

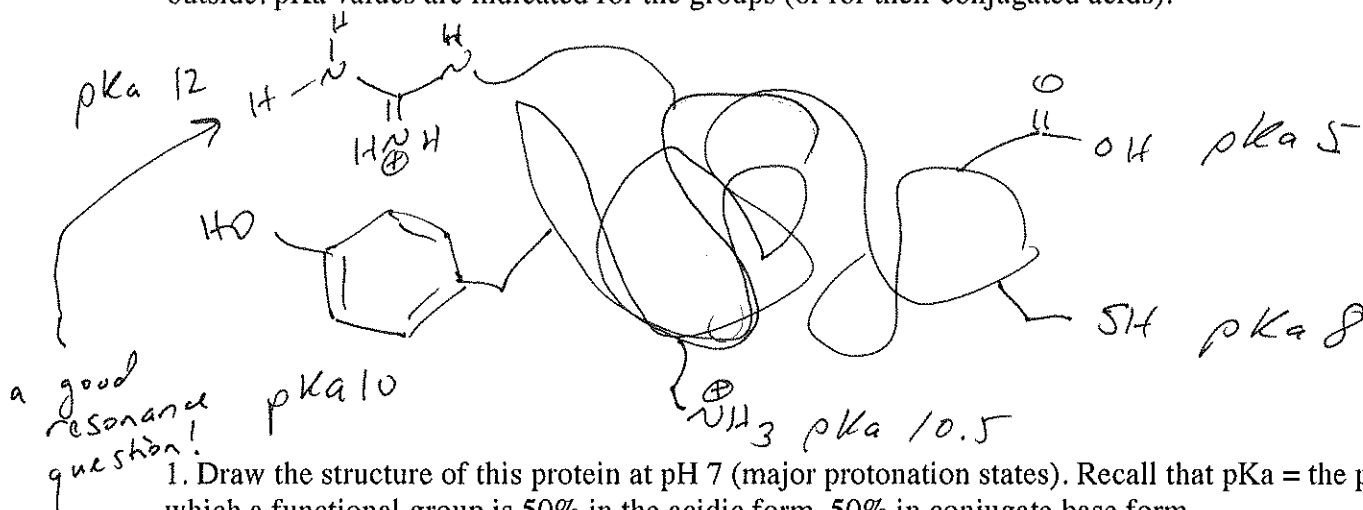
Problem Set 1

Five points. Due Monday, February 11, by the start of class.

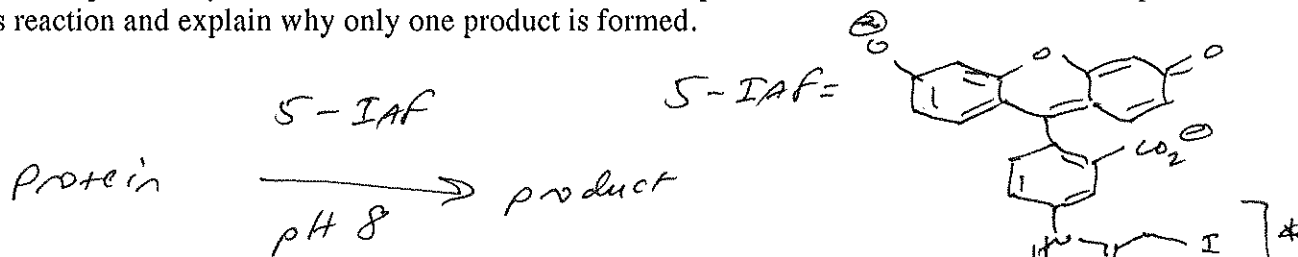
Provide answers on a separate sheet(s) of paper, stapling together multiple pages.

Organic chemistry is best learned with a pencil!

Proteins are polymers of amino acids that fold into defined 3-dimensional structures. Proteins have multiple functional groups, and it is the interactions of these functional groups that lead to protein functions. (See chapter 23 for more details; see pages 1176-1177 for the structures of the amino acid side chains.) A typical protein can be graphically depicted as shown below, with functional groups on the outside. pKa values are indicated for the groups (or for their conjugated acids).



1. Draw the structure of this protein at pH 7 (major protonation states). Recall that pKa = the pH at which a functional group is 50% in the acidic form, 50% in conjugate base form.
2. Draw the structure of this protein at pH 11.
3. Draw the structure of this protein at pH 3.
4. This protein can be labeled with the fluorescent molecule shown below, iodoacetamidofluorescein (IAF). At pH 8, only one molecule of IAF reacts with the protein. Draw the mechanism and product of this reaction and explain why only one product is formed.



5. At pH 11, multiple products form from reaction of the protein with IAF. Draw the mechanisms and some of these products. Explain why multiple products are formed.

6. At pH 5, no reaction occurs between the protein and IAF (or the reaction occurs very slowly). Explain. Be sure to include concepts of nucleophilicity in your answer.

7. Provide mechanisms and products for the following reactions.

