

Name _____

I.D. _____

Score _____

Exam 1, BICH 440, Section 500, Monday, September 30, 2002

Write your name on each page. 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) (15 pts) You just finished preparing 500 mL of 0.2M Tris buffer, pH 8.5. Then you accidentally spilled some 10N HCl, some of which splashed into the buffer solution. Now the pH of the Tris buffer is 7.8. How much hydrochloric acid was spilled into the buffer? The pKa for Tris is 8.1.

2) (12 pts) Consider the peptides labeled A through E, listed below. Choose one peptide that BEST answers each question. A given peptide can be used as the answer to MORE THAN ONE question.

- A. cys – glu – asp – met (plus the amino terminus is blocked by acetylation)
- B. met – trp – ala - cys
- C. leu – ala – ala
- D. arg – ala – his - val
- E. met – ala – pro - glu

___ does not react with phenylisothiocyanate (Edman's reagent)

___ would elute last from a carboxymethyl column at pH 8

___ least likely to be part of an alpha helix

___ would not be able to determine the amino acid composition of this peptide after acid hydrolysis

___ could be used as a buffer between pH 6-7

___ brief treatment with carboxypeptidase gives amino acid E

3) (9 pts) Calculate the net charge at (a) pH 8, (b) pH 11 and (c) the isoelectric point for the following peptide:

met – asp – his – trp – gly – gly – phe – ile – ala

Use (some) of the following approximate pKa's to answer this question:

carboxyl group on alpha carbon: 2.0

carboxyl group on sidechain: 4.0

imidazole group: 6.0

amino group on alpha carbon: 9.0

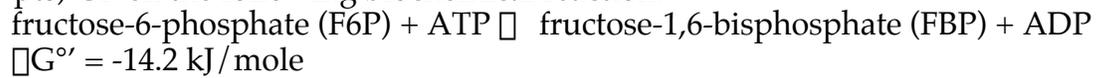
amino group on sidechain: 10.0

guanidino group: 12.0

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4) (9 pts) Draw the sidechain (R-group) of tyrosine in a hydrogen bond with the sidechain of ONE of the following amino acids to which it is capable of interacting in such an interaction – either leucine, phenylalanine, or glutamine (only one is correct!). The tyrosine sidechain is the hydrogen bond donor. The pH is 7.0.

5) (10 pts) Given the following biochemical reaction:



- a) What is the equilibrium constant for this reaction at 37°C?
- b) Given the following actual concentrations: [ATP] = 3 mM, [ADP] = 0.5 mM, [F6P] = 0.5mM, [FBP] = 6 mM. What is ΔG for this reaction at 37°C under these conditions?

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- 6) (15 pts) Draw the structure of the tripeptide met-trp-ala at pH 7. Clearly point to and identify one peptide bond, one bond described by a phi angle, and one bond described by a psi angle. You do NOT need to depict the proper stereochemistry.
- 7) (30 pts) Short answer:
- a) (3 pts) What is the pKa for a weak acid if the equilibrium constant for dissociation of the proton is 3×10^{-4} ?
- b) (3 pts) Draw the structure of, and circle the hydrophobic portion of, the anionic detergent, SDS (sodium dodecyl sulfate).
- c) (2 pts) Write the equation that relates the force of an electrostatic interaction in terms of the charges, distance and dielectric constant.
- d) (4 pts) What would be the absorbance at 280 nm of a 0.1 mM solution of tryptophan in a 1 cm path length cuvette? (molar extinction coefficient of trp at 280 nm, $\epsilon = 5000 \text{ M}^{-1}\text{cm}^{-1}$)

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- e) (2 pts) Which form of phosphate (write the chemical formula) predominates at pH 5? (The pK_a's for phosphoric acid are 2.1, 7.2 and 12.4.)
- f) (2 pts) Name of an amino acid that would be the most conservative substitution for asparagine.
- g) (2 pts) Name two amino acid residues that dictate cleavage specificity by trypsin.
- h) (3 pts) Draw the structure of the sidechain of cysteine after reaction with iodoacetic acid.
- i) (2 pts) Approximately how many amino acid residues are there in a protein of molecular weight 33,000?
- j) (4 pts) What is the approximate length of an alpha helix containing 4 turns?
in Angstroms:
in number of amino acid residues:
- k) (2 pts) Name the only amino acid that does not contain a primary amino group.
- l) (1 pt) What is the one-letter code for the amino acid phenylalanine?