[This question paper contains 6 printed pages]

Your Roll No. : .....

Sl. No. of Q. Paper : **1561 I**

Unique Paper Code : 2172581101

Name of the Paper : DSC-Inorganic Chemistry

Name of the Course : **B.Sc.(Prog.) in Applied Life Science with Agrochemicals and Pest Management**

Semester : I

Time : 2 Hours ***Maximum Marks : 60***

Instructions for Candidates :

(a) Write your Roll No. on the top immediately on receipt of this question paper.

(b) **All** questions carry equal marks. Attempt any **four** questions.

1. (a) What is 18 electron rule ? Using 18 electron rule as guide, predict which of the following compounds are stable : 5

(i) $Fe_3(CO)_{12}$

P.T.O.

(ii) $\left[Co(\eta^5 - C_5H_5)(CO)_3\right]$

(iii) $Mn(CO)_5Br$

(b) Arrange the following compounds in increasing order or IR stretching frequencies of C-O bond : 5

(i) $\left[Mn(CO)_6\right]^{2+}, \left[Cr(CO)_6\right]^{+}, \left[V(CO)_6\right]^{-}$

(ii) $\left[Fe(CO)_4\right]^{2-}, \left[Co(CO)_4\right]^{-}, \left[Ni(CO_4)\right]$

(c) Draw MO diagram of CO and explain why CO acts as an electron pair donor and acceptor through C and not O. 5

2. (a) What are organometallic compounds ? Giving appropriate examples, explain how will you classify organometallic compounds based on nature of metal-carbon bond present in it ? 5

(b) What is zeise's salt ? Discuss the bonding in zeise's salt on the basis of Dewar-Chatt-Duncanson model and IR studies. How is M-C bonding in zeise's salt different from that in metal carbonyl complexes ? 5

(c) (i) Describe different factors which affects the magnitude of Δ_0.

(ii) Which of the following compounds have high CFSE and why ? $\left[Cr(CN)_6\right]^{3-}$ or $\left[Cr(NH_3)_6\right]^{3+}$ 5

3. (a) The magnetic moment of $\left[Fe(H_2O)_6\right]^{3+}$ is 5.92 B.M. and that of $\left[Fe(CN)_6\right]^{3-}$ is 1.73 B.M. Explain on the basis of crystal field theory. 5

(b) Define the following terms : 5

(i) Ambidentate ligands

(ii) Crystal field stabilization energy (CFSE)

(c) Which of the following is not considered as an organometallic compounds and why ? 5

$(C_2H_5)Zn, B(OCH_3)_3, NaCN, Ni(CO)_4$ and CaC_2

4. (a) (i) Using the valence bond method, assign hybridization, geometry and predict the magnetic moment (in Bohr magnetons) for $\left[Cr(en)_3\right]^{2+}$ complex.

(ii) State two limitations of valance bond theory. 5

(b) Explain : 5

(i) Cu^{2+} ions are coloured and paramagnetic whereas Zn^{2+} ions are colourless and diamagnetic.

(ii) All tetrahedral complexes are high spin.

(c) Draw crystal field splitting diagram for $[CoCl_4]^{2-}$ and $[Fe(CN)_6]^{4-}$. Also calculate CFSE for both. 5

5. (a) Define Jahn-Teller theorem. Giving reason, explain in which case this effect would be observed : 5

$$t_{2g}^{3}eg^{1} \text{ or } t_{2g}^{6}eg^{2}$$

(b) Explain why crystal field splitting energy for octahedral complex is larger than square planar complex. 5

(c) $[Co(NH_3)_6]^{3+}$ is an inner orbital octahedral complex whereas $[Ni(NH_3)_6]^{2+}$ is an outer orbital complex. Explain. 5

6. (a) Write the IUPAC names of following complexes : 5

(i) $\left[Ni(NH_3)_2(H_2O)(NO_2)\right]Br$

(ii) $\left[Pt(py)_4\right]\left[PtCl_4\right]$

(iii) $\left[Co(en)_3\right]Cl_3$

(b) Name the type of isomerism in the following pairs of isomers and discuss a method to distinguish them : 5

(i) $\left[Co(NH_3)_6\right]\left[Cr(NO_2)_6\right]$ and

$\left[Cr(NH_3)_6\right]\left[Co(NO_2)_6\right]$

(ii) $\left[RuCl(en)_2(H_2O)\right]Cl_2$ and

$\left[RuCl_2(en)_2\right]Cl.H_2O$

(c) (i) The vanadium-carbon bond distance is longer in $V(CO)_6$ than is $\left[V(CO)_6\right]^-$. Explain.

(ii) What is meant by the term 'hapticity'. Explain with suitable examples. 5

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