1. For each of the following solutes, decide whether they will be more soluble in H\textsubscript{2}O or CCl\textsubscript{4} or neither. As a hint, the distribution total for each is in parenthesis.

   Solutes (10): HCl, CS\textsubscript{2}, NH\textsubscript{3}, PbCl\textsubscript{2}, PCl\textsubscript{5}, CH\textsubscript{3}OH, CH\textsubscript{3}(C=O)CH\textsubscript{3}, C\textsubscript{6}H\textsubscript{6}, KCl, BaSO\textsubscript{4}

   Soluble in H\textsubscript{2}O (5):

   Soluble in CCl\textsubscript{4} (3):

   Neither (2):

2. What is the percent composition (m/v) of a 0.500M NaCl solution?

3. Hydrochloric acid, HCl, is sold as a 38\% (m/m) solution. If this solution has a density of 1.19g/mL, then what is the molarity of this solution?

4. At 63.5°C, the vapor pressure of H\textsubscript{2}O is 175mmHg and that of ethanol, CH\textsubscript{3}CH\textsubscript{2}OH, is 400.mmHg. If 18.0g of water and 23.0g of ethanol are mixed, what is the vapor pressure, in mmHg, of this solution at 63.5°C? Assume that this solution obeys Raoult's Law.

5. A solution is made by adding 30.0g of glucose, C\textsubscript{6}H\textsubscript{12}O\textsubscript{6}, to 250.mL of water. What is the new boiling point and freezing point of this solution?
6. A solution of 0.0581 g of anethole (which is a licorice flavoring) in 5.00 g of benzene yielded a freezing-point temperature of 5.098°C. If the normal freezing point for benzene is 5.500°C and the $K_f$ for benzene is 5.12°C/m, then what is the MW for the anethole?

7. What is the boiling point (predicted) for a 0.200 m aqueous solution of Na$_2$SO$_4$? Remember to include the van't Hoff factor.

8. Two solutions are separated by a semipermeable membrane. Solution A has a concentration of 5% glucose while solution B has a concentration of 10% glucose.
   a. which solution has the higher osmotic pressure? A or B
   b. which direction will the solvent flow? A $\rightarrow$ B or B $\rightarrow$ A
   c. which solution will increase in total volume? A or B

9. Rank the solutions from lowest osmotic pressure to highest osmotic pressure. Note - you do not need to calculate each one - just multiply the van't Hoff factor (if it has one) times the molarity.
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   \text{RANK (#1 = highest)}
   \]
   a. 0.15 M NH$_3$
   b. 0.10 M NaCl
   c. 0.075 M CaCl$_2$
   d. 0.125 M C$_6$H$_{12}$O$_6$ (glucose)
   e. 0.075 M Al(NO$_3$)$_3$

10. For each of the examples, determine first whether it is a solution or a colloid. If it is a colloid, then determine its type (aerosol, emulsion, etc.).
   a. a gas tank containing He and O$_2$
   d. club soda
   b. milk
   e. peanut butter
   c. air freshener spray
   f. vodka (a mixture of ethanol and water)