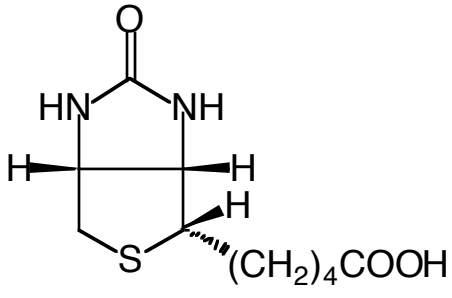
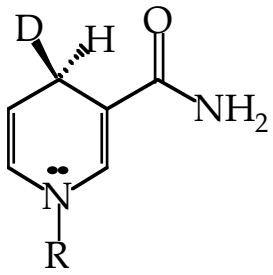
BMB 401 (Spring 2004)
Problem Set#2

Problem 1: From your textbook (Lehninger) – Chap 5, problems 1, 2, 3, 4, 5, 10, 15, 16 .

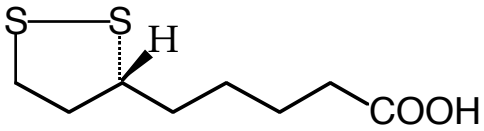
Problem 2: Assign the stereochemical configuraton (R,S system) of all chiral carbons on the compounds shown below.



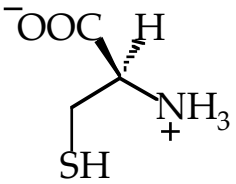
Biotin

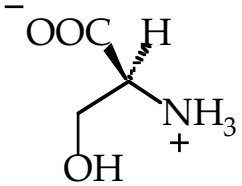


D stands for deuterium, a heavy isotope of H.



Lipoic Acid





Problem 3: Treatment of a polypeptide by dithiothreitol yields two polypeptides that have the following amino acid sequences:

1. A – F – C – M – Y – C – L – W – C – N
2. V – C – W – V – I – F – G – C – K

Chymotrypsin catalyzed hydrolysis of the intact polypeptide yields polypeptide fragments with the following amino acid compositions: (A, F), (N, C_2, M, Y), (C, G, K), (C_2, L, W_2, V), (I, F, V).

Indicate the positions of the disulfide bonds in the original polypeptide.

Problem 4: You have 50 mL of 10 mM fully protonated histidine. How many moles of NaOH must be added to bring the histidine solution to a pH that is equivalent to the pI?

Problem 5: Predict the order of elution of the following amino acids from an anion exchange column at pH 7.0: D, H, M, C, K.

Problem 6: Calculate the isoelectric points of the amino acids R, H, and E.

Problem 7: The enzyme cyclopropane fatty acid synthase has been cloned and sequenced by DNA technology. It is a monomeric protein, and among other amino acids, its polypeptide chain contains 20 **F**, 24 **R**, 29 **D**, 21 **E**, 19 **N**, 16 **Q**, and 29 **A**. An absorbance spectrum of a 1 mL solution of the enzyme was recorded ($A_{279\ nm}$ = 1.5), and then the solution was submitted to acid hydrolysis for 24 h at 110°C, and subsequent amino acid analysis. The following concentrations were determined.

F = 200 μM
R = 240 μM
ASX = 480 μM
GLX = 370 μM
A = 290 μM

Determine the molar absorptivity of cyclopropane fatty acid synthase using the above data.

Problem 8: The molar absorptivity of tyrosine changes as a function of deprotonation of its phenol side chain. In its non-ionized state (protonated), the molar absorptivity of tyrosine is 1400 $M^{-1} \bullet cm^{-1}$. In its ionized state (non-protonated), the molar absorptivity of tyrosine is 2400 $M^{-1} \bullet cm^{-1}$. Calculate the absorbance of a 1 mM solution of tyrosine at pH 9.5. Assume a cuvet pathlength of 1 cm..