

**SECOND SEMESTER M.Sc. DEGREE EXAMINATION, APRIL 2021**  
**CHEMISTRY**  
**FCHE2C06: CO-ORDINATION CHEMISTRY**

**Time: 3 Hours****Maximum Weightage: 30**

**Section A: Short answer questions. All questions can be answered.**  
**Each carries *one* weightage (Ceiling 6 weightage).**

1. Rationalize the fact that stability increases in the order:  
 $[\text{Co}(\text{NH}_3)_6]^{3+} < [\text{Co}(\text{en})_3]^{3+} < [\text{Co}(\text{dien})_2]^{3+}$ .
2. Mention the important factors that affect the magnitude of crystal field splitting.
3. Which of the two  $[\text{CoCl}_4]^{2-}$  and  $[\text{CoI}_4]^{2-}$  is expected to have higher  $\Delta_t$ ?
4. Give the ground state term symbol for Co in  $[\text{CoF}_6]^{3-}$ .
5. What is hole formalism? How it is useful in explaining the spectra of  $d^2$  and  $d^8$  metal ions?
6. The CO stretching frequencies for  $[\text{Ni}(\text{CO})_4]$ ,  $[\text{Co}(\text{CO})_4]^-$  and  $[\text{Fe}(\text{CO})_4]^{2-}$  are 2060, 1890 and  $1790 \text{ cm}^{-1}$  respectively. Account for this.
7. Draw the Mossbauer spectra of  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$  and  $\text{FeCl}_3$ .
8. How many PMR signals are expected for  $[\text{Fe}(\eta^1\text{-C}_5\text{H}_5)(\eta^5\text{-C}_5\text{H}_5)(\text{CO})_2]$ .
9. Is  $[\text{Ni}(\text{en})_3]^{2+}$  is labile or inert ? Explain.
10. Explain the significance of Kurnakov test.
11. The electron transfer from  $[\text{Co}(\text{NH}_3)_6]^{2+}$  to  $[\text{Co}(\text{NH}_3)_6]^{3+}$  is extremely slow. Explain.
12. What is Adamson's rule. Give its significance.

**Section B: Short essay question. All questions can be answered.**  
**Each carries *four* weightage (Ceiling 12 weightage).**

13. Distinguish between thermodynamic stability and kinetic stability of metal complexes. Give the relationship between over-all stability constant and stepwise stability constants.
14. Discuss the spectral consequences of Jahn-Teller effect.
15. Draw the Molecular orbital diagram of an octahedral complex with sigma bonding only.
16. Discuss the important selection rules in electronic spectra of metal complexes. Explain why tetrahedral complexes are found to be more intense than octahedral complexes.
17. Explain the term super hyperfine splitting in ESR with a suitable example.

**(PTO)**

18. Isomer shift value for the following Sn complexes follows the order:  
 $(\text{Et}_4\text{N})_2\text{SnBr}_4\text{F}_2 < (\text{Et}_4\text{N})_2\text{SnBr}_4\text{Cl}_2 < (\text{Et}_4\text{N})_2\text{SnBr}_6 < (\text{Et}_4\text{N})_2\text{SnBr}_4\text{I}_2$ . Justify.
19. Discuss  $\text{S}_{\text{N}}1\text{CB}$  Mechanism for base hydrolysis.

**Section C: Essay questions. Answer *All* questions can be answered.  
Each carries *six* weightage (Ceiling 12 weightage).**

20. (a) Discuss the important merits and demerits of valence bond theory.  
(b) Draw the Orgel diagram and explain the electronic spectra of  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ .
21. (a) Discuss Gouy method for the determination of magnetic moment.  
(b) Explain zero field splitting in ESR with any one example.
22. (a) Suggest a method for the preparation of three isomers of  $[\text{Pt}(\text{NH}_3)(\text{Py})(\text{Cl})(\text{Br})]$ .  
(b) Suggest the mechanism of the reaction:  
$$[\text{Fe}(\text{CN})_6]^{3-} + [\text{Mo}(\text{CN})_8]^{4-} \rightarrow [\text{Fe}(\text{CN})_6]^{4-} + [\text{Mo}(\text{CN})_8]^{3-}$$
23. (a) Discuss the application of IR spectroscopy to study the structure of metal carbonyls.  
(b) Write a note on chelate effect with suitable examples.