

34, ①

Chapter 11 - 39, 50, 56, 57, 66, 68, 72, 76, 77, 78, 82,
90, 91, 94, 97, 105, 108, 110

34 - The vapor pressure of the NaCl soln. is lower than pure H_2O
↳ More H_2O molecules go into the gas phase from the pure H_2O ,
than from the NaCl soln.

The result is represented by (6)

39 - (a) a gas in a liquid - soda

(b) a solid in a solid - alloys (like 14 karat gold)

(c) a liquid in a solid - dental amalgam (Hg in Ag)

50 - (a) Dissolve 0.150 mol glucose in H_2O + dilute to 1 L

(b) Dissolve 1.135 mol KBr in 1.0 kg H_2O

(c) Mix together 0.15 mol CH_3OH with 0.85 mol H_2O

56 - (i) $C_6H_8O_7$ $192.12 \text{ g mol}^{-1}$

$$0.655 \text{ mol } C_6H_8O_7 \times \frac{192.12 \text{ g}}{1 \text{ mol}} = 126 \text{ g } C_6H_8O_7$$

$$\% \text{ mass } C_6H_8O_7 = \frac{126 \text{ g}}{126 \text{ g} + 1000 \text{ g}} \times 100 = 11.2 \text{ mass } \%$$

(Next pg) -

SG cont -

(2)

$$(b) 0.135 \text{ mg} = 0.135 \times 10^{-3} \text{ g}$$

$$5.00 \text{ mL H}_2\text{O} \times (1 \text{ g/mL}) = 5.00 \text{ g H}_2\text{O}$$

$$\% \text{ mass KBr} = \frac{0.135 \times 10^{-3} \text{ g}}{(0.135 \times 10^{-3} \text{ g}) + 5.0 \text{ g}} \times 100 = 0.0027 \% \text{ mass KBr}$$

$$(c) \% \text{ mass Aspirin} = \frac{5.50 \text{ g}}{5.50 \text{ g} + 145 \text{ g}} \times 100 = 3.65 \% \text{ mass aspirin}$$

$$\underline{57} \rightarrow (a) \text{ molality} = \frac{0.655 \text{ mol}}{1.00 \text{ kg}} = 0.655 \text{ molal}$$

$$(b) \text{ KBr, } 119 \text{ g mol}^{-1}$$

$$0.135 \times 10^{-3} \text{ g} \times \frac{1 \text{ mol}}{119.00 \text{ g}} = 1.13 \times 10^{-6} \text{ mol KBr}$$

$$\frac{1.13 \times 10^{-6} \text{ mol KBr}}{0.0050 \text{ kg}} = \underline{2.27 \times 10^{-4} \text{ molal}}$$

(c)

$$5.50 \text{ g} \times \frac{1 \text{ mol C}_9\text{H}_8\text{O}_4}{180.16 \text{ g}} = 3.05 \times 10^{-2} \text{ mol C}_9\text{H}_8\text{O}_4$$

$$\frac{3.05 \times 10^{-2} \text{ mol}}{0.145 \text{ kg}} = 0.211 \text{ molal (m)}$$

66-

$$\frac{1.3 \times 10^{-3} \text{ mol}}{1 \text{ kg}} = \frac{1.5 \times 10^{-3} \text{ g} \times \frac{1 \text{ mol}}{311.34 \text{ g}}}{\text{kg solvent}}$$

solving for kg solvent \rightarrow 0.0037 kg or 3.7g

Since the soln. is very dilute, kg of solvent \approx kg of soln.

68- Assuming 1.0 L of soln.

$$\text{mass of soln.} = (1000 \text{ mL}) \left(\frac{1.0624 \text{ g}}{\text{mL}} \right) = 1062.4 \text{ g}$$

$$\text{mass of solute} = 0.944 \text{ mol} \times \frac{180.16 \text{ g}}{1 \text{ mol}} = 170.1 \text{ g } \text{C}_6\text{H}_{12}\text{O}_6$$

$$\text{mass of H}_2\text{O} = 0.112 \text{ kg} \times \frac{1000 \text{ g}}{1 \text{ kg}} = 112 \text{ g H}_2\text{O}$$

$$(a) \chi_{\text{C}_6\text{H}_{12}\text{O}_6} = \frac{0.944 \text{ mol}}{0.944 \text{ mol} + 49.5 \text{ mol}} = 0.0187$$

$$(b) \% \text{ mass} = \frac{170.1 \text{ g}}{1062.4 \text{ g}} \times 100 = 16.0\%$$

$$(c) \text{ molality} = \frac{0.944 \text{ mol}}{0.8923 \text{ kg}} = \underline{\underline{1.06 \text{ m}}}$$

