2023

(May/June)

CHEMISTRY

(Honours)

(Inorganic Chemistry—VI)

(Chem–H–601)

Marks : 38

Time : 2 hours

The figures in the margin indicate full marks for the questions

1. *(a)* What are π-acid ligands? Explain the bonding of metal nitrosyl. 3

(b) Give one method of preparation and one use of the following organometallic compounds : 2×2=4

(i) R_3SnX

(ii) Alkyl-lithium

(c) Write the steps involved in the synthesis of acetic acid using rhodium carbonyl iodide catalyst. 3

OR

2. *(a)* What are π-metal ethylenic complexes? Explain the bonding of metal ethylenic complex taking the example of Zeise salt. 1+3=4

(b) Draw the structures of the following metal carbonyls : 2

(i) $Fe_2(CO)_9$

(ii) $Mn_2(CO)_{10}$

(c) Draw the structure of metal complexes showing the following hapticity : 2

(i) $-\eta^2$

(ii) $-\eta^5$

(d) Describe the structure of ferrocene. 2

3. *(a)* What are essential and trace elements? What is the main role of Fe and Zn in biological system? 1+2=3

(b) Draw the structures of hemi group present in haemoglobin and myoglobin and mention their roles in biological system. 2+2=4

(c) How does *cis*-platin work as anti-cancer drug? Explain why *trans*-platin is ineffective as anti-cancer drug. 1½+1½=3

(Continued)

OR

4. *(a)* Using a schematic diagram, explain the mechanism of Na^+-K^+ pump in biological system. 4

(b) Give a probable mechanism for the reversible hydration of CO by carbonic anhydrase. What is the stereochemistry of Zn in carbonic anhydrase? 3+1=4

(c) Name the element whose deficiency/ excess is related to the following diseases : 2

(i) Anaemia

(ii) Hypothyroidism

(iii) Tetany

(iv) Diabetes

5. *(a)* Using Orgel diagram, discuss the spectrum of $[V(H_2O)_6]^{3+}$. 3

(b) What is the criterion for a molecule to be infrared active? Predict in order of *M*—*X* bond frequencies and also mention the approximate region in which these stretching frequencies occur. (*M* is a metal and X = F, Cl, Br, I) 1+2=3

(Turn Over)

OR

6. *(a)* Explain why ν_{CN} frequency is higher in complexes than in free cyano group. 2

(b) Find the ground state term symbol of an octahedral d^5 configuration. 1

(c) The electronic transition of the *d-d* type displayed in the spectra of octahedral transition metal complexes are forbidden by Laporte selection rule but moderately strong spectrum are observed in complexes. Explain. 3

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

(b) Discuss the mechanism of ligand displacement reaction of a square planar platinum (II) complex. 3

OR

8. *(a)* Explain how *trans*-effect is useful in the synthesis of *cis*-platin and *trans*-platin from the appropriate starting material. 3

(b) What are inert and labile complexes? Show that the inertness of a complex is different from its thermodynamic stability. 1+2=3

9. *(a)* Explain the application of gold nanoparticles in the field of medicine. 3

(b) Mention three properties of nanoparticles. 3

OR

10. *(a)* Describe one method of synthesis of silver nanoparticles and mention its use. 3

(b) What do you understand by the terms 'nanomaterials' and 'nanotechnology'? 1½+1½=3

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