

**M. Sc. DEGREE END SEMESTER EXAMINATION - MARCH 2024****SEMESTER 2 - CHEMISTRY / PHARMACEUTICAL CHEMISTRY****COURSE : 21P2CHET05 / 21P2CPHT05 - INORGANIC CHEMISTRY - II***(For Regular 2023 Admission and Improvement/Supplementary 2022/2021 Admissions )*

Duration : Three Hours

Max. Weights: 30

**PART A****Answer any 8 questions****Weight: 1**

1. An aqueous solution of Cr (III) is pale violet but an aqueous solution of  $(\text{CrO}_4)^{2-}$  is bright yellow. Explain the reason. (U, CO 2)
  2. Draw the structure of cerium nitrate. Predict the coordination number of Ce in it. (U, CO 5)
  3. What is Term symbol? Derive the term symbol for chromium atom in the ground state. (U, CO 2)
  4. State and explain Jahn-Teller Theorem. (U, CO 1)
  5. The three complex ions,  $[\text{Ti}(\text{H}_2\text{O})_6]^{2+}$ ,  $[\text{TiF}_6]^{3-}$  and  $[\text{Ti}(\text{CN})_6]^{3-}$  absorb light of wavelength  $4000 \text{ \AA}$ ,  $4920 \text{ \AA}$  and  $5900 \text{ \AA}$ . Identify the complex ion with wavelength of the light absorbed. Write explanation for your answer. (A, CO 1)
  6. Predict the products of electron transfer reaction between  $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$  and  $[\text{Co}(\text{NO}_2)(\text{NH}_3)_5]^{2+}$  redox pair. (A, CO 3)
  7. Explain, why base hydrolysis of cis  $[\text{Co}(\text{en})_2(\text{Cl})_2]^+$  is much faster than the base hydrolysis of trans  $[\text{Co}(\text{en})_2(\text{Cl})_2]^+$ . (en = ethylene diamine) (A, CO 3)
  8. Draw the structure of 12-crown[4]. Suggest one of its use. (U, CO 4)
  9. Discuss the magnetic properties octahedral complexes of Ni(II). (A, CO 2)
  10. Work out the number of unpaired electrons in  $\text{Ce}^{4+}$ ,  $\text{Yb}^{2+}$ ,  $\text{Gd}^{3+}$  and  $\text{Tb}^{4+}$ . (A, CO 5)
- (1 x 8 = 8)**

**PART B****Answer any 6 questions****Weights: 2**

11. With suitable examples explain the role of organolanthanoid complexes as catalysts. (An, CO 5)
  12. Explain Temperature independent paramagnetism with suitable example. (A, CO 2)
  13. Arrange the ions  $\text{MnO}_4^-$ ,  $\text{CrO}_4^{2-}$  and  $\text{VO}_4^{3-}$ , in the increasing order of absorption wavelength. Which one is the better oxidising agent? Give explanation. (A, CO 2)
  14. Write briefly on the complex forming ability of lanthanides, actinides and transition elements. (U, CO 5)
  15. The coordination number of Hg decreases from 6 to 4 when it forms chloro complex from its aqua complex. Explain (An, CO 1)
  16. Explain conjugate base mechanism of base hydrolysis. What are the advantages of this mechanism? (U, CO 3)
  17. Explain the inter and intra molecular mechanism of racemization reaction of complexes. (U, CO 3)
  18. Why CO is a strong field ligand? Explain with the help of MO diagram. (A, CO 1)
- (2 x 6 = 12)**

**PART C**  
**Answer any 2 questions**

**Weights: 5**

19. What is trans effect? Justify trans effect series by using any one theory. Explain the applications of trans effect. Using trans effect series as a guide, outline the synthesis of geometrical isomers of  $[\text{Pt}(\text{Cl})(\text{Br})(\text{Py})(\text{C}_2\text{H}_4)]$  starting from  $[\text{Pt}(\text{Cl})_4]^{2-}$  and other ligands. (A, CO 3)
20. Explain in detail about Temperature dependence of magnetism and Temperature independent paramagnetism. (A, CO 2)
21. Discuss briefly the CF theory of octahedral complexes. Illustrate With suitable examples how this theory is useful in explaining the spectral and magnetic properties of complexes? What are the shortcomings of this theory? (A, CO 1)
22. Give an account of Prussian blue and related structures. (U, CO 4)  
**(5 x 2 = 10)**

OBE: Questions to Course Outcome Mapping

CO	Course Outcome Description	CL	Questions	Total Wt.
CO 1	Understand the structural and bonding aspects of co-ordination compounds.	U	4, 5, 15, 18, 21	11
CO 2	Explain the spectral and magnetic properties of metal complexes.	A	1, 3, 9, 12, 13, 20	12
CO 3	Explain the thermodynamic and kinetic aspects of reactions of metal complexes.	U	6, 7, 16, 17, 19	11
CO 4	Understand the stereochemistry of co-ordination compounds.	U	8, 22	6
CO 5	Describe the co-ordination chemistry of lanthanoids and actinoids	U	2, 10, 11, 14	6

Cognitive Level (CL): Cr - CREATE; E - EVALUATE; An - ANALYZE; A - APPLY; U - UNDERSTAND; R - REMEMBER;