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MCH–011

M. SC. IN CHEMISTRY /

M. SC. IN ANALYTICAL CHEMISTRY

(MSCCHEM/MSCANCHEM)

Term-End Examination

December, 2025

MCH-011 : INORGANIC CHEMISTRY—I

Time : 2 Hours *Maximum Marks : 50*

Note : *(i) Attempt any* ***five*** *questions.*

(ii) All questions carry equal marks.

1. (a) Write the valence electron configurations for the following transition metal ions : 5

(i) Ir^{3+}

(ii) Mo^{2+}

(iii) Fe^{3+}

(iv) Pt^{2+}

(v) Nb^{3+}

(b) (i) Is there a possibility of $p\pi - d\pi$ bonding in the following molecules : 2

$S_4N_4F_4$, $N \equiv SF_3$, $H_3SiOSiH_3$, Et_3NO

Justify your answer.

(ii) Draw and label all the possible isomers of a square planar complex with formula [MABCD]. 3

2. (a) Write the method along with the reactions to prepare phosphazene polymers. Which type of polymer is used to fabricate artificial blood vessels ? Also, give the reaction to prepare poly (carbophosphazene). 5

   (b) Explain the concept of happticity with the help of any *three* suitable examples. 5

3. (a) What are metalacycles ? Show any *two* rearrangements that they may have. Give an example of η^2-vinyls and acyls. 5

   (b) Explain the molecular energy level scheme for carbon monoxide with a suitable diagram. 5

4. (a) With suitable diagrams, explain the *two* models of binding of dioxygen metal complexes. Also give examples where the binding of O_2 in metal complexes are with two metal atoms (any *three*). 5

   (b) Explain why the *bis* (pentahaptocyclopentadienyl) compounds of V, Cr, Co and Ni are all paramagnetic. Give the MO diagram suggested for ferrocene to explain this. 5

5. (a) With the help of Wade's rules, give the structural relationships between *closo, nido* and *arachno* boranes. 7

   (b) Explain dative bond in metal clusters with suitable examples. 3

6. (a) Explain with suitable diagrams the crystal field splitting of *d*-orbitals in a tetragonally distorted field. Explain how square planar complexes are formed. 5

   (b) What are the limitations of crystal field theory ? 5

7. (a) Explain the magnetic properties of the first transition series metal ions in both octahedral and tetrahedral complexes. 7

   (b) Give the predicted magnetic exchange for $d^1 - d^1$ and $d^8 - d^8$ systems at 90° as well as 180° exchange. 3

8. (a) While determining term symbols, what are the *four* important points that you should always keep in mind ? 5

(b) Explain the reaction profiles for intervalence for symmetrical as well as unsymmetrical complexes. 5

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