

UID# \_\_\_\_\_

Printed Name \_\_\_\_\_

Score printed on next page

**BICH 440, EXAM 1, Wednesday, September 24, 2008, 100 points total**

You MUST sign the following academic integrity statement:

On my honor, I have neither given nor received unauthorized aid on this academic work.

Signed: \_\_\_\_\_

1. Write your name on the cover page ONLY.
2. Write your student UID# on ALL pages. If you do not remember your UID#, make up a random 8 digit number. DO NOT use your social security number.
3. Write concise answers to demonstrate effectively your mastery of the subject. In order to obtain maximum credit, you need to show your work.
4. If you do not remember the one-letter code of an amino acid, I will "sell it" to you at the cost of one-half point each (i.e., deduction of one-half point). It's better to take this minor deduction rather than mess up the remainder of a problem.

gas constant  $R$  8.315 J/mol-K

Exam 1 Score \_\_\_\_\_

UID# \_\_\_\_\_

- 1.(12 pts) Consider the following peptide: MYTEAMISCRAP (oops, that just slipped out...)
- (A) Calculate the net charge on this peptide at pH7 and pH11.
- (B) Using the appropriate pKa values below, estimate the isoelectric pH (pI) of this peptide.  
C $\alpha$  carboxyl group: 2, C $\alpha$  amino group: 9; sidechain carboxyl group: 4; imidazole group: 6;  
thiol group: 8; phenolic hydroxyl group: 10; sidechain amino group: 10; guanidino group: 12

2.(15 pts) Draw the atomic structure of the peptide WHYME at pH 5. Depict all peptide bonds in trans configuration. You do not have to show proper stereochemistry about the alpha carbons. To decipher the ionization at pH5, use pKa values from problem 1.

3.(9 pts) You are trying to separate a DNA-binding protein (protein X) from other proteins in a solution containing only three other proteins (A, B, and C). These proteins have the following properties:

<b>protein</b>	<b>pI</b>	<b>molec. wt.</b>	<b>binds DNA?</b>
protein A	8.5	90,000	yes
protein B	4.2	30,000	yes
protein C	8.5	30,000	no
protein X	8.5	30,000	yes

What type of protein chromatography method might you use to separate:

(A) protein X from protein A? Explain why.

(B) protein X from protein B? Explain why.

(C) protein X from protein C? Explain why.

4. (12 pts) Remember the following reaction that was discussed in lecture:



The phosphate group transfer potential for phosphocreatine is 43.3, and for ATP it is 30.5.

(A) Calculate the  $\Delta G^{\circ}$  for the above reaction.

(B) In neurons the concentrations of these compounds are:

phosphocreatine = 4.7mM, creatine = 1.0mM, ATP = 2.6mM, ADP = 0.7mM

Calculate the  $\Delta G$  for the above reaction in neurons (37°C). In what direction does the reaction proceed under these conditions?

5. (15 pts) Drat!!!! My pH meter is broken again, just like it was years back about the time I wrote another exam for biochemistry. I have 500 mL of 0.1M MOPS buffer at pH 7.8 (Don't worry what the acronym "MOPS" means.). How much 1M HCl shall I add to adjust the pH of the solution to 7.1? The pKa for MOPS is 7.2.

6. (5 pts) Draw the structure of the triphosphate part of ATP at pH7. You do not need to draw the structure of the rest of ATP (look for that on a later exam....). Point out one phosphoanhydride linkage in the structure.

7. (32 pts) Short(er) answer questions:

(A) (2 pts) Which amino acid absorbs the most UV light around 280nm?

(B) (5 pts) A multisubunit protein has a basic quaternary structure described as  $\alpha_3\beta_3$ . One subunit has 100 amino acids and the other subunit has 500 amino acids. Estimate the molecular weight of the multisubunit protein.

(C) (4 pts) The axial distance of an alpha helical segment of a protein is 2.25 nm. How many amino acid residues are contained in this alpha helix?

(D) (2 pts) Name an amino acid when present at the C-terminal end of an alpha helix that would stabilize by helix capping.

(E) (2 pts) Name a reagent that will reduce disulfide bonds.

(F) (2 pts) Name two amino acids that are less likely to be included in an alpha helix.

(G) (4 pts) What thermodynamic property accounts for the hydrophobic effect? Explain briefly.

(H) (3 pts) Draw the Schiff base that forms between an amino group on  $R_1-NH_3^+$  and the aldehyde of  $R_2-CHO$ .

(I) (4 pts) During solid-phase peptide synthesis, what functional group is chemically blocked on the "incoming" amino acid? Explain why this group must be blocked.

(J) (2 pts) Name two amino acids after which trypsin catalyzes the hydrolysis of peptide bonds in proteins (either full name, one-letter code, or three-letter code is acceptable)

(K) (2 pts) You are comparing the two amino acid sequences below. If X and Z are conservative substitutions, name the best example of what they could be.

Protein A: .....MTGGAKLVSYW.....

Protein B: .....MXVAIZLVTNI.....

X =

Z =