THE UNIVERSITY OF MANITOBA

| April 12, 2014	6:00 pm – 9:00 pm	Page 1 of 4
Seat # 1 – 32	E2-165 EITC	Final Examination
CHEM 4630	Biochemistry of Proteins	Examiner: Dr. J. O'Neil

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Section 1: *You must answer **all** of the following questions in* Section 1.
*As a guide, you can spend up to 2 hours and 30 minutes on this part of the exam. Wherever possible **use diagrams and chemical structures** to enhance your answers.*

Marks

2   1.   In the following peptide fragment, three N atoms are labeled w, x, and y. Indicate the order of protonation of the atoms in strongly acidic solution.
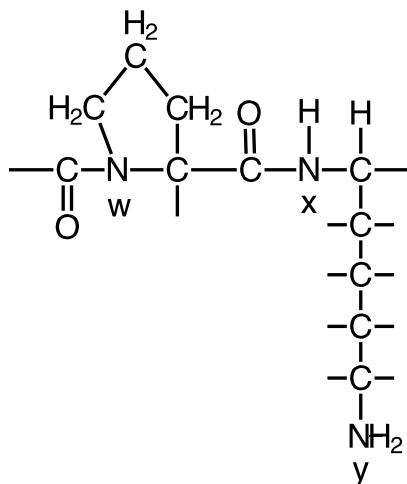

10   2.   Below is shown the mass spectrum of a protein. Name the method that was used to introduce the protein into the vacuum of the mass spectrometer.
Explain this method of introducing proteins into a mass spectrometer.
The spectrum contains 7 major peaks labeled by their mass-to-charge ratio. From the mass/charge ratios of two of the peaks calculate the molecular weight of the protein **showing your calculations**.
Near each of the major labeled major peaks in the spectrum are smaller peaks – what is their origin?

m/q
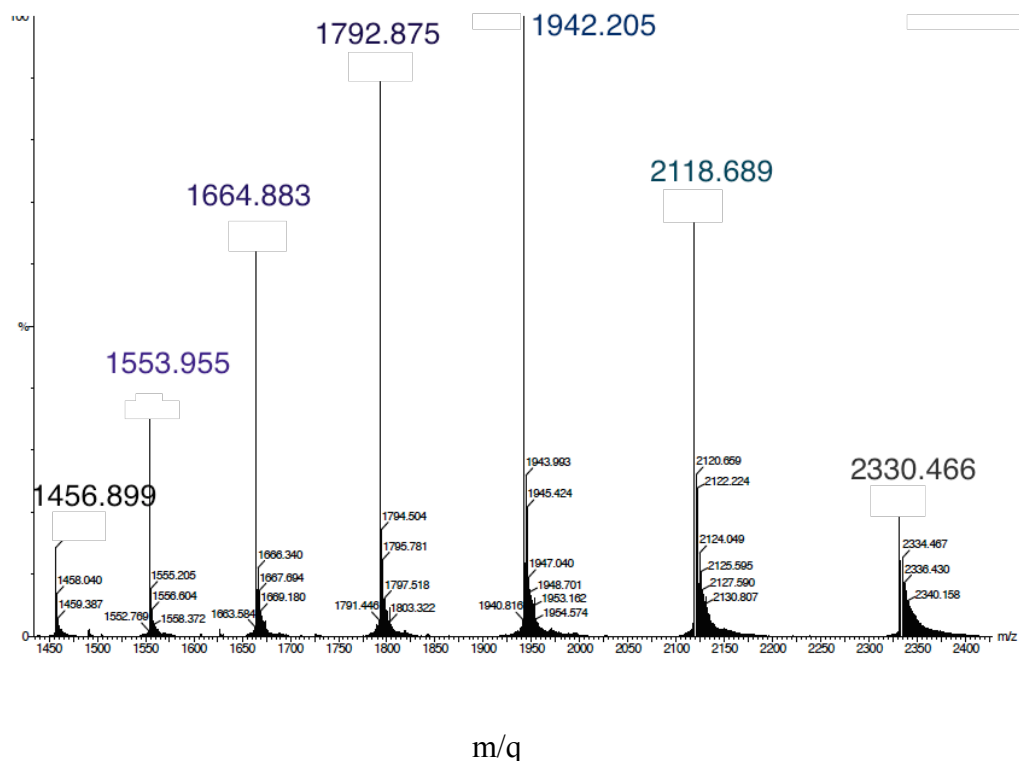
6   3.   Define proteomics.
Explain how the SILAC method can be used to quantify proteins in cells.

