Chemistry (P.G.)
[CBCS]
M.Sc. Second Semester End Examination-2024
(Regular & Supplementary Paper)
PAPER- CEM-203
[Inorganic Chemistry-II]

Full Marks: 40 ***Time: 02 Hrs***

The figures in the right-hand margin indicate marks.
Candidates are required to give their answers in their own words as far as practicable.
Illustrate the answers wherever necessary.

Group-A

Answer any four questions. **4×2=8**

1. a. Explain why the polarization effect is not observed in cubic or higher symmetry molecule.

   b. What is molybdenum blue?

   c. The molecule $(OC)_5M{=}C(OCH_3)(C_6H_5)$ obey 18 electron rule. Find the metalsfrom 3d and 4d group satisfying this condition.

   d. Established that $a_i = \frac{1}{h}\sum X(R).\ Xi(R)$ where the terms have usual significance.

   e. $[Mn(H_2O)_6]^{+2}$ demonstrates very weak colour – Explain.

   f. What is fluxional behavior? Explain with an appropriate example.

Group-B

Answer any four questions. **4×8=32**

1. a) Determine the character of irreducible presentation of C_{2h} point group. Write the appropriate Mulliken symbols for these irreducible representations.

   b) b) Prove that px to py is allowed electronic transition for a tetrahedral molecule.

Td	E	8C3	3C2	6S4	6d			
A1	+1	+1	+1	+1	+1	-	x2+y2+z2	xyz
A2	+1	+1	+1	-1	-1	-	-	-
E	+2	-1	+2	0	0	-	(2z2-x2-y2, x2-y2)	-
T1	+3	0	-1	+1	-1	(Rx, Ry, Rz)	-	[x(z2-y2), y(z2-x2), z(x2-y2)]
T2	+3	0	-1	-1	+1	(x, y, z)	(xy, xz,yz)	(x3, y3, z3) [x(z2+y2), y(z2+x2), z(x2+y2)]

4+4=8

3. a) Write the structure of Vaska's complex and mention the oxidation state of the central metal atom.

   b) KMnO4 is intensely coloured – Explain.

   c) How many B-B bonds are present in B_4H_{10}?

   d) What is STYX number of B_5H_9. Draw its structure. 1+2+2+3

4. a) What are the fundamental differences between the alkene and alkyne complexes while binding to the transition metal ion? Draw the possible binding mode of alkyne to transition metal ion.

   b) Briefly explain the term Agostic interaction with a suitable example.

   c) Which of the following metal alkene complex do you think will look most like a metallacyclopropane? Justify your answer.

   (I) $(CH_2{=}CH_2)Ni(PPh_3)_2$ (II) $(CH_2{=}CH_2)Fe(CO)_4$

   4+2+2

5. a) The Ground State of NO_2 is A1. It got excited by electronic dipole transition. Mention the symmetry of excited state and what polarization of light is it necessary. C_{2v} point group is given in other question one above.

   b) Use group theoretical principle to obtain the IR and Raman activity of the vibrational modes of H_2O.

C2v	E	C2 (z)	v(xz)	v(yz)			
A1	+1	+1	+1	+1	z	x2, y2, z2	z3, x2z,y2z
A2	+1	+1	-1	-1	Rz	xy	xyz
B1	+1	-1	+1	-1	x, Ry	xz	xz2,x3, xy2
B2	+1	-1	-1	+1	y, Rx	yz	yz2, y3, x2y

4+4=8

6. a) Write two major uses of Boron. Explain BNCT.

   b) Discuss the bonding of $[Re_2Cl_8]^{2-}$

   c) Discuss the structure and bonding of transition metal allyl complexes. 3+3+2

7. a) Compare the Fischer and Schrock carbene complex.

   b) Explain "reversal of polarity" during the reaction of transition metal boundalkene complexes.

   c) Explain why $Fe(CO)_5$ shows only one peak at room temperature while two peaks are observed at low temperature in ^{13}C nmr spectroscopy.

   d) Discuss any two method of preparing alkene complexes of transition metal.