www.AnkitGuptaClasses.weebly.com
gupta.ankit54@yahoo.com
ankitgupta.gupta175@gmail.com
9899875480.
9541241201


## UNIT—2

## SOLUTION

### 1 MARK QUESTIONS

**Q. 1. The vapour pressure of deliquescent substance is less or more than that of water vapours in air ?**

**Ans.** Less than that of water vapours in air.

**Q. 2. If $\alpha$ is the degree of dissociation of $Na_2SO_4$ then write the Vant Hoff factor used for calculating the molecular mass.**

**Ans.** $\alpha = i - 1 / m - 1$

$\alpha (m - 1) = i - 1$

$1 + \alpha (m - 1) = i$

$i = 1 + \alpha (3 - 1)$

$= 1 + 2 \alpha.$

**Q. 3. If $6.023 \times 10^{20}$ molecules of urea are present in 100 ml of its soln. then what is the conc. of urea soln. ?**

**Ans.** $N_0 = 6.023 \times 10^{23}$ = 1 mol

$6.023 \times 10^{20}$ molecules = 0.001 mol in 10 ml

$$M = \frac{N \times 1000}{v} = \frac{.001 \times 1000}{10 \times 1000}$$

= 0.01 M.

**Q. 4. Why camphor is used in molecular mass determination ?**

**Ans.** Because it has very high cryoscopic constant.

It has large depression in m. p. when an organic solute is dissolved in it.

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**Q. 5. 0.004 M soln of $Na_2SO_4$ is isotonic with 0.01 M soln of glucose at the temp. What is the apparent degree of dissociation of $Na_2SO_4$ ?**

**Ans.** 75%

**Q. 6. What happen when mango is placed in dilute aqueous soln of HCl ?**

**Ans.** When mango is placed in dilute aqueous soln. of HCl it swells.

**Q. 7. Out of (a) 200 ml of 2 M NaCl Soln and (b) 200 ml of 1 M glucose Soln. which one has higher osmotic pressure ?**

**Ans.** (a) 200 ml of 2 M NaCl Soln.

NaCl is an electrolyte which dissolve to give ions. Glucose and urea are non electrolytes. Thus glucose has minimum conc. and hence minimum osmotic pressure.

**Q. 8. Out of (a) 0.01 M $KNO_3$ (b) 0.01 M $Na_2SO_4$ which aqueous soln. will exhibit high B. P. ?**

**Ans.** (a) 0.01 M $Na_2SO_4$

**Q. 9. Out of (a) 1 M $CaCl_2$ (b) 1 M $AlCl_3$ which aqueous soln. will show max. vapour pressure at 300 K ?**

**Ans.** (a) 1 M $CaCl_3$, if we assume 100% dissociation, i for $CaCl_2$ = 3 and $AlCl_3$ = 4 and relative lowering of V. P. is directly proportional to i.

**Q. 10. Out of (a) $HNO_3 + H_2O$ and (b) $C_6H_6 + C_6H_5CH_3$ which will form max. boiling azeotrope ?**

**Ans.** (a) $HNO_3 + H_2O$.

**2 MARKS QUESTIONS**

**Q. 1. Two solns of a substance (non-electrolyte) are mixed in the following manner – 480 ml of 1.5 M (First Soln) + 520 ml of 1.2 M (Second Soln). What is the molarity of the final mixture ?**

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**Ans.** Total molarity $= \frac{M_1V_1 + M_2V_2}{V_1 + V_2}$

$= \frac{1.5 \times 480 + 1.2 \times 520}{480 + 520} = 1.344$ M

**Q. 2. To get the hard boiled eggs, why common salt is added to water before boiling the eggs ?**

**Ans.** Due to addition of common salt the B. P. of the salt containing water elevated, hence the egg at high temp. becomes hard.

**Q. 3. Equimolal Soln of NaCl and $BaCl_2$ are prepared in $H_2O$. B. F. pt. of NaCl is found to be – 2 °C. What freezing point do you expect from $BaCl_2$ soln ?**

**Ans.** i for NaCl = 2 i for $BaCl_2$ = 3

$$\frac{\Delta T_F(NaCl)}{\Delta T_F(BaCl_2)} = \frac{2}{3}$$

Therefore $\Delta T_F$ ($BaCl_2$) = $\frac{3 \times 2}{2} = 3$

$\Delta T_F$ for $BaCl_2$ = 3 °C

$T_F$ = – 3 °C.

