

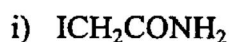
Mid-Term Test

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

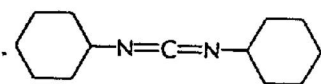
The total number of marks is 70 and you have 75 minutes so spend about 1 min. per mark i.e. 20 min. for a 20 mark question etc.

Do 1 of the following 2 questions. Each is worth 20 marks.

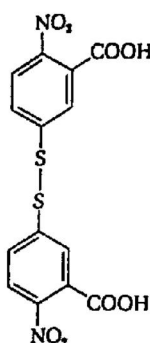
1. For 4 of the molecules below give the name of the molecule, an example of a chemical reaction involving the molecule, and describe the use of the molecule.



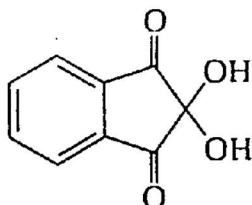
iii)



iv)



v)



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

Answer question 3. It is worth 15 marks.

3. The 99 residue HIV-1 protease was the first all *D*-amino acid protein to be synthesized. What difference would result in the product of a solid-phase synthesis of this protein if the average yield per cycle was 99% as compared to 99.9%?

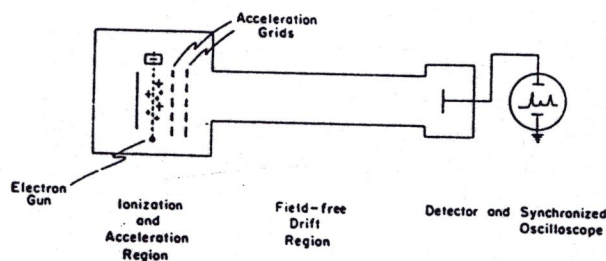
The all *L*-amino acid protease was also synthesized. Describe the differences in the structures and activities of the *D*- and *L*-proteins.

Answer question 4. It is worth 10 marks.

4. Explain what is a Ramachandran diagram. Sketch a Ramachandran diagram and indicate on it the location of the left- and right-hand α -helix, the collagen (polyproline) helix, and parallel and antiparallel β -strands.

Answer question 5. It is worth 15 marks.

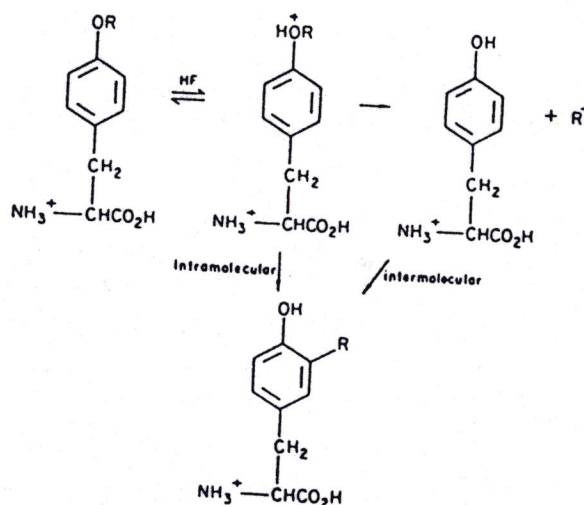
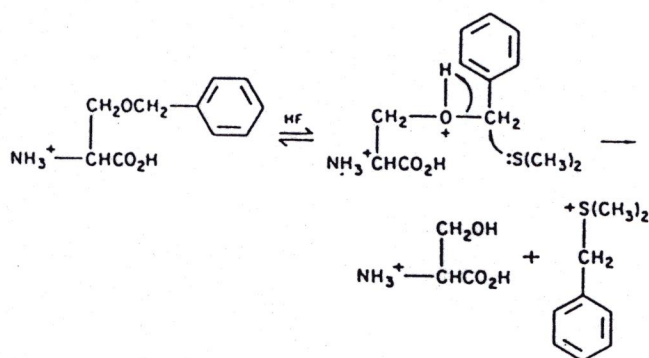
5. Using the diagram below explain how a time-of-flight mass spectrometer can be used to determine the mass of a protein or peptide.



Name 2 other types of mass spectrometer. Explain 2 methods by which proteins can be ionized and then introduced into a mass spectrometer. Explain how a protein can be sequenced with the use of a mass spectrometer.

Answer question 6. It is worth 10 marks.

6. Explain the Principle of Graduated Acid Lability. Using the diagrams below explain the Low-High HF cleavage method for deprotection and removal of synthetic peptides from styrene divinylbenzene.



Bonus Question: It is worth 5 marks.

7. In some proteins Lysine side-chains and the aromatic rings of Phenylalanines are observed to interact by a kind of "H-bond" in the interior of a folded protein. Draw a diagram to illustrate the geometry of two such interacting groups.