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BSc-M.Sc. Integrated Program, Chemistry/Semester-IV
Paper Title: Transition metal chemistry and group theory
Paper Code: BCH-CC08TH

Time 3 Hours

Maximum Marks 75

Note: This paper has 3 sections A, B, and C, Attempt all the three sections

Section A: Answer all the questions; Section B: Answer any 2 out of 4; Section C: Answer all the questions, each question has an internal choice.

Abbreviations Used: CLO- Course Outcome, PLO- Program Outcome, BTL- Bloom Taxonomy Level: BT level 1-Remember; BT level 2-Understand; BT level 3-Apply; BT level 4-Analyse; BT level 5-Evaluate, BT level 6-Create.

SECTION A

Very short type questions (Attempt all)

(10x2 = 20Marks)

Q. No.	Question	Marks	BTL	CLO	PLO
1	Write the IUPAC name of $K[Fe(H_2O)_3(NO_2)_2]$ and $[Co(NH_3)_3(H_2O)_2Br]Br_2$ complex compounds.	2	2	1	2
2	Write the relationship between the following isomers: a. $[Cu(NH_3)_4][PtCl_4]$ and $[Pt(NH_3)_4][CuCl_4]$ b. $[Co(en)_2(NO_2)_2]^+$ and $[Co(en)_2(ONO)_2]^+$	2	2	2	2
3	Calculate the magnetic moment of Cr^{2+} .	2	3	3	2
4	Write the stability of $[Fe(OH)_6]^{3-}$ and $[Fe(OH)_6]^{4-}$.	2	2	2	2
5	Write the outermost electronic configuration of Pd and Pt.	2	3	3	3
6	Which metals form the complex of coordination number 3.	2	4	3	3
7	Calculate the Magnetic moment of Gd^{3+} .	2	3	2	2
8	Write the energy profile of dissociative and associative mechanism.	2	1	1	2
9	Explain the Mulliken's symbol E''_{2g} .	2	4	4	4
10	Which point group has the chiral center(complex).	2	3	3	3

SECTION B

Long type questions (Attempt any two out of four)

(2x10 = 20)

Q. No.	Question	Marks	BTL	CLO	PLO
1	Describe the crystal field splitting in octahedral field and calculate the crystal field stabilization energy of $[Mn(H_2O)_6]^{3+}$ and $[Ni(CN)_6]^{3-}$. OR Describe the crystal field splitting in tetrahedral field and calculate the crystal field stabilization energy of $[NiCl_4]^{2-}$ and $[MnCl_4]^{2-}$.	10	3	3	3
2	Calculate the magnetic moment of f^2 configuration. OR Write the outer most electronic configuration of lanthanide elements. Discuss the oxidizing and reducing nature of	10	6	5	3

50
+20
70

	lanthanide ions.				
3	Define the trans effect and describe the theories of trans effect. OR Describe the Eigen–Wilkins’ mechanism for water exchange reactions.	10	4	3	3
4	Construct the character table of C_{2h} point group using the postulates and calculate the IR and Raman active vibrations. OR Construct the character table of C_{2v} point group using the postulates. And calculate the possible combinations of hybridization.	10	6	6	5

SECTION C

Short type questions. (Attempt all the questions)

(7x5 = 35)

Q. No.	Question	Marks	BTL	CLO	PLO
1	Discuss the property of $[Cr(H_2O)_6]^{3+}$, $[Cu(NH_3)_6]^{2+}$ complex compounds according to the “Valence Bond Theory”. OR Describe the Werner’s coordination theory with suitable examples.	5	3	3	2
2	Write a note on trigonal prismatic complexes. OR Discuss the stability of coordination number 5 complexes.	5	3	3	2
3	Draw the crystal field splitting energy diagram of $[PdCl_4]^{2-}$. OR Draw the energy diagram of z-elongation in $[MnCl_6]^{3-}$.	5	5	5	4
4	Describe the anation reaction with suitable examples. OR Describe the base hydrolysis.	5	4	4	3
5	Write the mechanism of cis- and trans $[Pt(NH_3)(NO_2)Cl_2]^{-1}$ complex. OR Describe the outer sphere and inner sphere electron transfer reactions.	5	5	4	4
6	Find out the point group of Cis-platin, trans-platin, ethene, cyclopentadiene and staggered form of ethane and calculate the total number of operations in each point group. OR Define the improper axis of rotation. Calculate total orientations of S_5 .	5	5	4	3
7	Define the axis of symmetry, plane of symmetry and inversion center with the help of suitable examples. OR Describe the separation method of lanthanide ions.	5	3	3	3