lose water from its cells.

(B) Sugar beet will absorb water from solution.

(C) Sugar beet will neither absorb nor lose water

(D) Sugar beet will dissolve in solution.

CORRECT ANSWER: A

SOLUTION:

Osmosis occurs from dilute solution to concentrated solution, i.e., exosmosis.

Q-38 - 11043606

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

(A) The solution is highly saturated.

(B) Positive deviation from Raoult's law.

(C) Negative deviation from Raoult's law.

(D) Nothing can be said.

CORRECT ANSWER: B

SOLUTION:

Positive deviation from Raoult's law are noticed when Experimental value of vapour pressure of mixture is more than calculated value.

Experimental value of boiling point of mixture is less than the calculated value.

$$\Delta_{\text{mixing}} H = +ve$$
$$\Delta_{\text{mixing}} V = +ve$$

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Q-39 - 11043607

Which salt shows maximum osmotic pressure in its $1m$ solution.

(A) $AgNO_3$

(B) Na_2SO_4

(C) $(NH_4)(3)PO_4$

(D) $MgCl_4$

CORRECT ANSWER: C

SOLUTION:

Osmotic pressure $\propto$ moles,

$(NH_4)_3PO_4$ furnishes 4 ions in solution.

Q-40 - 11043609

Azeotropic mixtures are

(A) Constant boiling point mixture without changing the composition.

(B) Those which boil at different temperatures.

(C) Mixtures of two solids.

(D) None of the above

CORRECT ANSWER: A

SOLUTION:

The difinition of azeotropic mixture.

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Q-41 - 11043610

Which solution will show maximum elevation in boiling point?

(A) $0.1MKCl$

(B) $0.1MBaCl_2$

(C) $0.1MFeCl_3$

(D) $0.1MFe_2(SO_4)_3$

CORRECT ANSWER: D

SOLUTION:

$Fe_2(SO_4)_3$ furnishes more number of ions.

Q-42 - 11043611

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

(A) $< 50 mL$

(B) $> 50 mL$

(C) $= 50 mL$

(D) Cannot be predicted.

CORRECT ANSWER: A

SOLUTION:

The interparticle forces in between $CHCl_3$ and acetone increase due to H-bonding and thus $\Delta_{\text{mixing}} V$ becomes negative.

Q-43 - 11043615

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

(A) $> 20mL$

(B) $< 20mL$

(C) $= 20mL$

(D) Cannot be predicted.

CORRECT ANSWER: C

SOLUTION:

No changes in interparticles forces as both are non-polar.

Q-44 - 11043622

Each pair forms ideal solution except

(A) C_2H_5Br and C_2H_5I

(B) C_2H_5Cl and C_2H_5Br

(C) C_6H_6 and $C_6H_5CH_3$

(D) C_2H_6I and C_2H_5OH

CORRECT ANSWER: D

SOLUTION:

C_2H_5OH show H-bonding as well as polarity both.

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Q-45 - 11043629

Blood has been found to be isotonic with

(A) Normal saline solution

(B) Saturated $NaCl$ solution

(C) Saturated KCl solution

(D) Saturated solution of a 1:1 mixture of $NaCl$ and KCl

CORRECT ANSWER: A

SOLUTION:

Normal saline is $0.16 M NaCl$ solution.

Q-46 - 11043630

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 of Raoult's law

CORRECT ANSWER: C

SOLUTION:

For an ideal solution.

$\Delta_{\text{mixing}}H = 0, \Delta_{\text{mixing}}V = 0$ and it should obey Raoult's law.

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Q-47 - 11043638

The colligative properties of a solution depend on

(A) The number of solute particles present in it

(B) The chemical nature of the solute particles present in it

(C) The nature of the solvent used

(D) None of these

CORRECT ANSWER: A

SOLUTION:

Colligative properties are properties of solution which depend on the number of particles present in solution.

Q-48 - 11043645

Equimolal solutions A and B show depression in freezing point in the ratio $2:1$. A remains in the normal state in solution. B will be

(A) Normal in solution

(B) Dissociated in solution

(C) Associated in solution

(D) Hydrolysed in solution

CORRECT ANSWER: C

SOLUTION:

$\frac{\Delta T_{f_A}}{\Delta T_{f_B}} = \frac{2}{1} = \frac{1}{1/2}$, i.e., B should associate to show higher ΔT.

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Q-49 - 11043647

If P and P_s are vapour pressure of solvent and its solution, respectively, χ_1 and χ_2 are mole fractions of solvent and solute, respectively, then

(A) $P_s = P^\circ / \chi_2$

(B) $P^\circ - P_s = P^\circ \chi_2$

(C) $P_s = P^\circ \chi_2$

(D) $\dfrac{P^\circ - P_s}{P_s} = \dfrac{\chi_1}{\chi_1 + \chi_2}$

CORRECT ANSWER: B

SOLUTION:

$\dfrac{P - P_S}{P}$ = Mole fraction of solute = χ_2

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Q-50 - 11043649

The value of K_f for water is 1.86, calculated from glucose solution,

The value of K_f for water calculated for NaCl solution will be,

(A) $= 1.86$

(B) < 1.86

(C) > 1.86

(D) Zero

CORRECT ANSWER: A

SOLUTION:

K_b is characteristic constant for given solvent.

