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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

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- (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 $(\text{BeMe}_2)_n$. 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 3F ground term. The 1D and 3P terms lie respectively 10642 and 12920 cm^{-1}

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