Biochemistry of Proteins 2.463 **February 7, 2005**

Term Test-1

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

The total number of marks is 45, and you have 50 minutes to complete the exam, so spend about 1 minute per mark i.e. 15 min. for a 15-mark question etc.

Answer question 1. It is worth 6 marks.

1. Draw the chemical structure at pH 7 of **one** of the peptides that results from the treatment of the following peptide with cyanogen bromide:
   Ala-Ile-Pro-Met-Leu-Lys-Tyr

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

2. Describe in chemical detail the main steps of an Edman degradation indicating the role and importance of pH, buffers, and organic solvents.

3. Outline a protocol for amino acid analysis of a protein and describe in chemical detail peptide hydrolysis by strong acid. Explain the problem that arises in amino acid analysis when a protein contains β-branched dipeptides and present a solution to the problem.

Answer questions 4 AND 5. Each is worth 6 marks.

4. A 50 micromolar solution of a protein comprising a single polypeptide chain has an absorbance in a 1 cm cuvette at 290 nm of 0.180 at pH 7 and an absorbance of 0.924 at pH 12. The molar extinction coefficient for tyrosinate at pH 12 is 2480 $M^{-1}cm^{-1}$ and for Tyrosine at pH 7 is 0. How many tyrosine residues are in this protein?
   What is the structure of tyrosinate?

5. Explain how Immobilized Metal Affinity Chelate Chromatography can be used to purify proteins.

Answer questions 6. It is worth 8 marks.

6. Describe the determination of disulphide pairs in a protein using a chemical method and using mass spectrometry.

Answer questions 7. It is worth 4 marks.

7. Name 3 methods for the determination of the M_r of a protein. Of the methods you have named which gives the most accurate measure of protein mass? Explain the physical meaning of the symbols in the following equation:

$$\frac{dr}{dt} = \frac{M_r(1-\bar{\nu}\rho)\omega^2 r}{N \bullet f}$$