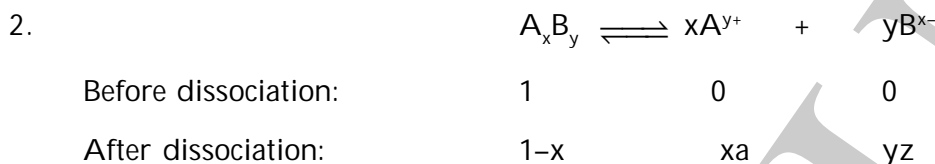


**SOLUTION TEST-B**

1. For isotonic solutions,  $\pi = \pi'$  or  $\frac{n_B}{V} = \frac{n_B'}{V}$  or  $\frac{w_B}{M_B} = \frac{w_B'}{M_B'}$   $\therefore M_B = \frac{0.5 \times 342}{2}$

$M_B = 85.5 \text{ g mol}^{-1}$

**The correct answer is (ii)**



$i = \frac{1 - \alpha + x\alpha + y\alpha}{1 + 0 + 0} = 1 - x + (x + y)\alpha$

$i = 1 - [1 - (x + y)]\alpha$

$[1 - (x + y)]\alpha = 1 - i$

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

**The correct answer is (iii)**

3. 93% w/V means 93 g  $H_2SO_4$  in 100 ml solution  $V_{sol} = 100 \text{ ml}, d_{sol} = 1.80 \text{ g/ml}$

$n_{H_2SO_4} = \frac{93}{98} = 0.95 \text{ mol}$

$m = \frac{0.95}{87} \times 1000$

$w_{soln} = 100 \times 1.80 = 180 \text{ g}$

$m = 10.92 \text{ m}$

$w_{H_2O} = 180 - 93 = 87 \text{ g}$

**The correct answer is (ii)**

4. Both assertion and reason are correct but reason is not the correct explanation.

**The correct answer is (ii)**

5. Azeotropic mixture have a constant composition in the liquid and the vapour phase. These mixtures are formed when the mixture shows deviations from Raoult's law.

6. It states that partial vapour pressure of a component in solution is directly proportional to its mole-fraction.

7. The solute is an electrolyte which associates.

8. (i) Acetone + chloroform shows negative deviation  $\Delta H_{mix} = -ve$

(ii) Ethanol + water shows positive deviations.  $\Delta H_{mix} = + ve$

9.  $M_B = 58.5 \text{ g/mol}, w_A = 1 \text{ kg} = 1000 \text{ g}$  and  $i = 2$  for NaCl.

$\Delta T_f = 3k, k_f = 1.86^\circ\text{C kg mol}^{-1}$

$$\Delta T_f = i \frac{k_f w_B 1000}{M_B w_A}$$

$$\therefore w_B = \frac{\Delta T_f M_B w_A}{i k_f 1000}$$

$$w_B = \frac{3 \times 58.5 \times 1000}{2 \times 1.86 \times 1000}$$

$$w_B = 47.18 \text{ g}$$

10. (i) Oxygen is diluted with helium gas as helium gas is less soluble and prevents the formation of bends when the diver comes to the surface.
- (ii) Pure water enter into the blood cells due to the process called osmosis. The blood cells swells up and finally burst.
11. Osmotic pressure is the extra pressure developed on the solution side when flow of solvent takes place from pure solvent side to the solution side through a semipermeable membrane. It is given by  $\pi$

$$\pi = M R T \quad M = \text{molarity}$$

$$\pi = \frac{w_B}{M_B} \frac{R T}{V}$$

$$\therefore \text{molar mass of solute, } M_B = \frac{w_B R T}{\pi V}$$

Osmotic pressure is preferred over other colligative properties because it can be used at room temperature.

12. (i)  $n_{EG} = \frac{222.6}{62} = 3.59 \text{ mol}$

$$\text{molality, } m = \frac{n_{EG}}{w_{H_2O}} \times 1000$$

$$m = \frac{3.59}{200} \times 1000 = 17.95 \text{ m}$$

(ii)  $\Delta T_f = k_f m$

$$\Delta T_f = 1.86 \times 17.95 = 33.387$$

$$T_f^0 = 0^\circ\text{C} \text{ or } 273 \text{ K for water. Freezing point of solution, } T_f \text{ is}$$

$$T_f = 0 - 33.387 = -33.387^\circ\text{C} \text{ or } 239.613 \text{ K.}$$

13. We observe abnormal molecular masses when the solute is an electrolyte and undergoes either dissociation or association. Also, we observe abnormal molecular masses when the observed value of the colligative property is not equal to the calculated value of the colligative property.

#### Case of dissociation

NaCl in solution dissociates to give two ions  $\text{Na}^+$  and  $\text{Cl}^-$ , therefore  $(\text{CP})_{\text{obs}} = 2 (\text{CP})_{\text{cal}}$

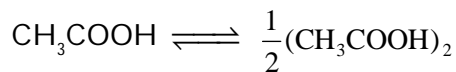
But colligative property is inversely related to molecular mass. Abnormal molecular mass of NaCl.

$$= \frac{1}{2} \times \text{normal molecular mass}$$

$$= \frac{1}{2} \times 58.5 = 29.25$$

**Case of association**

CH<sub>3</sub>COOH associates to form dimer in benzene via H-bonding.



$$\therefore (\text{CP})_{\text{obs}} = \frac{1}{2}(\text{CP})_{\text{cal}}$$

and the abnormal molecular mass will be twice the normal molecular mass. Abnormal molecular mass of CH<sub>3</sub>COOH = 2 × 60 = 120.

14.  $\Delta T_b = 0.01\text{K}$ ,  $k_b = 0.52 \text{ K kg mol}^{-1}$

$$w_A = 100\text{g}$$

$$\Delta T_b = k_b \frac{n_{\text{glu}}}{w_{\text{H}_2\text{O}}} \times 100$$

$$n_{\text{glu}} = \frac{0.01 \times 100}{0.52 \times 1000} = 1.92 \times 10^{-3} \text{ mol}$$

number of molecules of glucose in the solution =  $1.92 \times 10^3 \times 6.02 \times 10^{23} = 1.156 \times 10^{21}$

15. (i) When the external pressure is more than the osmotic pressure, then flow of solvent takes place from solution side to pure solvent side through semipermeable membrane. This is called reverse osmosis and used in desalination of water.

(ii) CaCl<sub>2</sub> is non-volatile and addition of this salt lower the freezing point of pure water and helps in clear the roads from snow.

(iii)  $w_B = 13\text{g}$   $w_{\text{solu}} = 100 \text{ g}$ ,  $w_{\text{H}_2\text{O}} = 87 \text{ g}$

(a)  $n_B = \frac{13}{98} = 0.13 \text{ mol}$

$$n_A = \frac{87}{18} = 4.83 \text{ mol}$$

$$\chi_B = \frac{0.13}{4.96} = 0.026, \quad \chi_A = 0.974$$

(b)  $m = \frac{n_B}{w_A} \times 1000 = \frac{0.13}{87} \times 1000 \quad \mathbf{m = 1.494 \text{ m}}$

(c)  $V_{\text{sol}} = \frac{100}{1.10} \text{ ml} = \frac{1}{11} \text{ L}$

$$M = \frac{n_B}{V} = \frac{0.13}{1/11} = 0.13 \times 11$$

$$m = 1.43\text{M}$$