

Chapter 13 Practice Problems

- 5.12 g of $\text{Mg}(\text{NO}_3)_2$ is dissolved in 800.2g of water. The K_b for water is $0.512^\circ\text{C}/\text{m}$. Assume complete dissociation of the salt in solution.
 - What is the boiling point elevation in $^\circ\text{C}$? At what temperature will the solution boil at 760 torr?
 - Would you expect the actual boiling point of this solution to be higher or lower than what you calculated? Explain.
 - Would you expect a NaNO_3 solution of equal molality to that of $\text{Mg}(\text{NO}_3)_2$, above, to have a higher or lower boiling point than that of the magnesium nitrate solution, above? Explain
- How many grams of ethanol, $\text{CH}_3\text{CH}_2\text{OH}$, are needed to raise the boiling point of 500.0 mL of water by 2.5°C ? The boiling point elevation constant $K_b = 0.512^\circ\text{C}/\text{molality}$.
- Assuming the van't Hoff factor for NaCl to be 1.84, calculate the freezing point of an aqueous 0.500 molal NaCl solution? For water, $K_f = 1.86^\circ\text{C}/\text{m}$.
- The solubility of an unknown gas in water at $20.^\circ\text{C}$ is 0.20 g/L when the partial pressure of the gas above the solution is 200. torr. What is the solubility of the gas in g/L when its partial pressure is 300. torr?
- Vinegar is 5.0% acetic acid, CH_3COOH .
 - Calculate the molarity, M, of vinegar if 5.0% is w/v.
 - Calculate the molality, m, of vinegar if 5.0% is w/w.
- A 20.0% (w/w) aqueous solution of HCl has a density of 1.10 g/mL. Calculate the molarity of the solution.
- How does each of the following affect the vapor pressure of a liquid in a closed container? Explain your responses.
 - Decreasing the temperature
 - Increasing the volume of liquid
 - Increasing the volume of the container at constant temperature
 - The addition of a nonvolatile solute
 - The addition of a volatile solute
- Ethylene glycol, a non-volatile liquid with formula $\text{C}_2\text{H}_6\text{O}_2$ and molar mass 62g/mol, is added to 2102g of water. At 89°C , the vapor pressure of this resulting solution is found to be 460 torr. How many grams of the non-volatile liquid were added to the water? The vapor pressure of pure water is 526 torr at 89°C .
- At 25°C the vapor pressure for pure CHCl_3 is 172.0 torr, while that for pure CCl_4 is 98.3 torr. What is the vapor pressure of an ideal solution containing 61.1g of, CHCl_3 , and 70.9g of carbon tetrachloride, CCl_4 at 25°C ?
- Explain why the formation of a solution between ethanol ("alcohol") and water is exothermic. Would the temperature of the solution increase, decrease or stay the same as the ethanol is added to the water? Explain.
- Explain why the formation of a solution between ammonium nitrate, NH_4NO_3 , and water is endothermic. Would the temperature of the solution increase, decrease or stay the same as the ammonium nitrate dissolves in the water? Explain.