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Q-51 - 11043650

What will be the molecular weight of $NaCl$ determined experimentally following elevation in the boiling point or depression in freezing point method?

(A) < 58.5

(B) > 58.5

(C) $= 58.5$

(D) None

CORRECT ANSWER: A

SOLUTION:

Normal molecular weight of electrolyte gt Experimental molecular weight.

Q-52 - 11043658

Which aqueous will have the highest boiling point?

(A) 1% glucose in water

(B) 1% sucrose in water

(C) 1% NaCl in water

(D) 1 $\% CaCl_2$ in water

CORRECT ANSWER: C

SOLUTION:

More is ΔT_b more is boiling point.

Q-53 - 11043659

Which of the following solutions has the minimum freezing point

(A) 1 molal NaCl solution

(B) 1 molal KCl solution

(C) $1 molal CaCl_2$ solution

(D) 1 molal urea solution

CORRECT ANSWER: C

SOLUTION:

More is ΔT_f lesser is freezing point.

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Q-54 - 11043660

The osmotic pressure of equimolar solutions of $BaCl_2$,$NaCl$,and glucose follow the order

(A)
$BaCl > NaCl > Glu\cos e$

(B)
$Glu\cos e > NaCl > BaCl_2$

(C)
$NaCl > BaCl_2 > Glu\cos e$

(D)
$NaCl > Glu\cos e > BaCl_2$

CORRECT ANSWER: A

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Q-55 - 11043668

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

(A) $1.64 atm$

(B) $2.46 atm$

(C) $4.10 atm$

(D) $2.05 atm$

CORRECT ANSWER: D

SOLUTION:

$\pi = \frac{\pi_1 + \pi_2}{2}$, if equal volumes are mixed,volume of solution becomes double.

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Q-56 - 11043669

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

(A) 31.25

(B) 3.125

(C) 312.5

(D) None

CORRECT ANSWER: A

SOLUTION:

$P - P_S \propto$ loss in weight of water chamber.

and $P_S \propto$ loss in weight of solution chamber.

$$\frac{P - P_S}{-P_S =} \frac{n_2}{n_1}$$

$$= \frac{W_2 \times Mw_1}{Mw_2 \times W_1}$$

or $\frac{0.04}{2.50} = \frac{5 \times 18}{Mw_2 \times 180}$

$\therefore Mw_2 = 31.25$

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Q-57 - 11043671

What should be the freezing point of aqueous solution containing

$17g$ of $C_2H(5)OH$ is $1000g$ of water (K_f for water =

$1.86 deg kg mol^{-1}$)?

(A) $-0.69^{\circ}C$

(B) $-0.34^{\circ}C$

(C) $0.0^{\circ}C$

(D) $-0.34^{\circ}C$

CORRECT ANSWER: A

SOLUTION:

$$\Delta T_f = \frac{1000 \times 1.86 \times 17}{46 \times 1000} = 0.69C$$

$$T_f = 0 - 0.69 = -0.69C$$

Q-58 - 11043675

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

(A) $100.52^{\circ} C$

(B) $101.04^{\circ} C$

(C) $99.48^{\circ} C$

(D) $98.96^{\circ} C$

CORRECT ANSWER: B

SOLUTION:

$$\Delta T_b = K_b \times m = 0.52 \times 1 \times 2 = 1.04$$

,

$$\therefore T_b = 100 + 1.04 = 101.04 C$$

Q-59 - 11043676

If a $6.84\,\%\,(weight/volume)$ solution of cane sugar (molecular weight=342) is isotonic with $1.52\,\%\,(weight/volume)$solution of thiocarbamide, then the molecular weight of thiocarbamide is

(A) 152

(B) 760

(C) 60

(D) 180

CORRECT ANSWER: B

SOLUTION:

For two non-electrolyte solutions, if isotonic $C_1 = C_2$.

$$\therefore \frac{6.84 \times 100}{342 \times 100} = \frac{1.52 \times 1000}{Mw_2 \times 100}$$

$$\Rightarrow Mw_2 = 760$$

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Q-60 - 11043679

The Van't Hoff factor of very dilute solution of $Ca(NO_3)_2$

(A) 1

(B) 2

(C) 3

(D) 4

CORRECT ANSWER: C

SOLUTION:

$$Ca(NO_3)_2 \rightarrow Ca^{2+} + 2NO_3^{?}$$

1	0	0
0	1	2

$$i = \frac{\text{Moles after dissociation}}{\text{Moles before dissociation}} = \frac{3}{1}$$