THE UNIVERSITY OF MANITOBA

April 13, 1993 FINAL EXAMINATION

PAPER NO: 112 PAGE NO: 1 of 3
DEPARTMENT & COURSE NO: CHEMISTRY 2.463 TIME: 3 HOURS

EXAMINATION: Biochemistry of Proteins EXAMINER: J. O'Neil

Marks

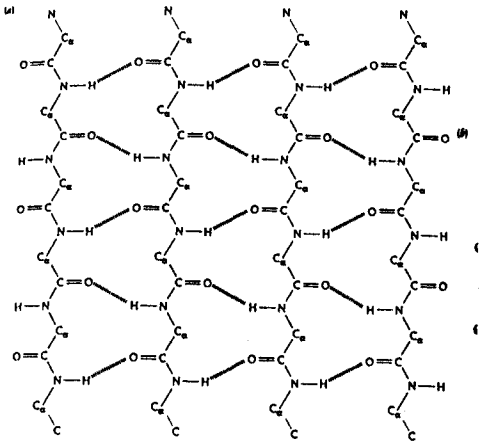
Section 1: You must answer all of the following questions in section 1. You can spend up to 2 hours on this part of the exam. Wherever possible use diagrams to enhance your answers.

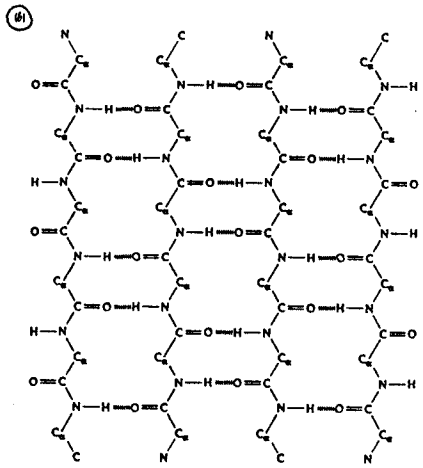
(10) 1. Suppose you have synthesized a peptide ser-met-ala-arg-thr-tyr using a solid-phase peptide synthesis technology in which coupling yields are 97% efficient per step. What fraction of the total product will be the target peptide? What will be the main contaminants of this synthesis? How do they arise and what fraction of the total product will the contaminants comprise? Show your calculations.

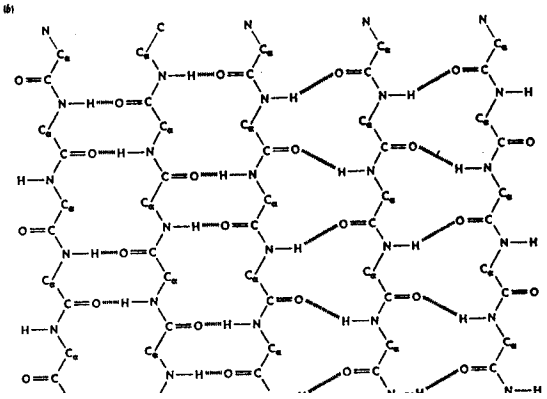
(8) 2. Draw the peptide ala-tyr and label the dihedral angles ϕ, ψ, ω, χ. Explain what is a Ramachandran Plot?

(6) 3. Explain the differences between a 3.6_{13} and a 3_{10} helix.

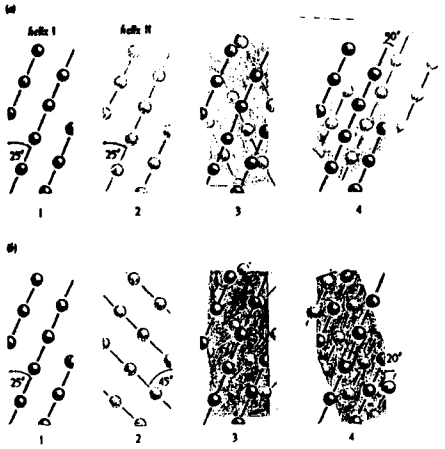
(6) 4. Identify the following structures. What are the main features of each?







(6) 5. Using the diagram below explain the common ways in which α-helices pack together.



(6) 6. Using words and a diagram suggest a folding pathway for the formation of a Greek Key motif.

(8) 7. Below are 2 topology diagrams. Explain why one forms a closed barrel and the other an open, twisted sheet. Where is the topological switch point in one of the diagrams and what generally is its function?

