2025

M.Sc. 1st Semester Examination

CHEMISTRY

Paper : CEMC402X0

(Inorganic Chemistry-I)

Full Marks : 50 Time : Two Hours

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

Group - A

Answer any ***four*** questions : 2×4=8

1. Cite an example for the following : Bi(III) complex used as a drug in gastric, duodenal ulcers, and Fe(II) complex used as an anti-cancer drug.

2. By which species does the transportation of iron in lower organisms happen? Mention its types and cite one example for each type.

3. Find out the sub-groups of the D_{3h} group.

4. Determine the point groups of the following molecules/ ions : ½×4=2

   (a) $[Cr(ox)_3]^{3-}$ (ox = oxalate dianion)

   (b) NH_4^+

P.T.O.

(c) NO

(d) $[ZnCl_4]^{2-}$

5. If X-rays of wavelength 0.5Å are diffracted at an angle of 50 degrees in the first order. What is the spacing between the adjacent planes of the crystal?

6. Derive the relation between interplanar distance and Miller Indices in a cubic lattice.

Group - B

Answer any ***four*** questions : 4×4=16

7. (i) Explain the magnetic property of deoxy- and oxy-hemerythrin.

   (ii) Discuss the mechanism of oxygenation in hemerythrin. 2+2

8. Draw the general active site structure of cytochrome and mention the variation in substitution in heme a, b, and c.

   Comment on the spectral property of cytochrome.

9. Write the complete enzymatic reaction of urease and discuss the active site structure of the enzyme.

10. Show that if a C_4 axis and one plane containing this axis exist, then there must be a total of four planes that contain this axis, and the angle between adjacent planes is 45°.

11. Determine the matrix form of all symmetry operations possessed by the H_2O molecule. Show that these

symmetry operations form a group. Determine classes present in this group. 2+1+1

12. Molybdenum has a BCC structure. Its density is 10.2×10^3 kg/m^3, and its atomic weight is 95.94. Determine the radius of molybdenum atom.

Group - C

Answer any *two* questions : 8×2=16

13. (i) In living systems, which reaction is catalysed by the enzyme carbonic anhydrase?

Draw the coordination environment around the central metal atom in the resting and active conditions of carbonic anhydrase, and mention the salient features.

(ii) What is meant by 'Blue copper proteins'? How are blue copper proteins characterised?

(iii) Draw and explain the active site structure of 'Plastocyanin'. (1+3)+2+2

14. (i) Derive the matrix form of all symmetry operations present in the $POCl_3$ molecule.

(ii) What are the differences between reducible and irreducible representations of a group? 6+2

15. (i) What do you mean by reciprocal lattice? Show that the reciprocal lattice of a simple cubic lattice is also a simple cubic lattice.

P.T.O.

(ii) Aluminium has an fcc structure. Its density is 2700 kg/m^3. Calculate the unit cell dimension and the atomic diameter. Atomic weight of Alumi nium = 26.98. (1+3)+4

16. (i) Verify that the scalar product of vectors $\vec{S}$ and $\vec{T}$ in h-dimensional space is equal to the sum of the products of the lengths of projections of the vectors in h-orthogonal axes with no cross terms.

(ii) What do you mean by platonic solids? Write all possible platonic solids where the faces are equilateral triangles.

(iii) State the meaning and draw stereographic projections of the following point groups :

(a) 622, (b) m3, (c) 4 mm, (d) 32. 2+2+4

Internal Assessment : 10 marks