2026
Chemistry
Paper : CH406
(Advanced Bioinorganic Chemistry)

Full Marks : 80

Time : 3 hours

The figures in the margin indicate full marks for the questions.

Section - A

1. Answer the following questions : 2×3=6

   a) What is biomineralisation ? Give the example of biomineralisation of Si and Ca. 1+1=2

   b) Mention the role of calcium in human body. Name the two important Ca^{2+} -regulatory protein found in human system. 1+1=2

   c) What are HiPIPs ? Show their one electron oxidation and reduction step.

2. Give the best characterized examples of transferrin protein. Explain the active site arrangement of the protein. 2+2=4

   Or

   Name the enzyme responsible for active transport of Na^+/K^+ ion across the cell membrane. Explain the total cycle involved in the transport of Na^+ -K^+ ions across the cell membrane. 1+3=4

3. Name the important types of Peroxidases enzyme. Explain the catalytic cycle peroxidase enzymes. 1+4=5

   Or

   What are the catalytic function of catalase and super oxide

dismutase enzyme ? Give the active site description of mononuclear and hetero dinuclear SOD. 2+3=5

4. i) What are Haemerythrins (Hr) and haemocyanins ? 3

ii) Discuss the mechanism of active transport of ions across the cell membrane. 4

Or

Discuss the structural representation of 4

a) the dicopper (I) site in deoxy-hemocyanin

b) the dicopper (II) site of oxy-hemocyanin

5. Explain the consequences of the reactions of naked heme groups. Explain how **James Collman** developed the *"picket fence"* porphyin as model compound of Hemoglobin on the basis of these reactions. 3+3=6

6. i) What is PS-II and PS-I ? 2

ii) Explain the water splitting reaction that take place at the initiation of the photosynthesis process. 5

Or

Explain the Electron flow in Photosystems I and II (Z-Scheme) during the reduction of carbohydrate. 5

iii) Explain the respiratory electron transfer chain that occurs in inner mitochondrial membrane. 5

Or

What is Fe-S protein ? Explain the structure of [2Fe-2S], [4Fe-4S], [3Fe-4S] proteins. 1+4=5

Section - B

7. i) Give the structural features of Cytochrome P450. 2

ii) Give the structural representation of nitrogenase enzyme. 2

Answer *any three* from questions 8, 9, 10 and 11 : $5 \times 3 = 15$

8. i) Discuss the structural features of Carboxypeptidase A in resting state as well as in active form. 3

   ii) Write the role of ATP in driving the nitrogenase reaction. 2

9. Discuss the mechanism involved in the monooxygenation of hydrocarbon. 5

10. Write the detail mechanism involved in hydration of carbon dioxide using carbonic anhydrase enzyme. 5

11. Discuss in detail the various supramolecular interaction involved in carboxypeptidase enzyme. 5

Section - C

12. Describe the preparation of $BaSO_4$ suspension for radiological use. 3

Or

Explain how silica nanoparticles are used for controlled drug relase. 3

13. Outline the mechanism of iron uptake and release by transferrin. 5

14. Describe different monitoring techniques used to study the interaction of metal complexes with DNA. 5

15. Explain how platinum complexes interact with DNA and describe their biological consequences. 4+4=8

Or

16. i) Illustrate the role of Fenton reaction in oxidative stress and free radical formation. 5

   ii) Discuss the significance of chelating ligands in gadolinium-based contrast agent. 3

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