72-

$$M = k \cdot P$$

$$k = \frac{M}{P} = \frac{2.21 \times 10^{-3} \text{ mol/L}}{1.0 \text{ atm}} = 2.21 \times 10^{-3} \frac{\text{mol}}{\text{L} \cdot \text{atm}}$$

$$\text{O}_2 \text{ molarity} = \frac{(4 \times 10^{-3} \text{ g} \times \frac{1 \text{ mol}}{32.0 \text{ g}})}{1 \text{ L}} = 1.25 \times 10^{-4} \text{ M}$$

$$P_{\text{O}_2} = \frac{M}{k} = \frac{1.25 \times 10^{-4} \text{ M}}{2.21 \times 10^{-3} \frac{\text{mol}}{\text{L} \cdot \text{atm}}} = 0.06 \text{ atm}$$

76- The difference in entropy between the solvent in a soln. & a pure solvent is responsible for the colligative properties.

77- Osmotic Pressure is the amt of pressure needed to cause osmosis to stop.

78- NaCl is the non-volatile solute, Methyl alcohol is a volatile solute.

When NaCl is added to H_2O , the vapor pressure decreases
 \therefore the boiling point increases.

When Methyl alcohol is added to H_2O , the vapor pressure increases, & the boiling point will decrease.

82

(5)

(a) $\text{CH}_4\text{N}_2\text{O}$, 60.06 g mol^{-1}

$$10.0 \text{ g CH}_4\text{N}_2\text{O} \times \frac{1 \text{ mol}}{60.06 \text{ g}} = 0.167 \text{ mol CH}_4\text{N}_2\text{O}$$

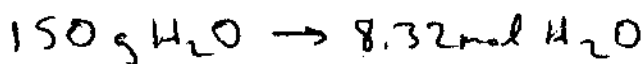
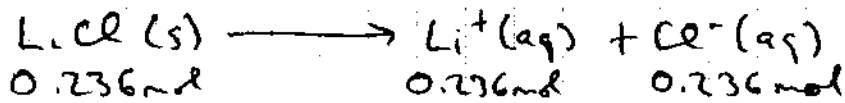
$$150 \text{ g H}_2\text{O} \times \frac{1 \text{ mol}}{18.02 \text{ g}} = 8.32 \text{ mol H}_2\text{O}$$

$$X_{\text{H}_2\text{O}} = \frac{8.32 \text{ mol}}{8.32 \text{ mol} + 0.167 \text{ mol}} = 0.980$$

$$P_{\text{soln}} = P_{\text{H}_2\text{O}}^{\circ} \cdot X_{\text{H}_2\text{O}} = (71.93 \text{ mmHg})(0.980) = 70.5 \text{ mmHg}$$

(b) LiCl , 42.39 g mol^{-1}

$$10.0 \text{ g LiCl} \times \frac{1 \text{ mol}}{42.39 \text{ g LiCl}} = 0.236 \text{ mol LiCl}$$



$$X_{\text{H}_2\text{O}} = \frac{8.32 \text{ mol}}{8.32 \text{ mol} + 0.236 + 0.236} = 0.946$$

$$P_{\text{soln}} = P_{\text{H}_2\text{O}}^{\circ} \cdot X_{\text{H}_2\text{O}} = (71.93 \text{ mmHg})(0.946) = \underline{68.0 \text{ mmHg}}$$

(6)

90

In the liquid, $X_{\text{Acetone}} = 0.602$ + $X_{\text{ethyl acetate}} = 0.398$ In the vapor, $P_{\text{total}} = 219 \text{ mm Hg}$

$$P_{\text{Acetone}} = P_{\text{Acetone}}^{\circ} \cdot X_{\text{Acetone}} = (285 \text{ mm Hg}) (0.602) = 172 \text{ mm Hg}$$

$$P_{\text{ethyl acetate}} = P_{\text{ethyl acetate}}^{\circ} \cdot X_{\text{ethyl acetate}} = (118 \text{ mm Hg}) (0.398) = 47 \text{ mm Hg}$$

$$X_{\text{Acetone}} = \frac{P_{\text{Acetone}}}{P_{\text{total}}} = \frac{172 \text{ mm Hg}}{219 \text{ mm Hg}} = 0.785$$

$$X_{\text{ethyl acetate}} = \frac{P_{\text{ethyl acetate}}}{P_{\text{total}}} = \frac{47 \text{ mm Hg}}{219 \text{ mm Hg}} = 0.215$$

