2022

(May/June)

CHEMISTRY

(Honours)

(Part—A : Inorganic Chemistry)

(Chem–H–601)

Marks : 38

Time : 2 hours

The figures in the margin indicate full marks for the questions

Answer **one** question from each Section

SECTION—I

1. *(a)* What type of ligands qualify as π-acid ligands? Give one example of a π-acid ligand and discuss its role in the stabilization of low oxidation states of metals. 4

(b) Determine the structure and bonding of ferrocene. 3

(c) Give one method of preparation of Zeise salt and mention two applications of it. 3

2. *(a)* Give the mechanism of catalytic hydrogenation of alkenes with Wilkinson's catalyst $[RhCl(PPh_3)_3]$. 3

(b) What is synergic effect? Explain the fact that CO group forms stable carbonyls with a metal though C is a weak donor atom. 3

(c) Describe any one method of preparation and one use of organometallic compounds of tin and lithium. 4

SECTION—II

3. *(a)* What are the functions of sodium and potassium in the cell? Describe the active transport of sodium and potassium ions across the cell membrane. 4

(b) Which metal ion is present in chlorophyll? State the light and dark phase reactions of photosynthesis. 3

(c) Discuss the toxicity of mercury and lead. 3

4. *(a)* In vitamin B_{12} what is the oxidation state of Co? Which groups occupy the fifth and sixth coordination positions of Co? Discuss the methylation reaction involving vitamin B_{12}. 5

(b) What is cooperativity in haemoglobin? How is it conveyed? 3

(c) Name two essential trace elements and two ultratrace elements. 2

SECTION—III

5. *(a)* Find the Russel-Saunders terms for a P^2-configuration. What will be the ground state? 3

(b) Electronic transitions of the *d-d* type displayed in the spectra of octahedral transition metal complexes should be forbidden by Laporte selection rule. Why are moderately strong spectra actually observed? 3

6. *(a)* What are spin multiplicity forbidden and Laporte forbidden transitions? Explain. 3

(b) Show how the following terms are obtained for a d^2-configuration :

^1G, ^3F, ^1D, ^3P and ^1S

Which of these belong to the ground state? 3

SECTION—IV

7. (a) Explain the difference between stepwise stability and overall stability constants and derive a relationship between the two. 3

(b) Explain in terms of lability and inertness, why $[Co(CN)_6]^{3-}$ is inert while $[Co(Br)_6]^{3-}$ is a labile complex. 3

8. (a) Explain with example how *trans*-effect is useful in distinguishing *cis*- and *trans*-isomers. 3

(b) How does the nature of the central metal ion as well as the ligand affect the stability of complexes? 3

SECTION—V

9. (a) Give one method of preparation of gold nanoparticles and mention its uses. 3

(b) Distinguish between top-down nanotechnology and bottom-up nanotechnology. 3

10. (a) Give one method of preparation of platinum nanoparticles and mention its uses. 3

(b) What are the different types of nanomaterials? 3

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