MCH–011

M. SC. IN CHEMISTRY /

M. SC. IN ANALYTICAL

CHEMISTRY

(MSCCHEM/MSCANCHEM)

Term-End Examination

June, 2025

MCH-011 : INORGANIC CHEMISTRY—I

Time : 2 Hours   *Maximum Marks : 50*

Note : *Attempt any **five** questions. All questions carry equal marks.*

1. (a) What are isoelectronic ions ? How does their size vary with the change of atomic number ?   2+3

(b) Explain the periodicity in electronegativity values of elements giving suitable diagram.   2+3

2. (a) What are the shapes of the ions of solid Pentachloride ? Comment on the shape of PCl_4^+ ?   5

(b) How is $S_3N_3^-$ prepared ? Give its qualitative molecular diagram.   5

3. (a) Explain the structure of $(BeMe_2)_n$.   3

(b) Give the steps to calculate the EAN of metal carbonyls along with a suitable example.   7

4. (a) What is the Tolman cone angle in phosphines ? Draw a suitable diagram to explain it.   5

(b) What hapticities are possible for the interaction of each of the following ligands with a single d-block metal atom such as cobalt ?   5

(i) C_2H_4

(ii) Cyclopentadienyl

(iii) C_6H_6

5. (a) What are the differences between metalloboranes and metallocarboranes ?

5

(b) Explain the capping rule with suitable example in metal carbonyl type cluster.   5

6. (a) Explain Jahn-Teller effect in the d^9 configuration of $CuCl_2$.   5

(b) What is the shape of the curve which shows the lattice energies of the divalent metal halides of the 1st series ? Also, give the reasons for obtaining such a shape of the curve in the light of crystal field theory. 5

7. (a) With a suitable diagram, explain the magnetic properties of lanthanoids. 5

(b) With a suitable illustration, explain the super exchange model of antiferromagnetic interaction in d-metal complexes. 5

8. (a) The gas-phase ion V^{3+} has a $^3\underline{F}$ ground term. The $^1\underline{D}$ and $^3\underline{P}$ terms lie respectively 10642 and 12920 cm^{-1}

above it. The energies of the terms are given in terms of Racah parameters as $\underline{E}(^3\underline{F}) = \underline{A} - 8\underline{B}$, $\underline{E}(^3\underline{P}) = \underline{A} + 7B$, $\underline{E}(^1\underline{D}) = \underline{A} - 3\underline{B} + 2\underline{C}$. Calculate the values of B and C for V^{3+}.   5

(b) What does the negative sign of the Cotton effect for the lowest energy CD band of the *fac* - (–) and *mer* - (–) isomers suggest ? Explain.   5

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