91 - In the liquid $X_{\text{CHCl}_3} = 0.222$ + $X_{\text{CH}_2\text{Cl}_2} = 0.778$ In the vapor - $P_{\text{total}} = 368 \text{ mm Hg}$

$$P_{\text{CHCl}_3} = P_{\text{CHCl}_3}^{\circ} \cdot X_{\text{CHCl}_3} = (205 \text{ mm Hg}) (0.222) = 45.5 \text{ mm Hg}$$

$$P_{\text{CH}_2\text{Cl}_2} = P_{\text{CH}_2\text{Cl}_2}^{\circ} \cdot X_{\text{CH}_2\text{Cl}_2} = (415 \text{ mm Hg}) (0.778) = 323 \text{ mm Hg}$$

$$X_{\text{CHCl}_3} = \frac{P_{\text{CHCl}_3}}{P_{\text{total}}} = \frac{45.5 \text{ mm Hg}}{368 \text{ mm Hg}} = 0.124$$

$$X_{\text{CH}_2\text{Cl}_2} = \frac{P_{\text{CH}_2\text{Cl}_2}}{P_{\text{total}}} = \frac{323 \text{ mm Hg}}{368 \text{ mm Hg}} = 0.876$$

94-

(7)

$$\Delta T_b = K_b \cdot m = 1.76^\circ\text{C}$$

$$m = \frac{\Delta T_b}{K_b} = \frac{1.76^\circ\text{C}}{3.06 \frac{^\circ\text{C} \cdot \text{kg}}{\text{mol}}} = \underline{0.573 \text{ molal}}$$

$$97 - \Pi = MRT = \left(\frac{11.5 \times 10^{-3} \frac{\text{mol}}{\text{g}} \times 5990 \text{ g}}{0.0066 \text{ L}} \right) \left(0.0821 \frac{\text{L} \cdot \text{atm}}{\text{mol} \cdot \text{K}} \right) (298 \text{ K})$$

$$= 0.00711 \text{ atm}$$

$$\Pi = 0.00711 \text{ atm} \times \frac{760 \text{ mm Hg}}{1 \text{ atm}} = 5.41 \text{ mm Hg}$$

$$\text{height of H}_2\text{O column} = 5.41 \text{ mm Hg} \times \frac{13.534 \text{ mm H}_2\text{O}}{1.0 \text{ mm Hg}} = 73.2 \text{ mm or } \underline{0.0732 \text{ m}}$$

105- Na_2SO_4 (142 g mol^{-1})

$$m = \frac{(71 \text{ g} \times \frac{1 \text{ mol}}{142 \text{ g}})}{1.00 \text{ kg}} = 0.50 \text{ molal}$$

$$\Delta T_b = K_b \cdot m = (0.51 \frac{^\circ\text{C} \cdot \text{kg}}{\text{mol}}) (0.50 \text{ m}) = \underline{0.26^\circ\text{C}}$$

The experimental ΔT is 3x the predicted... because...

Na_2SO_4 dissociates into 3 particles ($2 \text{ Na}^+ + \text{SO}_4^{2-}$) in soln.

108-

8

K_f for snow (H_2O) is $1.86 \text{ }^\circ\text{C} \cdot \text{kg/mol}$.

Reasonable amts. of salt are capable of lowering the freezing point (ΔT_f) of the snow below an air temperature of -2°C .

Reasonable amts. of salt are not able to cause a ΔT_f of more than 30°C , which would be required if it is to melt snow when the air temperature is at -30°C .

110- $C_2H_6O_2$ (62.07 g/mol) $\Delta T_f = 22^\circ\text{C}$

$$\Delta T_f = K_f m \quad m = \frac{\Delta T_f}{K_f} = \frac{22^\circ\text{C}}{1.86 \frac{^\circ\text{C} \cdot \text{kg}}{\text{mol}}} = 11.8 \text{ mol/kg} = 11.8 m$$

$$\text{mol } C_2H_6O_2 = (3.55 \text{ kg}) (11.8 \text{ mol/kg}) = 41.9 \text{ mol } C_2H_6O_2$$

$$\text{mass } C_2H_6O_2 = 41.9 \text{ mol } C_2H_6O_2 \times \frac{62.07 \text{ g } C_2H_6O_2}{1 \text{ mol } C_2H_6O_2} = 2.60 \times 10^3 \text{ g } C_2H_6O_2$$