In order to minimize distractions for your classmates, please make sure your cell phones are completely off.

1. [8 pts] Calculate the molarity of a solution prepared by dissolving 10.0 g of glucose \((C_6H_{12}O_6)\) in enough water to make 800.0 mL of solution.

\[
M = \frac{\text{moles glucose}}{L \text{ solution}} = \frac{10.0 \text{ g} \ C_6H_{12}O_6}{180.156 \text{ g}} \left( \frac{1 \text{ mole} \ C_6H_{12}O_6}{180.156 \text{ g}} \right)
\]

\[
= \frac{0.0694 \text{ mol}}{L \text{ solution}}
\]

2. [8 pts] What mass of 0.88% alcohol solution would contain 82 mg of alcohol?

\[
\frac{82 \text{ mg} \text{ alcohol}}{100 \text{ g} \text{ solution}} \left( \frac{0.001 \text{ g}}{1 \text{ mg}} \right) = \frac{82 \times 0.001}{100} \times 0.88 \text{ g solution} = 9.3 \text{ g solution}
\]

3. [8 pts] Calculate the concentration, in mass percent, for a solution prepared by mixing 17.0 g of octane \((C_8H_{18})\) with 2.1 mL of liquid bromine. The density of octane is 0.703 g/mL and that of bromine is 3.10 g/mL, though you may not need both of these numbers for this calculation.

\[
\text{mass} \% = \frac{\text{mass } Br_2}{\text{mass solution}} \times 100\% = \frac{6.51 \text{ g}}{17.0 + 6.51} \times 100\% = 28\% \text{ bromine}
\]

mass \(Br_2 = 2.1 \text{ mL} \left( \frac{3.10 \text{ g}}{1 \text{ mL}} \right) = 6.51 \text{ g}
\]

4. [8 pts] Suppose you have a reaction that requires 6.0 grams of calcium chloride in order to go to completion. What volume of 0.17 M CaCl\(_2\) would provide this amount of the compound?

\[
6.0 \text{ g } \text{CaCl}_2 \left( \frac{1 \text{ mole } \text{CaCl}_2}{110.94 \text{ g } \text{CaCl}_2} \right) \left( \frac{1 \text{ L } \text{solution}}{0.17 \text{ mole } \text{CaCl}_2} \right) = 0.32 \text{ L of solution}
\]
5. [3 pts] Draw a molecular-level picture of the particles present in a solution that results after lithium phosphate crystals are dissolved in water. Represent the water molecules as a V-shaped molecule, like we did in lecture:

6. [3 pts] Draw a molecular-level picture of the particles present in a solution that results after NH₃ is dissolved in water. Represent the water molecules as a V-shaped molecule, like we did in lecture:

7. [8 pts] Predict whether each of the solutes below will be soluble in the solvent listed.
   a) methane (CH₄) in water
      → not Soluble
   b) hydrofluoric acid (HF) in water
      → Soluble
   c) water in carbon tetrachloride (CCl₄)
      → not Soluble
   d) sulfur difluoride (SF₂) in CCl₄
      → not Soluble

8. [8 pts] Identify each of the following solutions as either an electrolyte or a nonelectrolyte.
   a) C₂H₅OH (aq)       b) pure water       c) LiCl (aq)       d) NH₄Cl (aq)
      electrolyte        electrolyte        not electrolyte

9. [6 pts] True/False
   a) An increased temperature would increase the solubility of carbon dioxide gas in water.  
   T  b) An increased temperature would decrease the solubility of carbon dioxide gas in water.  
   T  c) An increased temperature would increase the solubility of ordinary table salt (NaCl) in water.  
   F  d) An increased temperature would decrease the solubility of ordinary table salt (NaCl) in water.  
   T  e) Increasing the pressure of oxygen gas breathed by a patient will increase the solubility of oxygen in his blood.  
   F  f) Increasing the pressure of oxygen gas breathed by a patient will decrease the solubility of oxygen in his blood.
10. [2 pts] Write an expression for $K_{eq}$ for the following reaction:

$$2 \text{H}_2\text{O} \ (l) \rightleftharpoons 2 \text{H}_2 \ (g) + \text{O}_2 \ (g)$$

$$K_{eq} = \frac{[\text{H}_2]^2}[\text{O}_2]$$