

PG CBCS
M.Sc. Semester-I, Examination, 2020
CHEMISTRY
 PAPER: CEM 103
(INORGANIC CHEMISTRY-I)

Full Marks: 40

Time: 2 Hours

Answer any four questions from the following:

[4×10] = 40

1. (a) Derive the expression for relation between interplanar distance and Miller indices
 (b) The lattice constant of a cubic crystals is 2.25 Å. Find the interplanar spacing of a set of crystallographic plane having miller indices (100). [5+5]
2. (a) Deduce the expression for the Braggs diffraction in terms for reciprocal lattice.
 (b) For a hexagonal lattice, the three sides are 10 Å, 10 Å and 15 Å. Calculate the volume of the lattice. [5+5]
3. State the meaning and draw stereographic projections of the following point groups.

(i)	4mm	
(ii)	6/m mm	
(iii)	4/m mm	
(iv)	23	[5 x 2.5]
4. (a) Derive the matrix form $C_n(x)$ symmetry element. [4+4+2]
 (b) Prove that, $S_2=i$ with the help of corresponding matrices.
 (c) What are the symmetry criteria for a molecule to be optically active?
5. (a) Assign the point group to the following molecules and ions:
 (i) ClF_3 ; (ii) B_2H_6 ; (iii) $cis-[Co(en)_2Cl_2]^+$, (iv) $Be(C_2O_4)_2^{2-}$
 (b) Work out the product of the following elements in C_{3v} point group:
 $\sigma_v''C_3^1 \sigma_v$ and $\sigma_v'C_3^2 \sigma_v$
 (c) Construct the 'group multiplication table' for H_2O molecule. [4+4+2]
6. (a) Find the inverse of S_n^m operation when
 - (i) n is even and m is odd
 - (ii) n is odd and m is even
 (b) Write down the 'Hermann-Mauguin notation' for the following point groups:
 D_2, C_{3v}
 (c) Write the closure rule for the construction of point group of a molecule.
7. (a) What are the essential criteria for a collection of entities must have to form a group?
 (b) What do you mean by 'Abelian group'? Give an example.
 (c) Derive the matrix representation of vertical planes in NH_3 molecule.

(2)

8. Answer the following questions: [1x10]

- (a) What is methemoglobin?
- (b) Give an example of a naturally occurring M-C π -bonded species
- (c) Name two Zn containing enzymes
- (d) Draw the structure of two common amino acids.
- (e) What are the different peroxo binding modes in dinuclear metal complexes?
- (f) State the role of Superoxide Dismutase enzyme
- (g) What are ionophores?
- (h) What are the different iron Sulphur proteins?
- (i) Draw the structure of rubredoxin.
- (j) State and explain briefly the magnetic property of oxyhemocyanin.

9. (a) What is the nature of the dioxygen binding site in Hemoglobin? Explain how protein part is also involved in the binding of oxygen. [4]

(b) Draw the structure of a non-heme iron protein and explain its function. [4]

(c) Explain Bohr effect for the binding and release of oxygen in hemoglobin. [2]

10. (a) State and explain the binding features of oxygen in hemocyanin. Write the typical spectroscopic features observed in oxyhemocyanin and correlate with its structure. [4]

(b) Write the structural integrity of Ferritin and state its significance. [4]

(c) Describe the major role of Hepcidine in the regulation of iron transport. [2]
