

**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 metals from 3d and 4d group satisfying this condition.
- d. Established that  $a_i = \frac{1}{h} \sum X_i(R)$ .  $X_i(R)$  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.

(2)

## 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) Prove that  $p_x$  to  $p_y$  is allowed electronic transition for a tetrahedral molecule.

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

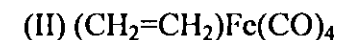
4+4=8

3. a) Write the structure of Vaska's complex and mention the oxidation state of the central metal atom.
- b)  $KMnO_4$  is intensely coloured – Explain.
- c) How many B-B bonds are present in  $B_4H_{10}$ ?

(3)

d) What is STYX number of  $B_3H_6$ . 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.



4+2+2

5. a) The Ground State of  $NO_2$  is  $A_1$ . 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  $H_2O$ .

$C_{2v}$	E	$C_2$ (z)	$v(xz)$	$v(yz)$			
$A_1$	+1	+1	+1	+1	z	$x^2, y^2, z^2$	$z^3, x^2z, y^2z$
$A_2$	+1	+1	-1	-1	Rz	xy	xyz
$B_1$	+1	-1	+1	-1	x, Ry	xz	$xz^2, x^3, xy^2$
$B_2$	+1	-1	-1	+1	y, Rx	yz	$yz^2, y^3, x^2y$

4+4=8

6. a) Write two major uses of Boron. Explain BNCT.  
b) Discuss the bonding of  $[\text{Re}_2\text{Cl}_8]^{2-}$   
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 bound alkene complexes.  
c) Explain why  $\text{Fe}(\text{CO})_5$  shows only one peak at room temperature while two peaks are observed at low temperature in  $^{13}\text{C}$  nmr spectroscopy.  
d) Discuss any two method of preparing alkene complexes of transition metal.

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