**Q. 4. Why water cannot be separated completely from ethyl alcohol by fractional distillation ?**

**Ans.** Ethyl alcohol and water (95.4% ethyl alcohol and 4.6% water) form constant boiling mixture (azeotrope) boiling at 351.1 °K. Hence, further water cannot be separated completely from ethyl alcohol by fractional distillation.

**Q. 5. Why a person suffering from high blood pressure is advised to take minimum quantity of common salt ?**

**Ans.** Osmotic pressure is directly proportional to the conc. of solutes. Our body fluid contain a number of solutes. On taking large amount of salts, ions enter the body fluid there by raising the conc. of the solutes. As a result osmotic pressure increases which may rapture the blood cells.

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**Q. 6. Chloro acetic acid is a monoprotic acid and has $K_a = 1.36 \times 10^{-3}$. Calculate b. p. of 0.01 M aqueous soln ? ($K_b$ = 0.51 k kg/mol)**

**Ans.** $K_b$ = 0.51 k kg/mol

$\alpha = K_a / C$

$= 1.36 \times 10^{-3} / 0.01$

$= 0.3687$

$i = 1 + \alpha$

$= 1 + 0.3687 = 1.3687$

$\Delta T_b = i \times K_b\ m$

$= 1.36 \times 10^{-2} \times .51$

$= 0.0069\ °C$

**Q. 7. Which colligative property is preferred for the molar mass determination of macro molecules ? Why ?**

**Ans.** Osmotic pressure is preferred over all other colligative properties because :

(a) even in dil. soln the o. p.values are appreciably high and can be measured accurately.

(b) o. p.can be measured at room temp. on the other hand elevation in B. P. is measured at high temp. where the solute may decompose. The depression in freezing point is measured at low temp.

**Q. 8. How much ethyl alcohol must be added to 1 litre of water so that the solution will freeze at 14 °F ? ($K_f$ for water = 1.86 °C/mol)**

Ans. $(14 - 32) / 9 = C / 5$

$C = 5 \times (-18) / 9$

$= -10\ °C$

$\Delta T_F = \dfrac{K_F \times 1000 \times W_b}{W_a \times M_b}$ $W_b$ = mass of solute

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$M_b$ = molar mass of solute

$W_a$ = mass of solvent

$$10 = \frac{1.86 \times 1000 \times W_b}{1000 \times 46}$$

$W_b$ = 247.31 g

**Q. 9. 75.2 g of phenol is dissolved in solvent of $K_F$ = 14, if the depression in freezing point is 7 k. What is the % of phenol ?**

**Ans.** $K_F = 14$

$$M_b = \frac{1000 \times K_F \times W_2}{W_1 \times \Delta T_F}$$

Taking the solvent as 1 kg

$$M_b = \frac{1000 \times 14 \times 75.2}{1000 \times 7k}$$

= 150.4 g per mol

phenol (molar mass) — 94 g/mol

$$i = \frac{\text{Calculated molar mass}}{\text{Observed molar mass}}$$

= 94 / 150.4 = 0.625

$$2\ C_6H_5OH \longleftrightarrow (C_6H_5OH)_2$$

| | |
|---|---|
| 1 | 0 |
| $1 - \alpha$ | $\alpha / 2$ |

Total $= 1 - \alpha + \alpha / 2$

$= 1 - \alpha / 2$

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i = 1 – α + α / 2

= 1 – α / 2 = 0.625

α / 2 = 0.375

α = 0.75

% of association = 75%

**Q. 10. How many ml of 0.1 M HCl are required to react completely with 1 gm mixture of $Na_2CO_3$ & $NaHCO_3$ containing equimolar amounts of both ?**

**Ans.** Let the amount of $Na_2CO_3$ be x

Let the amount of $NaHCO_3$ be 1 – x

Since no. of moles of both are equal

$$\frac{x}{N(Na_2CO_3)} = \frac{1-x}{M(NaHCO_3)}$$

$$\frac{x}{106} = \frac{1-x}{84}$$

84 x = 106 – 106 x

x = 0.5578

$XNa_2CO_3$ = 0.5578 / 106

= 0.00526

$XNaHCO_3$ = 0.00526

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$Na_2CO_3 + 2\ HCl \longrightarrow 2\ NaCl + CO_2 + H_2$

$NaHCO_3 + HCl \longrightarrow NaCl + CO_2 + H_2O$

$M_1V_1 = 2\ M_2V_2 + M_3V_3$

$0.1 \times V_1 = 2 \times 0.00526 + 0.00526$

$V_1 = \dfrac{0.01578}{0.1}$

$= 0.1578\ L$

$V = 157.8$ ml.

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