6   4.   Define the dihedral angle ω. Explain why it rarely deviates from 180°.

6   5.   Explain the main function of *E. coli* Elongation Factor P (EF-P). Why is this protein necessary?

THE UNIVERSITY OF MANITOBA

April 12, 2014   6:00 pm – 9:00 pm   Page 2 of 4
Seat # 1 – 32   E2-165 EITC   Final Examination
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_10_   6.   Give a full description of parallel and antiparallel β-sheet structures.

_10_   7.   Helices can form with 3.5, 3.6 and 3.7 residues per turn. Briefly describe the important structural implications of such structures.

_5_   8.   Briefly comment on the structure and function of homeodomains.

_4_   9.   Draw simple diagrams illustrating an up-and-down motif and a Greek-key motif.

_12_   10.   With the use of the following diagrams describe the structure and function of hemagglutinin.
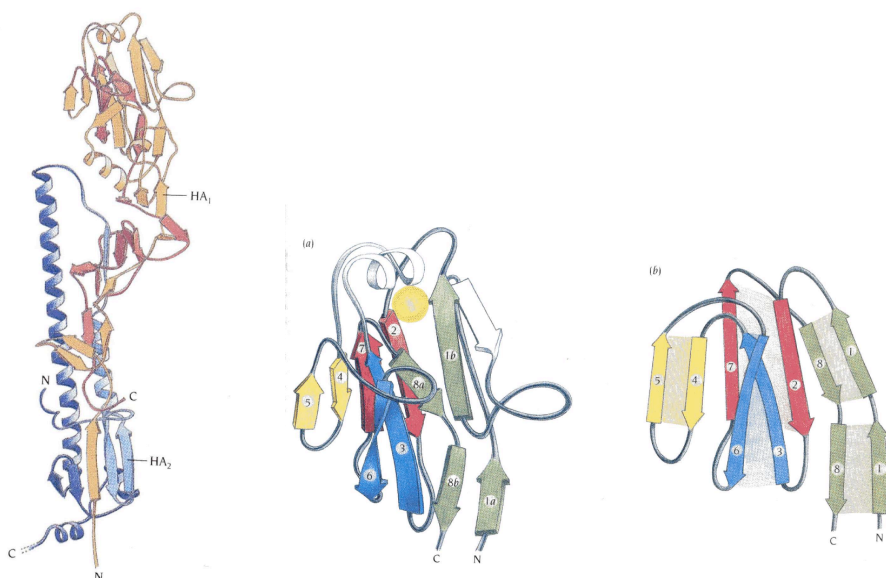

_4_   11.   Which two factors determine the efficiency of fluorescence resonance energy transfer between a donor and acceptor chromophore.

_2_   12.   Draw a simple diagram illustrating the secondary structure in a parallel β-barrel.

_3_   13.   Draw a simple diagram illustrating the secondary structure in an open-twisted β-sheet NAD binding domain and label the topological switch point.

_3_   14.   Identify the following structure and describe its function in proteins.
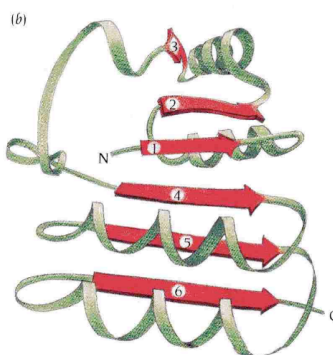
_8_   15.   Describe one way to determine the relative hydrophobicities of the amino acids. Explain how to produce a hydropathy plot and explain what is the purpose of the plot.

_4_   16.   Explain why it is easier to make low energy conformational changes in β-sheets than in α-helices.

_8_   17.   Briefly describe conformational changes involving α-helices.

