## **Biochemistry of Proteins – CHEM 4630**

February 12, 2019

## Term Test-1

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

The total number of marks is 55 and you have 75 minutes to complete the exam.

#### Answer questions 1, 2 and 3.

(8) Draw the chemical structure at pH 7 of <u>all</u> of the products that result from treatment of the following peptide with 10% acetic acid-pyridine, pH 2.5, at 40°C for 24 – 48 h.

#### Val-Gly-Gln-Asp-Pro-Met-Arg-Tyr

- 2. (6) Explain how Immobilized Metal Affinity Chelate Chromatography can be used to purify proteins.
- 3. (2) Draw a structure of fused colloidal silica.

#### Answer question 4 or question 5. Each is worth 15 marks.

- 4. (15) Outline a protocol for amino acid analysis of a protein and describe in chemical detail peptide hydrolysis by strong acid. What problem arises in amino acid analysis of proteins containing threonine? What can be done about this? Over what range of wavelengths does the peptide bond absorb?
- 5. (15) Describe in chemical detail the main steps of an Edman degradation describing the role and importance of pH, buffers, and organic solvents.

### Answer questions 6 - 8.

- 6. (2) Define proteomics.
- 7. (8) Explain how Asn <u>or</u> Gln <u>or</u> Cys biosynthesis in certain bacteria or archaea help support an explanation of the evolution of the genetic code.
- 8. (6) A 12 micromolar solution of a newly discovered protein, *Singin*, was discovered in raindrops. The protein solution had an absorption at 280 nm of 0.3123 and an absorption at 288 nm of 0.2056, in a cell of 1 cm path length. The extinction coefficients (in M<sup>-1</sup>· cm<sup>-1</sup>) for tyrosine and tryptophan at the two wavelengths are listed below. From the information given, calculate the number of tyrosine and tryptophan residues in *Singin*. For full marks show your work.

	<b>E</b> <sub>280</sub>	<b>E</b> <sub>288</sub>
Trp	5690	4815
Tyr	1280	385

# Answer question 9 or question 10. Each is worth 8 marks.

- 9. (8) Draw the amino acid Cys showing the structure of the side-chain that is chemically reactive. Show the reactions that take place between oxidized glutathione OR oxidized dithiothreitol and a protein containing two reduced Cys. (You don't have to show the full structures of glutathione or dithiothreitol.) Explain how these reactions could be involved in the folding of a protein.
- 10. (8) Describe the new Met-specific iodonium-reagent developed by Taylor *et al.* (2018) including a description of some applications. What is an important role of Met in biology?