

Name \_\_\_\_\_

Score \_\_\_\_\_

**Exam 1, BICH 440 Honors, Monday, September 27, 2004**

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. (15 pts) How much 5M NaOH is required to change the pH of 2 liters of 0.2M glycine buffer from pH9 to pH10? The pKs of glycine are 2.3 and 9.6.

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2. (15 pts) Draw the structure of the tetrapeptide: leucine – proline – lysine – histidine that is ionized as it would exist at pH 12. You do NOT need to depict the proper stereochemistry.

3. (16 pts) Consider the peptides labeled A through E, below. Choose one peptide (or two, depending on the query) that best answers each question. A given peptide may be used as the answer to more than one question.

- A. glycine – methionine – proline - glycine
- B. cysteine – tryptophan – tyrosine - histidine
- C. lysine – serine – valine – glutamic acid
- D. glutamic acid – tyrosine – alanine - methionine
- E. arginine – threonine – leucine – aspartic acid

\_\_\_\_\_ reacts with N-ethylmaleimide.

\_\_\_\_\_ predicted to elute last from a DEAE column at pH 8.

\_\_\_\_\_ two peptides with sequences containing conservative substitutions

\_\_\_\_\_ This sequence is least likely to be part of an alpha helix in a protein.

\_\_\_\_\_ has the greatest absorbance at 280 nm.

\_\_\_\_\_ cleaved by cyanogen bromide

\_\_\_\_\_ has the lowest isoelectric point (worth 4 points)

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4. (10 pts) Briefly describe how the bicarbonate buffer system of blood plasma can work at pH 7.4 even though the relevant pKa for the dissociation of a proton to form bicarbonate is 3.77. A diagram might be useful in your answer.
5. (15 pts) The phosphate group transfer potentials for creatine phosphate and ATP are 43.3 and 30.5 kJ/mole, respectively. Given the following concentrations: creatine: 2 mM, ATP: 4 mM, ADP: 0.5 mM, phosphate: 2 mM. What concentration of creatine phosphate is necessary to drive the formation of ATP at 37°C?

Name \_\_\_\_\_

6. (15 pts) Deduce the sequence of a peptide from the following information. You must explain your reasoning in order to obtain full credit.
- i) Amino acid analysis: R, C (2 equivalents), G, I, H, M, Y, V
  - ii) After one round of Edman degradation, a mixture of gly and ile were detected.
  - iii) Treatment with beta-mercaptoethanol yielded two peptides, a 4-mer and a 5-mer.
  - iv) A brief treatment with carboxypeptidase resulted in an equimolar mixture of his and val.
  - v) Treatment with trypsin yielded a 7-mer and a dipeptide that contained H and Y.
  - vi) Treatment with cyanogen bromide yielded a 7-mer and a dipeptide that contained met and ile.

Name \_\_\_\_\_

7. (4 pts) Is the force of electrostatic interaction between two charged groups increased or decreased when transferred to a solution of lower dielectric constant? **Why?**

8. (4 pts) Briefly describe two reasons why proline is rarely found in alpha helices of proteins.

9. (4 pts) Are proteins relatively more soluble or less soluble when the pH of their solution equals the isoelectric point? **Why?**

10. (2 pts) What quantity is determined from the slope of a van't Hoff plot?