1. In Denver, water boils at 95 °C. Why is this different than the standard bp for water? What is the atmospheric pressure in Denver given $\Delta H_{\text{vap}} = 40.67 \text{ kJ/mol}$ for water.

2. Oxalic acid (H$_2$C$_2$O$_4$) is a diprotic acid found in high concentration in spinach and rhubarb. Too much oxalic acid can lead to kidney stones. If a 1.25 M solution of oxalic acid in water has a density of 1.06 g/mL, determine the mole fraction of oxalic acid and the normality of the solution.

3. Remembering that acetic acid is a weak acid, calculate the percent of the acid that has ionized if a 0.110 m solution of acetic acid in water freezes at -0.436 °C. $K_c = 1.86 \text{ °C} \cdot \text{kg/mole}$

4. Find the molality of a 1.25 M glucose (C$_6$H$_{12}$O$_6$) solution that has a density of 1.10 g/mL.

\[
\ln \left( \frac{1 \text{ atm}}{P_2} \right) = \frac{-40.67 \times 10^3 \text{ J/mol}}{8.314 \text{ J/molK}} \left( \frac{1}{368} - \frac{1}{373} \right)
\]

Solve for $P_2$

\[
\ln \left( \frac{1 \text{ atm}}{P_2} \right) = +0.178 \quad \frac{1 \text{ atm}}{P_2} = 0.8483 \quad P_2 = 0.84 \text{ atm}
\]

\[1.25 \text{ mol H}_2\text{C}_2\text{O}_4 \quad 1 \text{ L solution} \]

\[\text{1 L solution} \times 1.06 \text{ g/mL} \times \frac{1000 \text{ mL}}{\text{ L}} = 1060 \text{ g solution} \]

\[-112.5 \text{ g H}_2\text{C}_2\text{O}_4 \quad 947.5 \text{ g H}_2\text{O} \]

\[947.5 \text{ g H}_2\text{O} \times \frac{\text{ mol}}{18 \text{ g}} = 52.6 \text{ mol H}_2\text{O} \]

\[\chi_{\text{H}_2\text{C}_2\text{O}_4} = \frac{1.25 \text{ mol}}{1.25 \text{ mol} + 52.6 \text{ mol}} = 0.023 \quad N = M \times 2 = 2.50 \text{ N} \]
A solution consisting of equal masses of water and ethanol, C₂H₅OH, (both are volatile liquids) is allowed to come to equilibrium with its vapor. Given that the vapor pressure of pure water is 175 torr and pure ethanol has a vapor pressure of 400.0 torr, calculate the vapor pressure of the solution and the mole fraction of each component in the vapor above the solution.

1. Assume 100g each:
   \[ \frac{100g \times 1 \text{ mol H₂O}}{18g} = 5.56 \text{ mol H₂O} \]
   \[ \frac{100g \times 1 \text{ mol eth}}{46g} = 2.17 \text{ mol eth} \]

   \[ \chi_{H₂O} = \frac{5.56}{5.56 + 2.17} = 0.719 \quad \chi_{eth} = 0.281 \]

   \[ P_{tot} = \chi_{H₂O} \cdot 175 \text{ torr} + \chi_{eth} \cdot 400 \text{ torr} = 2.58 \text{ torr} \]

2. \[ \chi_{H₂O \text{ vap}} = \frac{0.719 \times 175}{238} = \frac{P_{H₂O}}{P_{tot}} = 0.528 \quad \chi_{eth} = 0.472 \]
3. \( \Delta T = i K_p m = \) 

\[ 0.436 = i = 1.86^\circ C \cdot 0.22 \, m \]

\[ i = 1.07 \]

\% ionization? If \( \% \) ionization, \( i = 1 \)

\[ 100\% \quad \therefore \quad i = 2 \]

\[ 1.07 = \% \text{ un-ionized} \times 1 + \% \text{ ionized} \times 2 \]

\[ = x + (1-x) \times 2 \]

\[ 1.07 = x + 2 - 2x \]

\[ x = 0.93 \quad \therefore \quad 93\% \text{ intact}, \quad 7\% \text{ dissoc.} \]

4. \( 1.25 \text{ mol C}_6\text{H}_2\text{O}_6 \)

\[ \frac{1.25 \text{ mol C}_6\text{H}_2\text{O}_6}{L \text{ solution}} \times \frac{L}{1100 \text{ g}} = \frac{1.25 \text{ mol C}_6\text{H}_2\text{O}_6}{1100 \text{ g soln}} \]

\[ 1.25 \text{ mol C}_6\text{H}_2\text{O}_6 \times \frac{180 \text{ g}}{\text{ mol}} = 225 \text{ g C}_6\text{H}_2\text{O}_6 \]

1100 g total - 225 g tot = 875 g H_2O

\[ \therefore \quad m = \frac{1.25 \text{ mol C}_6\text{H}_2\text{O}_6}{0.875 \text{ kg H}_2\text{O}} = 1.43 \text{ m} \]