1. Define the following concentration units:
   a. molarity
   b. molality
   c. mole fraction
   d. mass percent

2. Fill in the blanks:
   When a nonvolatile solute is dissolved in a solvent, the freezing point ________________,
   the boiling point ________________, the vapor pressure ________________ and the
   osmotic pressure ________________.

3. Calculate the boiling point and freezing point of 10.0g of NaF dissolved in 50.0 g water.
   (NaF: 42 g/mol, $K_b = 0.51 \, ^\circ C \, kg/mol$, $K_f = 1.86 \, ^\circ C \, kg/mol$)

4. Rank the following 1.0 M solutions from lowest to highest osmotic pressure:
   
   $C_6H_{12}O_6 \quad CaCl_2 \quad K_3PO_4 \quad HCl \quad CH_3COOH$
5. When NH₄NO₃ is dissolved in water, the solution gets cold. Predict the sign of ΔS for the dissolution of ammonium nitrate.

6. 15.0 g of a nonvolatile, nonelectrolyte solute are dissolved in 100 g water. The freezing point of the solution is -4.65 °C and the mole fraction of solute is 0.043. Calculate the vapor pressure of the solution at 100 °C.

7. The vapor pressures of pure methanol and propanol at 40°C are 303 and 44.6 torr
   a. A solution is made by mixing 0.677 moles of propanol and 0.428 moles of methanol at 40 °C. Calculate the vapor pressure of the solution assuming it behaves ideally.

   b. If the vapor pressure of a methanol-propanol solution is 212 torr at 40 °C, calculate the mole fraction of propanol in solution.