

Biochem I Make Up Test DUE – 20 December.

Turn into the **CHEMISTRY OFFICE ONLY** by 3:00.

NO OTHER LOCATION WILL BE ACCEPTED!

This is a take home-open book/note test. Do not ask anyone for help.

This test will replace only one of your lowest scores. If the grade for this is less than 40% lower than the test you wish to replace, you will receive this grade. Otherwise your higher test score will remain.

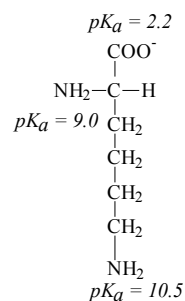
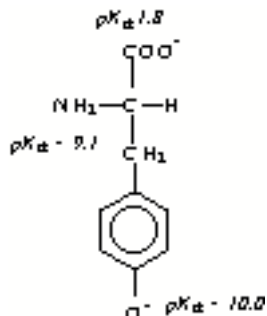
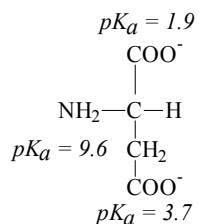
Name _____

1. a) Complete the following table of amino acids: (6 points)

Amino Acid Name	Histadine	Isoleucine	Glutamate
(a) Structure of amino acid at pH 1 and 14			
(b) 3-Letter Abbreviation			
(c) 1-Letter Abbreviation			
(d) Net charge at pH 6			

- b) On the structures below **draw in protons** to show the state of the amino acid at **pH 1** (3 points)

- c) Then circle **all** hydrogens which can be involved in hydrogen bonds. (3 points)



2. Explain why two hydrophobic molecules, when dissolved in water, are attracted to one other. (4 pts.)

3. Explain how the bicarbonate buffering system functions to keep the pH of the blood constant when the blood is exposed to an increased concentration of protons. (4 pts.)

4. The amino acid glycine has an amino group that has a pK_a of 9.6. Thus, the group can exist as the protonated form ($-NH_3^+$) or as the uncharged base ($-NH_2$) with the following equilibrium:



a. (2pts) Over what range of pH is this amino group an effective buffer of the cell's pH?

b. (3pts) At pH 10.0, what ratio of the glycine side chains are in the ($-NH_3^+$) form?

c. (10pts) How much 5.0M KOH must be added to 1.00L of 0.10M glycine at pH 9.0 to bring the pH to exactly 10.0? (For this problem, you may ignore the total volume changes.)

5. For the following amino acid sequence :GQEMHR.

a) write the sequence of the peptide using the 3-letter abbreviations for amino acids (3 points)

b) Draw the structure of the peptide. Indicate the peptide bond, side group/chain and the C and N terminus (4 points)

c) Indicate the total charge of the predominant species in solution at the following pHs (4 points)

pH 3.0 _____

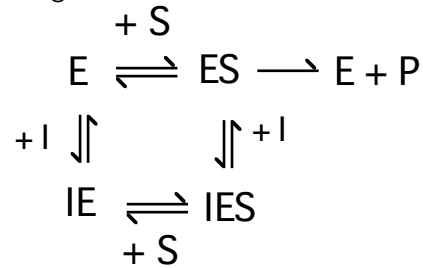
pH 7.0 _____

pH 11.0 _____

pH 14.0 _____

6. (10 pts) Some amphibians are able to stay underwater for very long periods of time. Of course they only breath air yet they can utilize nearly 100% of the O_2 in their blood, whereas humans can only extract 66% of the O_2 in their blood. These amphibians hemoglobin do not bind BPG yet the Hb have a high affinity for HCO_3^- and acts allosterically. How does this help these animals attain this feat? Explain the effects of both molecules.

7. (10pts) An inhibitor, I, binds to free enzyme, E, and also to the ES complex yielding a dead-end IE complex and an inactive IES complex. The binding reactions are shown below:



What type of inhibition does this reaction indicate? Draw the S vs. V for this reaction and the lineweaver burk plot. Indicate the Km, Vmax, and Km app or Vmax app if appropriate. Write the Michealis-Menten equation.

8. Explain in biochemical terms why in conditions of vitamin C deficiency a person develops the following symptoms: loose teeth, skin lesions, and fragile blood vessels. (4 pts)

- 9 Describe the catalytic mechanism of lysozyme. Make sure you address why these states of Glu 35 and Asp 52 are necessary for lysozyme to function properly (6 pts.)

10. (10pts.) A given globular protein's gene is subjected to several point mutations where one amino acid's codon is turned into the codon for another amino acid. Indicate in each case below whether the transition is likely to cause a "Large Effect" or "Little Effect" on the resulting mutant protein's tertiary structure: In one sentence explain why for each.

a. Val ---> Asp _____

b. Ile ---> Leu _____

c. Ala ---> Gly _____

d. Ser ---> Tyr _____

e. Gln ---> Glu _____

10. The following manipulations of the HbS (sickle-cell Hb) protein were performed in the laboratory. Predict whether each of the following manipulations will increase or decrease the tendency of HbS to aggregate. Give a rationale for each answer (4 pts).

a) An increase in the partial pressure of oxygen.

b) Stripping the HbS molecules of BPG.

11. a. (5pts.) Draw the structure of phosphatidylinositol if R_1 is a saturated 16 carbon fatty acid and R_2 is an 18:2^{A9,12} fatty acid.

b. (2pts.) Another class of lipid is the fats. Draw a general depiction of a fat:

Is it a hydrophilic molecule? _____

c. (3pts.) Sphingolipids are found at high concentration in nervous tissue membranes. List three components of a ganglioside (one type of sphingolipid):

12. (5 pts) You are working to purify a protein that unfortunately only separates from the membrane when you add detergent to your buffers. Explain what kind of protein this is and some of its likely characteristics. What would you expect the hydropathy plot of this protein to look like?

13 (5 pts) The basic statement " a membrane is a homogeneous mixture of lipids in a freely mobile environment" is not accurate. Make a more correct statement about the true make up of the heterogeneity of membranes.