

34 - The vapor pressure of the NaCl soln. is lower than pure H₂O

↳ More H₂O molecules go into the gas phase from the pure H₂O, than from the NaCl soln.

The result is represented by (b)

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)

48 - (a) Dissolve 0.150 mol glucose in H₂O + dilute to 1 L

(b) Dissolve 1.135 mol KBr in 1.0 kg H₂O

(c) Mix together 0.15 mol CH₃OH with 0.85 mol H₂O

54 - (a) C₆H₈O₇ 192.12 g mol⁻¹

$$0.655 \text{ mol C}_6\text{H}_8\text{O}_7 \times \frac{192.12 \text{ g}}{1 \text{ mol}} = 126 \text{ g C}_6\text{H}_8\text{O}_7$$

$$\% \text{ mass C}_6\text{H}_8\text{O}_7 = \frac{126 \text{ g}}{126 \text{ g} + 1000 \text{ g}} \times 100 = 11.2 \text{ mass } \%$$

(Next pg.) -

54 cont.

(2)

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

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

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

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

55- (a) molality = $\frac{0.655 \text{ mol}}{1.00 \text{ kg}} = 0.655 \text{ molal}$

(b) KBr, 119 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) $5.50 \text{ g} \times \frac{1 \text{ mol C}_9\text{H}_8\text{O}_4}{180.16 \text{ g}} = 3.05 \times 10^{-2} \text{ mol C}_9\text{H}_8\text{O}_4$

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

64-

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

solving for kg solvent \rightarrow 0.0037 kg or 3.7g

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

66- Assuming 1.0L of soln.

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

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

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

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

$$(b) \% \text{ mass} = \frac{170.1 \text{ g}}{1062.4 \text{ g}} \times 100 = 16.07\%$$

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

72-

$$M = k \cdot P$$

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

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

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

80-

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

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

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

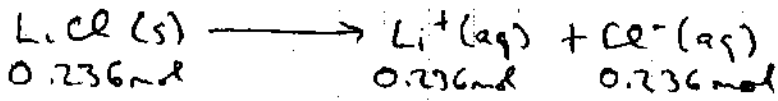
$$X_{\text{H}_2\text{O}} = \frac{8.32 \text{ mol}}{8.32 \text{ mol} + 0.167 \text{ mol}} = 0.980$$

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

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

80 cont-

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



$$150 \text{ g H}_2\text{O} \rightarrow 8.32 \text{ mol H}_2\text{O}$$

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

$$P_{\text{soln}} = P_{\text{H}_2\text{O}}^{\circ} \cdot \chi_{\text{H}_2\text{O}} = (71.53 \text{ mmHg})(0.946) = \underline{68.0 \text{ mmHg}}$$

~~80~~

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

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

97- $\pi = MRT = \left(\frac{11.5 \times 10^{-3} \frac{\text{mol}}{\text{g}} \times 5590 \text{ g}}{0.0066 \text{ L}} \right) \left(0.0821 \frac{\text{L} \cdot \text{atm}}{\text{mol} \cdot \text{K}} \right) (298 \text{ K})$
 $= 0.00711 \text{ atm}$

$$\pi = 0.00711 \text{ atm} \times \frac{760 \text{ mmHg}}{1 \text{ atm}} = 5.41 \text{ mmHg}$$

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

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

Reasonable amts. of salt are capable of lowering the freezing point (ΔT_f) of the snow below an air temperature of $-2 \text{ }^\circ\text{C}$.

Reasonable amts. of salt are not able to cause a ΔT_f of more than $30 \text{ }^\circ\text{C}$ which would be required if it is to melt snow when the air temperature is at $-30 \text{ }^\circ\text{C}$.

105- Na_2SO_4 (142 g/mol)

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

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

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

Na_2SO_4 dissociates into 3 particles ($2 Na^+ + SO_4^{2-}$) in soln.

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

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

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

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