MCB 11 February 17, 2006
Spring 2006 Problem Set 2 M. D. Alper

1. What characteristic of oxygen leads to the capability of water to dissolve charged and ionic materials? Discuss in terms of energy considerations and the various aspects of those considerations.

2. Excess doses of Vitamin E lead to its accumulation in the body while excess doses of Vitamin C generally do not. Explain.

3. The acid group --COOH usually takes another form in water.
   a. What is that form.
   b. How is the H different in these two forms? Discuss in terms of its electronic structure.

4. Liposomes (vesicles) can be used as carriers of polar drugs in the body. Micelles are also being studied for the purpose of carrying nonpolar drugs in the body.
   a. What is a non polar molecule?
   b. Describe what happens when non polar molecules are put into a container of water. Why does this happen? Explain fully.
   c. Draw a diagram of a micelle, showing where the non polar drug would be carried. Explain why you put it where you did.

5. The conversion of A to B is has a very high positive entropy change, a very high negative enthalpy change and a very high activation energy. Is this reaction likely to take place if you leave a tube of A for a week. Explain fully, accounting for each of these three factors.

6. One new pesticide is shown to kill insects by disrupting their ability to produce the cocoon. Another works by interfering with the transmission of signals from nerves to muscles. Which of these is more likely to be safer for use near homes? Is it sure to be safe? Explain fully.

7. Membranes form spontaneously when certain types of lipids are put in water.
   a. What characteristic of the molecular structure of the phospholipid that makes up membranes is most important in the process of membrane formation.
   b. Are there any "helper" molecules around to help these lipids align themselves in the structure of the membrane. Explain.
   c. Can charged molecules penetrate a membrane? Explain.
   d. Can an amino acid penetrate a membrane without help? Explain.

8. The process of protein formation involves the breaking of covalent bonds.
   a. Explain this. Show chemical structures.
   b. How can this happen, given that, as we have said, nature likes to form bonds?

9. Protein structure is one of the basic elements of biochemistry.
   a. Hemoglobin can be discussed in terms of primary, secondary, tertiary, and quaternary structure. Describe primary, tertiary and quaternary structure in detail and indicate the "problem" that secondary structure needs to solve.
   b. The interaction of two subunits of hemoglobin can be affected by mutations. Suggest a mutation (one **type** of amino acid for another **type** of amino acid) that could affect this interaction and explain how it has the resulting effect.