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II Semester M.Sc. Degree Examination, November - 2022

CHEMISTRY

Inorganic Chemistry - II

(CBCS 2019-20 Scheme)

Paper : Ch - 201

Time : 3 Hours

Maximum Marks : 70

Instructions to Candidates:

Answer question No.1 and any Five of the remaining.

Answer any Ten of the following.

(10×2=20)

1.
 - a) What is chelate effect?
 - b) Depict the bonding in metal dihydrogen complexes.
 - c) How are terminal and bridging carbonyls distinguished by IR-spectroscopic techniques.
 - d) What are the factors that favour low coordination number complexes?
 - e) Give the postulates of crystal field theory.
 - f) What is stereochemical nonrigidity? How is it detected?
 - g) Deduce the total number of microstates for V^{2+} and Ni^{2+}
 - h) Why is the $MnCl_2$ solution feebly coloured?
 - i) Obtain the ground terms for d^3 metal ion.
 - j) Calculate the spin only magnetic moment for $[Fe(CN_6)]^{4-}$ and $CoCl_4^{2-}$
 - k) What is spin crossover?
 - l) What is Kasha's rule?

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2. a) Discuss the bonding in metal isocyanide complexes. (3+4+3=10)
- b) Describe the stability constant determination of a metal complex by polarographic method.
- c) What are the possible ways of binding NO to metal? Describe the bonding in them.
3. a) How do nature of metal ion and ligand affect the stability of metal complexes. (5+5=10)
- b) Describe the crystal field splitting of d orbitals in tetrahedral and trigonal bipyramidal field. Why is crystal field of tetrahedral complex lower than octahedral complexes.
4. a) Discuss the factors influencing CFSE. Calculate CFSE of $[\text{Co}(\text{NH}_3)_6]^{3+}$
(Given pairing energy = 21000 cm^{-1} and $\Delta_0 = 29500 \text{ cm}^{-1}$) (4+3+3=10)
- b) Construct the MO diagram of $[\text{CoCl}_4]^{2-}$ with only σ bonding involved.
- c) On the basis of CFT, explain the colour of transition metal complexes.
5. a) What is Nephelauxetic effect? Give any two evidences for it. (4+3+3=10)
- b) Explain the selection rules in electronic spectroscopy.
- c) How do ^3P and ^3F free ion terms of a d^2 metal ion get transformed in an octahedral complex. Assign the transitions.
6. a) Sketch the Orgel diagram of a d^4 system. Discuss the merits of Tanabe-Sugano energy level diagram as compared to Orgel diagram. (4+3+3=10)
- b) Describe briefly on the charge transfer transitions exhibited by metal complexes.
- c) The electronic spectrum of an octahedral $\text{Cr}(\text{III})$ complex exhibits three absorption bands at $16000, 17000$ and 33000 cm^{-1} . Assign these transitions. Calculate $10 Dq$, B^1 and β ($B=918 \text{ cm}^{-1}$ for chromium(III)).



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7. a) Describe the magnetic moment measurement of a complex by gouy method. Why is $\text{Hg}[\text{Co}(\text{SCN})_4]$ used as a calibrant? (5+5=10)
- b) What is spin-orbit coupling? How does it affect the magnetic moments of transition metal complexes?
8. a) With suitable examples discuss the photosubstitution reactions occurring in metal complexes. (4+6=10)
- b) Write briefly on :
- Diamagnetic Correction
 - Jahn-Teller Effect

