ACH 551

IV Semester M.Sc. Degree Examination, September/October 2022
(CBCS – 2016 – 17 Syllabus) (Freshers and Repeaters)
APPLIED CHEMISTRY
Coordination Chemistry

Time : 3 Hours   Max. Marks : 70

Instructions : i) Answer **all** questions in Part – **A** and **any four** questions from Part – **B**.
ii) Figures to the **right** indicate marks.

PART – A

Answer **all** sub-divisions.   **(9×2=18)**

1. a) Find the ground term for the configurations of $3d^5(Mn^{2+})$ and $3d^3(Cr^{3+})$.

   b) What is nephelauxetic effect ? Place the following ligands in order of increasing nephelauxetic effect : H_2O, Br^-, en, F^-, CN^-.

   c) Account for the color intensity difference of Octahedral $\left[Co(H_2O)_6\right]^{2+}$ and tetrahedral $[CoCl_4]^{2-}$.

   d) Among actinides, in terms of magnetic properties, Pu(III) and Am(III) appear as exceptions. Why ?

   e) Spin-state isomerism is not observed in tetrahedral and square planar complexes. Justify.

   f) The free sulphate ion shows two IR active bands at 1104 and 613 cm^{-1}, but in the complex $[Co(NH_3)_5SO_4]Br$, each band is split into two peaks. Why ?

   g) Differentiate between labile and inert complexes.

   h) How Cis and trans-isomers of $[Pt(NO_2)NH_3Cl_2]$ are prepared ?

   i) Predict the products of acid hydrolysis of $[Cr(C_2O_4)_3]^{3-}$.

PART – B

Answer **any four** questions. **(4×13=52)**

2. a) Explain solar energy conversion by taking $[Ru(biph)_3]^{2+/3+}$ complex as an example. Discuss its applications.

   b) Explain the mechanism of photoredox reactions.

   c) Discuss why $[Mn(H_2O)_6]^{2+}$ exhibits extremely weak absorption bands in its absorption spectrum. **(5+4+4=13)**

3. a) Discuss the selection rules for electronic transitions with suitable examples.

   b) Explain the advantages of Tanbe-Sugano diagram over Orgel diagram. Represent a Tanbe-Sugano diagram for the d^6 configuration and predict its spin allowed transitions/energies.

   c) How are charge transfer bands different from d-d bands ? Discuss their origin, types and characteristics. **(4+5+4=13)**

4. a) Indicate the changes that occur in the IR spectra of carbonate and perchlorate groups upon complexation.

   b) Describe Faraday's method for the determination of magnetic susceptibility of a compound.

   c) Calculate magnetic moments for $[Mn(H_2O)_6]^{2+}$ and $[Fe(H_2O)_6]^{3+}$ complexes. Why spin only values are precise in these cases ? **(4+5+4=13)**

5. a) Discuss the ESR spectrum of bis-salicylideneiminocopper (II) complex.

   b) Discuss the application of Mossbauer spectroscopy in determination of structures of iron complexes.

   c) Calculate a value for μ_{eff} of $[Ni(H_2O)_6]^{2+}$ taking into account spin-orbit coupling (Given $\lambda = -315$ cm^{-1} and $\Delta_0 = 8500$ cm^{-1}). **(4+5+4=13)**

6. a) Explain the mechanism of anation reactions.

   b) Discuss the mechanism involved in those reactions where there is no M-L bond cleavage.

   c) Discuss base hydrolysis of octahedral complexes. **(5+4+4=13)**

7. a) What are two electron transfer reactions ? How this reaction is useful in the preparation of coordination compounds ?

   b) Complete the following reaction and write its mechanism :

   $$\left[Co(NH_3)_5\,Cl\right]^{2+} + \left[Cr(H_2O)_6\right]^{2+} \xrightarrow{\ H^+\ } ?$$

   c) Discuss the factors affecting nucleophilic substitution reactions on square planar complexes. **(4+5+4=13)**

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