KAMARAJ COLLEGE (Autonomous)

Accredited with A+ Grade by NAAC

(Affiliated to Manonmaniam Sundaranar University, Tirunelveli)

(4 Pages) **Reg. No:……**

Question Code: 26E02201 **Course Code : 24PMCH32**

PG Degree - End Semester Examinations, April 2026

Third Semester

M.Sc., CHEMISTRY

Coordination Chemistry-I

(For those who joined in July 2024 onwards)

Time : 3 Hours **Maximum : 75 Marks**

PART – A (10 × 1 = 10 Marks)

Answer ALL Questions

Choose the correct answer :

CO:1 K:1 1. In an octahedral crystal field, the higher energy orbitals are:

(a) t_{2g} (b) e_g

(c) a_{1g} (d) b_{2g}

CO:1 K:2 2. Which of the following ligands produces the strongest crystal field?

(a) I^- (b) Cl^-

(c) NH3 (d) CN^-

CO:2 K:1 3. The electronic transition responsible for colour in many transition metal complexes is

(a) s → p transition (b) d → d transition

(c) f → f transition (d) p → d transition

CO:2 K:2 4. Which diagram is used for high-spin octahedral complexes to interpret electronic spectra?

(a) Frost diagram (b) Orgel diagram

(c) Ellingham diagram (d) Born–Haber diagram

CO:3 K:1 5. The Irving–Williams series is applicable to

(a) Alkali metals (b) Lanthanides

(c) First row transition metal divalent ions (d) Actinides

CO:3 K:2 6. Job's method is also known as

(a) Continuous variation method (b) Slope ratio method

(c) Dilution method (d) Spectral method

CO:4 K:1 7. The trans effect is commonly observed in _____ complexes.

(a) Octahedral (b) Tetrahedral

(c) Square planar (d) Linear

CO:4 K:2 8. Which ligand shows a strong trans effect?

(a) NH_3 (b) H_2O

(c) CN^- (d) OH^-

CO:5 K:1 9. Marcus–Hush theory explains

(a) Substitution reactions (b) Electron transfer reactions

(c) Ligand exchange (d) Complex formation

CO:5 K:2 10. TiO_2 is widely used as a photocatalyst for

(a) Hydrogen storage (b) Air and water purification

(c) Metal extraction (d) Fertilizer production

PART – B (5 × 5 = 25 Marks)

Answer ALL Questions choosing either (a) or (b).

Answer should not exceed 250 words.

CO:1 K:4 11. (a) Calculate and explain the Crystal Field Stabilization Energy for high spin and low spin octahedral complexes.

(OR)

(b) Contrast the Jahn–Teller distortion in an octahedral complex and discuss its consequences on structure and properties.

CO:2 K:3 12. (a) Develop the selection rules governing electronic transitions in coordination complexes.

(OR)

(b) Organize the characteristics of d–d transitions in coordination complexes and explain why these transitions are generally weak.

CO:3 K:3 13. (a) Explain any five differences between inert and labile complexes.

(OR)

(b) Apply spectrophotometric method used for determining the stability constant of complexes.

CO:4 K:4 14. (a) Contrast the mechanism of substitution reaction in square planar complexes with suitable example.

(OR)

(b) Discuss briefly the associative and dissociative mechanisms involved in substitution reactions.

CO:5 K:3 15. (a) List out the role of TiO_2 as a green photocatalyst in environmental applications.

(OR)

(b) With suitable example, illustrate the outer sphere electron transfer mechanism in octahedral complexes.

PART – C (5 × 8 = 40 Marks)

Answer ALL Questions choosing either (a) or (b).
Answer should not exceed 600 words.

CO:1 K:3 16. (a) Discuss the factors affecting crystal field splitting energy and explain the spectrochemical series.

(OR)

(b) With the help of Molecular Orbital Theory, explain the structure of sigma and pi bonded octahedral complex with suitable examples.

CO:2 K:4 17. (a) Contrast the Orgel diagrams and explain their application in interpreting the spectra of transition metal complexes.

(OR)

(b) Analyze the Tanabe–Sugano diagrams and describe how they are used to determine ligand field parameters.

CO:3 K:3 18. (a) Apply Job's method in determining the stability of coordination complexes.

(OR)

(b) Organize the various factors affecting stability of metal complexes with suitable example.

CO:4 K:5 19. (a) Explain the applications of the trans effect in the synthesis of square planar complexes and describe the Kurnakov test.

(OR)

(b) Criticize the mechanism of acid hydrolysis and base hydrolysis reactions of octahedral complexes with suitable examples.

CO:5 K:6 20. (a) Construct the inner sphere electron transfer mechanism taking place in octahedral complex and explain the role of bridging ligand in it.

(OR)

(b) Discuss photo-substitution and photo-isomerization reactions in coordination complexes.