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Reg. No. : .....

Name : .....

Third Semester M.Sc. Degree Examination, January 2020

Chemistry/Polymer Chemistry

CH/CL/CM/CA/PC 231 — INORGANIC CHEMISTRY III

COMMON FOR CHEMISTRY

(Common for Chemistry (2016 Admission onwards) and Polymer Chemistry (2018 Admission))

Time : 3 Hours Max. Marks : 75

PART – A

Answer **any two** among (a), (b) and (c) from each question. Each sub-question carries **2** marks :

1. (a) Give the structure of a complex where the nitrosyl groups bond to metal in linear and bent forms. How many electrons are donated by each type of ntrosyl group to the metals.

   (b) Represent the structures of $Fe(CO)_5$, $Fe_2(CO)_9$ and $Fe_3(CO)_{12}$.

   (c) What do you mean by hapto nomenclature?

2. (a) $Cr\left(H_2O\right)_6^{2+}$ is labile and $Cr\left(CN\right)_6^{2-}$ is inert. Why?

   (b) How is and *trans* isomers of $\left[Pt\,Cl_2\left(NH_3\right)NO_2\right]^-$ are prepared from $\left[PtCl_4\right]^{2-}$?

   (c) Write down the Marcus equations.

P.T.O.

3. (a) What are essential and trace elements in biological systems?

(b) Explain the role of calcium in biological systems.

(c) Write one toxic effect of each metal Cd, Hg and Cr.

4. (a) How many signals do you expect for $[Cu(H_2O)_4]^{2+}$ in EPR spectroscopy?

(b) How IR spectroscopy can be used to study the nature of carbonyls in metal complexes?

(c) What do you mean by chemical shift in NMR spectroscopy?

5. (a) What is the connection between nuclear stability and binding energy of atomic nucleus?

(b) What are half-life and average life of a radioactive species.

(c) Explain the liquid drop model of the nucles.

(10 × 2 = 20 Marks)

PART – B

Answer either (a) and (b) of each questions. Each question carries **5** marks.

6. (a) Draw the structures of $CO_2(CO)_8$, $Ru_3(CO)_8$, $Ru_3(CO)_{12}$ and $RH_4(CO)_{12}$. Show that 18-electron rule is satisfied in each case.

(b) Explain the synthesis of dibenzene chromium. Describe its structure.

7. (a) Describe the A and D mechanisms of substitution reactions involving coordination complexes. How can you distinguish between them?

(b) Explain the mechanism of outer sphere redox reactions.

8. (a) Explain mechanistic aspects of Na^+/K^+ ion-pump.

(b) What is carboxypeptidase A? Explain its structure and functions.

9. (a) Explain briefly the principle of ^{1}H NMR spectroscopy.

(b) The EPR spectrum of bis (salicylaldimine) copper (II) shows four groups of lines which result from the coupling of an electron with $^{63}Cu\,(I = 3/2)$ nucleus; the hyperfine structure in each of the four groups consists of eleven peaks with intensity ratio of 1: 2: 3: 4: 5: 6: 5: 4: 3: 2: 1. Explain the two types of splitting observed.

10. (a) State and explain the semiempirical mass equation.

(b) What is radioactive equilibrium? Explain the difference between transient and secular equilibria.

(5 × 5 = 25 Marks)

PART – C

Answer **any three** questions, and each question carries 10 marks.

11. How ferrocene is synthesized? Describe its structure and bonding.

12. Explain the mechanism of ligand substitution in octahedral complexes.

13. Why nitrogen fixation is an important process? Taking two examples of *in-vitro* complexes and explain their importance on understanding nitrogen fixation process and mechanism.

14. Describe the use of Mössbauer spectra for the study of high and low spin complexes of iron (II) and iron (III).

15. Explain the 'nuclear fission, how it can be used as a source of energy?

(3 × 10 = 30 Marks)

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