Five Year Integrated M.Sc. Examination, 2017

Semester - VI

Course: CH-3-6-1

(Chemistry)

Time: Four Hours **Full Marks: 80**

Questions are of value as indicated in the margin.

Group-A

1. Answer ***any ten*** of the following: 10x2=20
   a) What are essential and beneficial metals? Give two examples of each such metal.
   b) Name a chelating drug used in beryllium poisoning and draw its structure.
   c) What is 3Fe-4S ferredoxin? Draw its structure.
   d) What is double ligand therapy? Give example.
   e) Write down the structure and absolute configuration of L-proline in R, S – nomenclature.
   f) What is an isoelectric point for an α-amino acid?
   g) Define catabolism and anabolism.
   h) Explain why the peptide C—N bond is shorter than the normal C—N bond.
   i) Define cyclic group and give one example of such a group.
   j) What is irreducible representation? How to ascertain whether a particular representation is irreducible or not?
   k) What is the Mulliken notation for the following irreducible representation?

	E	C_2	i	σ_h
	1	-1	-1	1

   l) Using the definition of group construct the character table of a group comprising of three elements: E, A and B.

Group-B

Answer ***any two*** questions.

2. a) Give two effects of lead toxicity and the reason behind them. What are the clinical symptoms of lead toxicity? Suggest a drug that can be used to treat lead poisoning. 2+1+1
   b) What is Calvin cycle? Draw the structure of chlorophyll and specify when it is '*a*' and when '*b*'. Discuss the role of magnesium (II) in chlorophyll. 1+2+3

3. a) Compare the relative stabilities of crown ether complexes versus linear ligand complexes with suitable examples. 3
   b) Discuss the role of distal histidine residues in hemoglobin and myoglobin. 3
   c) Why *trans*-platin is inactive for the treatment of cancer? 2
   d) What are the limitations of chelation therapy in metal ion detoxification? 2

4. a) Name two crown ethers and draw their structures. 2
   b) What is active and passive transport across a membrane? What are the ratio of concentrations of Na^+ and K^+ inside and outside for a typical cell? 1+1
   c) What role does 2,3-diphosphoglycerate play towards O_2 affinity of hemoglobin? 2
   d) What are the essential requirements of a chelating antidote in metal ion detoxification? 2
   e) How can you distinguish between carrier and channel former type ionophore? 2

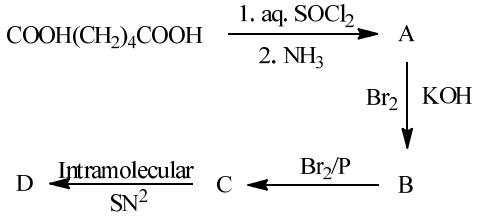
Group-C

Answer ***any two*** questions.

5. a) Define the essential and non-essential amino acids in protein chemistry. 2

P.T.O.

b) What are A, B, C, D of the following reaction scheme? 4



c) Give evidences in support of the dipolar nature of amino acids. 1.5

d) Give the structure of the products of the reactions of ninhydrin with phenylalanine and proline, respectively. How these compounds are useful for the identification of amino acids. 2.5

6. a) Delineate the role of dicyclohexylcarbodimide (DCC) in the formation of the peptide linkage between two different suitably-blocked amino acids. 2

b) What is meant by primary and secondary structure of polypeptide? 2

c) Using Sanger's reagent, how can you determine the N-terminal of a peptide? 2

d) Write equations showing protection and deprotection of an amino acid using tert-butyloxycarbonylgroup. 2

e) What is meant by denaturation of protein? 2

7. a) Account for the mutagenic activity of nitrous acid on DNA. 2

b) Mention the names of different types of RNA's and their functions. 3

c) Which 'N' of guanidine is more basic? 1

d) What is turn over number? 1

e) Define coenzyme with an example. 2

f) Give the name of one proteolytic enzyme. 1

Group-D

Answer ***any two*** questions.

8. a) Identify the point symmetry group of the following molecules and list the symmetry elements.
(i) CH_2Cl_2 (ii)BCl_3 4

b) Discuss any one method of your choice to obtain the matrix representation of rotation (C_θ), reflection $(\sigma)_6$ and inversion (i) operations. 6

9. a) Show that the trace of a matrix remains invariant under a similarity transformation. 3

b) Write down the Great orthogonality theorem and hence obtain the orthogonality theorem in terms of the character of the matrix representation of the symmetry operation. 4

c) Discuss in brief the link between Group theory and Quantum Mechanics. 3

10. a) Prove that the direct product representation $T^{\mu\otimes\nu}$ will have totally symmetric representation only if $T^{\mu} = T^{\nu}$. 4

b) Determine the irreducible representation to which the normal mode of vibration of H_2O molecule belongs. Test which of these modes are infra-red and Raman active? 6

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