Biochemistry of Proteins CHEM 4630

February 9, 2012

<u>Term Test-1</u>

Answer all questions in the Exam Booklets. Put your name and student number on all exam booklets. You may use a calculator, and draw <u>structures</u> and <u>diagrams</u> where appropriate.

The total number of marks is 59 and you have 75 minutes to complete the exam.

Answer question 1. It is worth 7 marks.

1. Draw the chemical structure at pH 7 of the following peptide:

Ser-Gln-His-Tyr

Name all of the products of acid hydrolysis of the peptide above. Where would CNBr cleave this peptide?

Answer question 2 OR question 3. Each is worth 15 marks.

- 2. Outline a protocol for amino acid analysis of a protein and describe in chemical detail peptide hydrolysis by strong acid. What problem arises in the determination of Ser and Thr? What can be done about this?
- 3. Describe in chemical detail the main steps of an Edman degradation indicating the role and importance of pH, buffers, and organic solvents.

Answer question 4. It is worth 6 marks.

4. A 10 micromolar solution of a newly discovered protein, Laughin, has an absorption at 280 nm of 0.431 and an absorption at 288 nm of 0.2695, in a cell of 1 cm path length. The extinction coefficients (in M^{-1.} cm⁻¹) for tyrosine and tryptophan at the two wavelengths are listed below. From the information given, calculate the number of Tyrosine and Tryptophan residues in Laughin. For full marks show your work.

	ϵ_{280}	ϵ_{288}
Гrр	5690	4815
Гyr	1280	385

Answer question 5. It is worth 9 marks.

5. Which ionization state of the Cys side-chain is chemically reactive? Show the reaction between oxidized glutathione OR oxidized dithiothreitol and a reduced protein. Explain how these reactions could be involved in the protein folding process. Outline how cells maintain cytoplasmic proteins in a reduced state.

Answer question 6. It is worth 14 marks.

6. Explain the meanings of all of the symbols in each of the following equations:

$$f = \frac{M_r (1 - \rho_0 \overline{v})}{N \bullet s_{20,w}^0} \qquad \qquad f = 6\pi\eta r$$

What information is gained about a protein by comparing measurements of f (left equation) to theoretical values of f (right equation)? Why are hydrodynamic measurements on proteins attractive compared to other methods?

Answer question 7. It is worth 8 marks.

7. What is Proteomics? Explain how mass spectrometry can be used to sequence a protein.

Bonus Question: 2 marks maximum

8. Name the protein that permits a gecko to walk upside-down on a ceiling. Briefly explain the nature of the molecular force that explains the gecko's ability to reversibly bond to hydrophobic and hydrophilic surfaces.