THE UNIVERSITY OF MANITOBA

April 12, 2014 — 6:00 pm – 9:00 pm — Page 3 of 4
Seat # 1 – 32 — E2-165 EITC — Final Examination
CHEM 4630 — Biochemistry of Proteins — Examiner: Dr. J. O'Neil

10   18.   With the use of the following diagrams, outline the major changes in conformation that occur in myosin that drive the muscle power stroke.
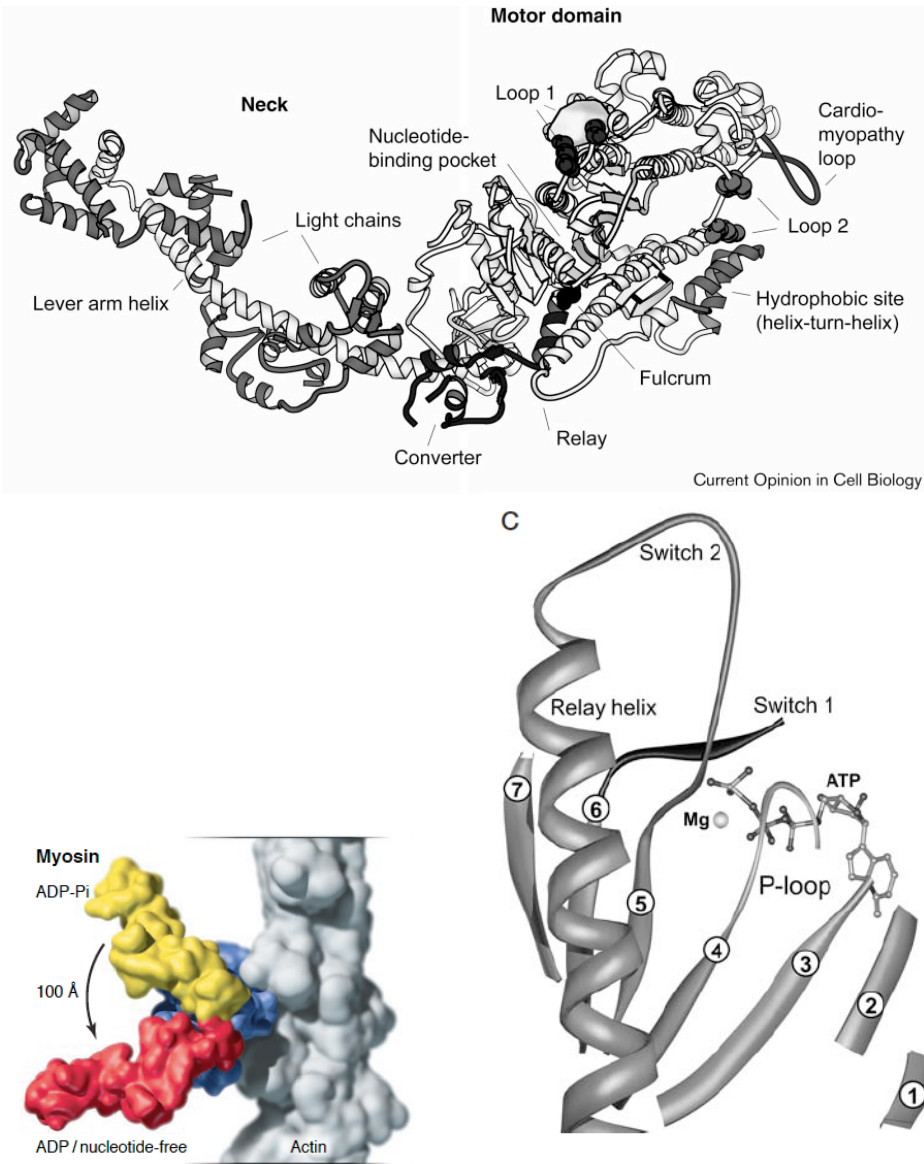
3   19.   What is meant when a protein is described as "*soft*"?

4   20.   What is known about the transition states for protein folding based on molecular dynamics simulations?

6   21.   Which properties of amino acid sequences suggest intrinsic disorder?

2   22.   What is the purpose of the GroE chaperonin complex?

2   23.   With respect to protein structure prediction, what is "*threading*"?

10   24.   Describe the structure, function and mechanism of the protein disulfide isomerase.

THE UNIVERSITY OF MANITOBA

April 12, 2014   6:00 pm – 9:00 pm   Page 4 of 4
Seat # 1 – 32   E2-165 EITC   Final Examination
CHEM 4630   Biochemistry of Proteins   Examiner: Dr. J. O'Neil

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Section 2:   *Answer Question 25. You can spend about 20 min. on this question.*

Marks

15   25.   With the use of the appropriate diagrams discuss the structure and function of the enzyme cycloxygenase (also known as prostaglandin synthase) **_OR_** the photosynthetic reaction centre from *Rhodopseudomonas viridis*.

A

B

C

D

E

F

155