

Total pages: 2

**PG CBCS**  
**M.Sc. Semester-I Examination, 2021**  
**CHEMISTRY**  
 PAPER: CEM 103  
**(INORGANIC CHEMISTRY-I)**

Full Marks: 40

Time: 2 Hours

Answer any **TWO** questions from each group:**4×10= 40****Group-A**

1. (a) Show that the reciprocal lattice of cubic lattice is also a cubic lattice.  
 (b) Derive Bragg's expression for direct lattice. [5+5]
2. (a) For a hexagonal lattice the three sides are 15Å, 15Å and 20Å then what will be the volume of the lattice  
 (b) If x-rays of wave length 0.5Å are diffracted at an angle at 50° in the first order. What is the spacing between the adjacent planes of the crystal? [5+5]
3. State the meaning and draw stereographic projections of the following point groups.  
 (i) 622, (ii) 4 mm, (iii) 32, (iv) 222, (v) mmm [2×5=10]
4. (a) Derive the matrix form of C<sub>n</sub>(z) symmetry element.  
 (b) Prove that, S<sub>2</sub>=i with the help of corresponding matrices.  
 (c) What are the symmetry criteria for a molecule to be optically active? [4+4+2]
5. (a) Assign the point group to the following molecules and ions:  
 (i) ClF<sub>3</sub> (ii) B<sub>2</sub>H<sub>6</sub> (iii) *cis*-[Co(en)<sub>2</sub>Cl<sub>2</sub>]<sup>+</sup> (iv) [Fe(C<sub>2</sub>O<sub>4</sub>)<sub>3</sub>]<sup>3-</sup>  
 (b) Work out the product of the following elements in C<sub>3v</sub> 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<sub>2</sub>O molecule. [4+4+2]

**Group-B**

6. (a) Find the inverse of S<sub>n</sub><sup>m</sup> operation when  
 (i) 'n' is odd and 'm' is odd  
 (ii) 'n' is odd and 'm' is even  
 (b) Write down the 'Hermann-Mauguin notation' for the following point groups:  
 $C_{3v}$ ,  $D_{3d}$   
 (c) Write the closure rule for the construction of point group of a molecule. [4+4+2]
7. (a) What are the essential criteria for a collection of entities must have to form a group?  
 (b) What is meant by 'Abelian group'? Give an example.  
 (c) Derive the matrix representation of vertical planes in NH<sub>3</sub> molecule. [3+3+4]

(P.T.O.)

(2)

8. Answer the following questions:

- (a) What is methemoglobin?
- (b) Give an example of a naturally occurring M-C  $\sigma$ -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 types of iron-sulphur proteins?
- (i) Draw the structure of rubredoxin.
- (j) State the magnetic property of oxyhemocyanin. [1x10]

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.

- (b) Draw the structure of a non-heme iron protein and explain its function.
- (c) Discuss Bohr effect for the binding and release of oxygen in hemoglobin. [4+4+2]

10. (a) Write the structure of transferrin protein and explain its function.

- (b) Discuss the mechanism of action of  $\text{Na}^+ - \text{K}^+$  pump.
- (c) Describe the active site structure of cytochrome c. [4+4+2]

\*\*\*\*\*