

Five Year Integrated M.Sc. Examination, 2019

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: 10×2=20
- Comment on the thermodynamic and kinetic aspects of nitrogen fixation.
 - How does the presence of imidazole moieties affect the activity of carbonic anhydrase?
 - Briefly explain heterotropic allosteric effect in hemoglobin.
 - What is double ligand therapy? Give example.
 - Write the structure of S-Glycine.
 - What is meant by reducing sugar?
 - Give the products formed when glucose is reacted with $\text{Br}_2/\text{H}_2\text{O}$.
 - Give example of a basic amino acid and an acidic amino acid.
 - Name the point symmetry group of NH_3 molecule and arrange the symmetry operations according to the class.
 - What do you mean by an abelian group? Give one example of such a group.
 - Write down the criterion for irreducibility of a representation of a point symmetry group.
 - How many different irreducible representations are there for C_{3v} point symmetry group?

Group-B

Answer *any two* questions.

2. a) What is cytochrome P-450? What is the origin of its name? What do you mean by peroxide shunt in explaining the activity of cytochrome P-450? 1+1+2
- b) How can you distinguish between carrier and channel former type ionophore? 2
- c) What are the limitations of chelation therapy in metal ion detoxification? 2
- d) What are the roles of proximal and distal histidine residues in hemoglobin? 2
3. a) Write note on 2Fe-2S ferredoxin? What is Rieske's centre? 2+1
- b) What are the various interactions leading to T-form of hemoglobin? What is the mechanism of transformation from the T-form to R-form? 1+2
- c) What are cryptands? Give one example. 2
- d) Draw the structures of two anti-cancer platinum drugs and write their names. 2
4. a) What is active and passive transport across a membrane? Write a note on Na-K-pump. 1+3
- b) Discuss the function of PS-I and PS-II in photosynthesis. How are they connected? 4
- c) Explain the role of polyaminocarboxylic acids as chelation drugs. 2

Group-C

Answer *any two* questions.

5. a) What do you mean by mutarotation of glucose? Explain with mechanism. 1+3
- b) What is Ruff degradation? What is its use in carbohydrate chemistry? Give the reagents involved in this method. 1+1+2
- c) Give the product(s) of the reaction of D-glucose with periodic acid. 2
6. a) What is Kiliani-Fischer synthesis? Using this synthetic method convert D-arabinose to D-glucose. 4
- b) Glucose and fructose form the same osazone with phenyl hydrazine. Justify the statement. 3

P.T.O.

- c) How can you convert D-glucose to D-fructose? Give the mechanism. 3
7. a) What is isoelectric point? Show that $pI = (pK_1 + pK_2)/2$ (pI = Isoelectric point of the amino acid; pK_1 and pK_2 = two pK_a values of the amino acid) 1+3
- b) Draw the form in which glycine predominantly exists in a solution at (i) $pH=3$ and (ii) $pH=12$. 2
- c) How can Alanine be prepared by Strecker synthesis method? Give mechanism. 2+2

Group-D

Answer *any two* questions.

8. a) Write down the great orthogonality theorem and explain the different terms in it. Hence obtain the orthogonality theorem in terms of characters. 3+3
- b) Find out an expression for the number of times an irreducible representation occurs in a given reducible representation in terms of the characters of the symmetry operations. 4
9. Consider the C_{2v} character table given below. Using this table classify the normal modes of vibration of *trans*- H_2O molecule according to symmetry. Using group theory explains which of these normal modes are infrared and Raman active. 10

C_{2v}	E	C_2	$\sigma_v(xz)$	$\sigma_v(yz)$		
A_1	1	1	1	1	z	x^2, y^2, z^2
A_2	1	1	-1	-1	R_z	xy
B_1	1	-1	1	-1	x, R_y	xz
B_2	1	-1	-1	1	y, R_x	yz

(Hint: For every unmoved nucleus as a result of R use the results)

R	E	$C(\theta)$	σ	$S(\theta)$
$\chi(R)$	3	$1+2 \cos \theta$	1	$-1+2 \cos \theta$

10. a) Using the 's' orbitals of three hydrogen and nitrogen atoms of NH_3 molecule construct the matrix representations of different symmetry operations of NH_3 molecule. 5
- b) Using the theorems of irreducible representation construct the character table of C_{3v} point symmetry group. 5