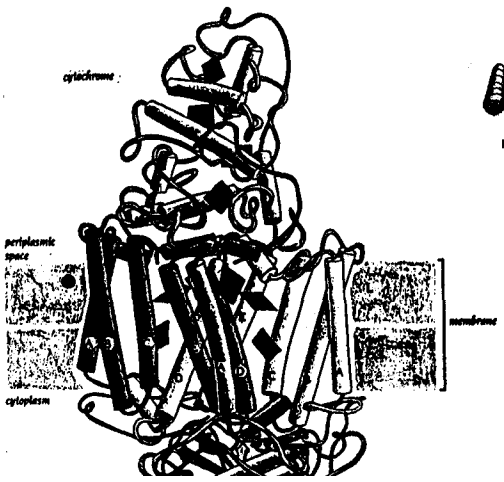
(6) 8. What is a molten globule?

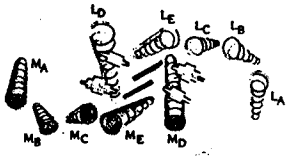
(10) 9. What are the factors which cause helix <---> coil transitions in long polymers to be so highly cooperative?

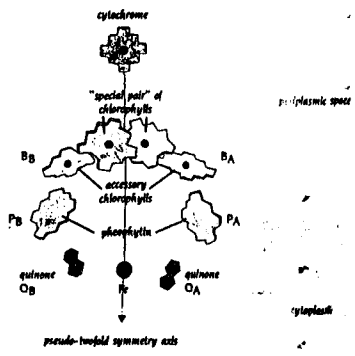
(14) 10. Describe what is known about the folding of α-lytic protease and the function of its pro piece. How does this molecule illustrate the possibility that, in general, the folded state of a protein may not be the global, free-energy minimum state.

Section 2: Answer 1 of the following questions in section 2. You can spend about 1/2 hour on this question.

(20) 11. With the use of the diagrams below discuss the structure of the photosynthetic reaction centre from *Rhodopseudomonas viridis* and indicate how knowledge of the structure improves our understanding of the function of the complex.

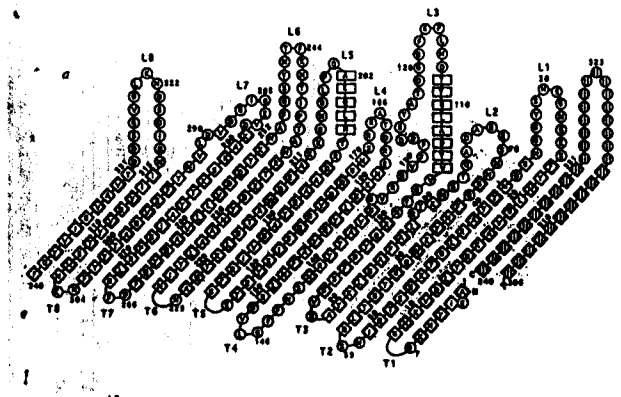


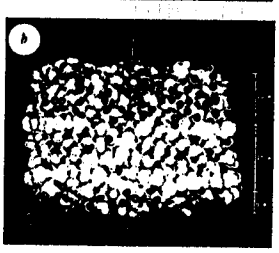


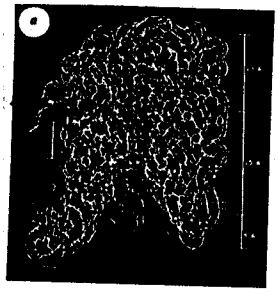


or

(20) 12. With the use of the diagrams below discuss the structure of the *E. coli* porin complex and indicate how knowledge of the structure improves our understanding of the function of the molecule.







Section 3: Answer 1 of the following questions in section 3. You can spend about 1/2 hour on this question.

(20) 13. Suppose you wanted to study the folding pathway of an acidic protein (APTI) containing 7 cys residues (3 disulfides and 1 thiol). Outline a strategy for determining the folding pathway. Explain the kinds of data you would expect to obtain and explain how you would interpret the data. Finally, propose a reasonable pathway.

or

(20) 14. Explain the difference between an equilibrium intermediate and a kinetic intermediate in a protein folding pathway. Describe tests for the existence of both types of intermediate. Provide typical data and explain how you would interpret the data.