M. Sc. (Chemistry) Examination, 2023

(4th Semester)

Paper: XVI–O

[Organic Chemistry Special]

Time : Two Hours Full Marks : 40

(20 marks for each unit)

Use a separate answer script for each unit.

Unit: O-4161

1. Answer ***any four*** questions : 4×5

   a) Discuss the major differences between an α-helix and Π-helix. Why does an α-helix contain dipole moment?

   b) Polyglycine, a simple polypeptide, can form a helix with $\phi = -80°$ and $\Psi = +150°$. From the Ramachandran plot, describe this helix with respect to number of residues per turn and handedness.

   c) Describe the limitations of the Ramachandran plot.

   $2\frac{1}{2}+1\frac{1}{2}+1$

2. a) Describe in brief the steps for the biosynthesis of the polypeptide chain.

   b) A polypeptide hormone angiotensin II has the amino acid compositon (Asp, Arg, Ile, Met, Phe, Pro, Tyr, Val)

The following observations are made:

- Trypsin yields a dipeptide containing Asp and Arg, and a hexapeptide with all the rest.
- Cyanogen bromide cleavage yields a dipeptide containing Phe and Pro, and a hexapeptide containing all the others.
- Chymotrypsin cleaves the hormone into two tetrapeptides, of composition

  (Asp, Arg, Tyr, Val)

  and

  (Ile, Met, Phe, Pro)
- The first product of carboxypeptidase cleavage is Phe.

a) From the above observations, write the amino acid sequence of the polypeptide hormone with explanation.

b) Discuss briefly the experimental approach to determine the positions of the -S-S- bonds in a protein.

c) Write the name of a transport and a storage protein. 2+2+1

3. a) Write the structural features and stability of the collagen triple helix.

b) Why does ascorbic acid deficiency lead to denatured collagen fibres formation?

Tetrapeptide: H_2N-Gly-Lys-Pro-Val-$CONH_2$ (All amino acids are in L-configuration). 1+2

9. Answer **any two** of the following questions.

a) What is the difference between 'nucleoside' and 'nucleotide'? PNA is a DNA-mimic justify. 1+2

b) Write down a plausible synthetic scheme of chiral α and γ-PNA monomer with a nucleobase of your choice. $1\frac{1}{2}+1\frac{1}{2}$

c) What is PMO? Give a plausible synthetic scheme of a PMO monomer with a nucleobase of your choice. 1+2

10. Write a short note on (***any one***) : 2

i) Ala scan

ii) Pseudopeptide

c) Why antiparallel β-sheets are more stable than parallel β-sheets? $2+1\frac{1}{2}+1\frac{1}{2}$

4. a) What is circular dichroism (CD)? Why the near UV-CD is an important tool to predict the correctly folded structure of a protein?

   b) What is a 'motif'? Explain the formation and importance of a 'βαβ' motif. 3+2

5. a) What is 'energy landscape model' or 'funnel model' of protein folding?

   b) Write the name of the different kinetic factors for protein folding. Discuss about the role of any one of them in protein folding.

   c) What is protein misfolding? $1\frac{1}{2}+2\frac{1}{2}+1$

6. a) Write a brief account of the followings (any ***two***) :

      i) Amide-I band of protein in FTIR and its importance.

      ii) Glutathione

      iii) DTE or DTT

   b) Write down the steps for the determination of N-terminal end of a polypeptide by Edman method. Mention the advantage of this method. $1\frac{1}{2}\times 2+2$

Unit: O-4162

7. Answer **any two** of the following questions :

   a) How does the fluid mosaic model help in designing a synthetic lipid? Comment on the unique structural features of a membrane lipid. 1+2

   b) Write down two plausible synthetic schemes (one each) of DPPC and a mimic of DPPC of your choice with a justification. $1\frac{1}{2}+1\frac{1}{2}$

   c) Give one example in each case of a bolaform and pseudoglyceryl cationic lipid and a plausible synthetic scheme of any one of them. 1+2

8. Answer **any two** of the following questions :

   a) What are Type-II and Type-III peptidomimetics? What do you understand by the terms peptoids and depsipeptide? Give a plausible synthetic route of a peptoid. 1+2

   b) What are β-turn in peptide secondary architecture? Give a plausible synthesis of a chiral α-methylamino acid. 1+2

   c) Write down a plausible mimics of the following tetrapeptide having (i) backbone modified and (ii) side chain modified architecture. Give a plausible synthetic scheme of any one of the above mentioned two.