

Name _____

Score _____

Exam 1, BICH 440, Monday, September 25, 2006

You MUST sign the following academic integrity statement:

On my honor, as an Aggie, I have neither given nor received unauthorized aid on this academic work. Signed: _____

Write concise answers to demonstrate effectively your mastery of the subject. Show your work in order to receive maximum credit where applicable.

gas constant R 8.315 J/mol-K

1)(12 pts) From the list of peptides below, match the BEST choice with each statement. A peptide can be used for more than one answer.

- A. AFIV
- B. QWMH
- C. RPLK
- D. LCDM
- E. ENID

- ___ contains an epsilon-amino group
- ___ binds tightest to an anion-exchange column (pH7)
- ___ contains the highest number of nonpolar sidechains
- ___ absorbs the most UV light (280 nm)
- ___ has the highest isoelectric point
- ___ is cleaved by cyanogen bromide

2)(8 pts) Explain the thermodynamic basis of the hydrophobic effect (i.e., role of entropy change).

Name _____

3)(15 pts) When 200 mL of 0.2M “mystery” buffer HZ is mixed with 200 mL of 0.5M of NaZ (the deprotonated form of HZ), the resultant solution has a pH of 7.4 (25°C).

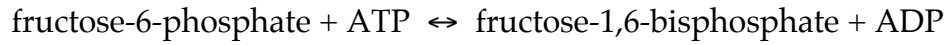
- (A) (11 pts) Calculate the equilibrium constant for dissociation of a proton from HZ.
- (B) (4 pts) Calculate the standard free energy change for this reaction.

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4)(15 pts) Draw the structure of the residues ----alanine-leucine-tyrosine-histidine---- that are in the interior of the primary structure of a protein at pH 5. Your drawing should include the nitrogen preceding the alanine alpha carbon and the carbonyl group following the alpha carbon of the histidine residue. You do not need to depict the proper stereochemistry. This sequence is part of an alpha helix in the protein. Mark the hydrogen bond donor and corresponding hydrogen bond acceptor that would be involved in stabilizing the alpha helix.

Name _____

5)(13 pts) Consider the following reaction:



The phosphate group transfer potentials for ATP and fructose-1,6-bisphosphate are 30.5 and 16.3, respectively.

(A)(5 pts) What is the standard free energy change for the overall reaction written above?

(B)(8 pts) Assume the following concentrations:

ATP: 3mM, ADP: 0.5mM, fructose-1,6-bisphosphate: 5mM

Below what concentration of fructose-6-phosphate would the reaction proceed backwards (right to left) at 37°C?

Name _____

6)(13 pts) Given the following peptide:

met-pro-trp-tyr-asn-asp-his-gly

Assume the following pKa values:

alpha-amino group: 9; alpha-carboxyl: 2; side-chain carboxyl: 4; side-chain sulfhydryl: 8;
sidechain imidazole: 6; sidechain phenol: 10; sidechain amino 10.5

A)(8 pts) What is the net charge on this peptide at pH 8?; also at pH 11?

B)(5 pts) Estimate the isoelectric pH for this peptide.

7)(24 pts) Short Answer

A)(3 pts) How many turns exist in an alpha helix that is approximately 16 Angstroms in length?

B)(4 pts) Define the specific activity of an enzyme. Does the specific activity increase, decrease, or remain constant upon purification? Why?

C)(2 pts) Name two reagents that can be used to chemically modify free sulfhydryl (thiol) groups at cysteine residues in a protein.

D)(2 pts) Estimate the molecular weight of a protein that contains 550 amino acid residues.

E)(2 pts) What is the name of the famous chemist who proposed the structure of the alpha helix?

F)(2 pts) What type of electrophoresis is used in each dimension of a typical 2D protein separation?

G)(2 pts) What direction does a peptide grow during solid phase synthesis?

H)(2 pts) After what amino acid residues in a protein does trypsin cleave?

Name _____

I)(2 pts) What two amino acid residues are relatively more likely to exist in beta turns in proteins?

J)(3 pts) Draw the structure of phosphoserine at pH7 (hint: a phosphoric acid is in an ester linkage with the sidechain of serine).