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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 $3d^5(\text{Mn}^{2+})$ and $3d^3(\text{Cr}^{3+})$.
- 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 $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$ and tetrahedral $[\text{CoCl}_4]^{2-}$.
- 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 $[\text{Co}(\text{NH}_3)_5\text{SO}_4]\text{Br}$, each band is split into two peaks. Why ?
- g) Differentiate between labile and inert complexes.
- h) How Cis and trans-isomers of $[\text{Pt}(\text{NO}_2)\text{NH}_3\text{Cl}_2]$ are prepared ?
- i) Predict the products of acid hydrolysis of $[\text{Cr}(\text{C}_2\text{O}_4)_3]^{3-}$.

P.T.O.



PART – B

Answer **any four** questions.

(4×13=52)

2. a) Explain solar energy conversion by taking $[\text{Ru}(\text{biph})_3]^{2+/3+}$ complex as an example. Discuss its applications.
b) Explain the mechanism of photoredox reactions.
c) Discuss why $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$ 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 Tanabe-Sugano diagram over Orgel diagram. Represent a Tanabe-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 $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$ and $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ 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 $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$ taking into account spin-orbit coupling (Given $\lambda = -315 \text{ cm}^{-1}$ and $\Delta_0 = 8500 \text{ cm}^{-1}$). **(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 :
- $$\left[\text{Co}(\text{NH}_3)_5\text{Cl}\right]^{2+} + \left[\text{Cr}(\text{H}_2\text{O})_6\right]^{2+} \xrightarrow{\text{H}^+} ?$$
- c) Discuss the factors affecting nucleophilic substitution reactions on square planar complexes. **(4+5+4=13)**
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