Problem Set 3

1. If an adult takes two aspirin tablets, calculate the number of molecules being taken for each cell in an adult. Clearly show the basis for all of your calculations, all equations, and all work. Comment on the magnitude of your answer.
2. The log P for chloroform ($CHCl_3$) was found to be 1.97 for a mixture of 200 mL of water and 300 mL of 1-octanol.
    a. Calculate the value of the partition coefficient P.
    b. Based upon the value of P, discuss the underlying reasons (in terms of intermolecular forces) for the solubility behavior of chloroform in 1-octanol vs. water.
    c. If the water phase had a chloroform concentration of 0.125 mM, calculate the expected concentration of chloroform in the 1-octanol phase.
    d. Describe how the two chloroform concentrations would change (increase, decrease, or no change) if 100 mL of water were added to the mixture.
    e. For the addition of this 100 mL of water to the mixture, predict whether and how the total mass of chloroform present in the octanol phase would change.
    f. Draw a diagram of a container holding this mixture and clearly label the concentration of each of the phases.
    g. Use thermodynamics to explain and to predict how the concentration of chloroform in water would change with an increase in temperature (assume constant volumes of liquids).
3. Explain how each of the following properties affects cell membrane fluidity; clearly explain why for each of these:
    a. Temperature
    b. Increase in the chain length of phospholipid fatty acid components
    c. Increase in the degree of unsaturation of phospholipid fatty acid chains
    d. Increase in the amount of cholesterol found in the membrane
4. Draw the structure for a triglyceride clearly showing all atoms, all carbon-carbon, and all carbon-oxygen bonds.
5. Fats and oils both are different types of triglycerides; oils are normally liquids at room temperature, while fats are normally solids. Use molecular structures, your understanding of intermolecular forces, and the kinetic molecular distribution to clearly explain, using the applicable fundamental scientific principles, the underlying reasons for this difference in physical properties between these two classes.
6. Draw structures and outline the difference between omega-3 and omega-6 fatty acids. Identify the primary dietary source for each of these. Discuss the current human health recommendations for consumption of these.