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1 (Sem-5/FYUGP) CHE01MJ

2025

CHEMISTRY

(Major)

Paper : CHE0500104

(Inorganic Chemistry-II)

Full Marks : 45

Time : 2 hours

The figures in the margin indicate full marks for the questions.

1. Answer the following questions : $1 \times 5 = 5$

(a) ✓ How many possible microstates can be there for an ion having d^2 configuration ?

(b) ✓ What is the pseudohalide ion of cyanogen ?

(c) ✓ Write the structure of $(\eta^5 - C_5H_5)_2 (\eta^1 - C_5H_5)_2 Ti$.

(d) Out of the two forms of hydrogen which form is more stable at room temperature?

(e) Find the electron count of iron in iron pentacarbonyl.

2. Answer **any five** from the following questions : $2 \times 5 = 10$

(a) Explain hapticity of organic ligands. Give *one* example of tetrahapto ligand.

(b) Give *two* preparations of metal carbonyls.

(c) What is spin-orbit coupling?

(d) Using VSEPR theory explain the shape of XeO_3 .

(e) What is Zeise's salt? Give its structure.

(f) Give reason why KO_2 is used in space capsule, submarine and breathing mask.

(g) What is styx number? Assign styx number for diborane.

(h) Based on bond type what are the different classes of organometallic compounds.

(i) Explain why lead preferentially exhibit +2 oxidation state.

(j) Mention the various allotropes of phosphorous. Which allotrope of phosphorous inflames in air?

3. Answer **any four** from the following questions : $5 \times 4 = 20$

(a) What is spin crossover phenomena? Explain with the help of appropriate Orgel diagram. $1 + 4 = 5$

(b) What is borazine? How is it prepared? Why is borazine called inorganic benzene? $1 + 1 + 3 = 5$

(c) Discuss the bonding in diborane.

(d) Give *two* methods of preparation of IF_7 . Discuss the structure of IF_7 . $2 + 3 = 5$

(e) How is XeF_2 prepared? Discuss its structure in the light of VBT. Mention *one* use of Xe . $1 + 3 + 1 = 5$

(f) Discuss why *d-d*-transitions in octahedral complexes are weakly allowed.

(g) Discuss the structure and bonding in $Mn(CO)_5$.

(h) How is Zeise's salt prepared? Explain the nature of bonding in Zeise's salt. $1 + 4 = 5$

4. Answer **any one** from the following questions : $10 \times 1 = 10$

(a) Find out the ground state term symbols for d^1 and d^8 configurations. Show their splitting of energy levels in octahedral field. $3+3+2+2=10$

(b) How is S_4N_4 prepared? Discuss its structure. What are the *two* main types of reactions it undergoes? Give *one* example of each type. $2+4+2+2=10$

(c) How is nitric acid manufactured by Ostwald process? How does copper reacts with (a) cold and very dilute nitric acid (b) cold and moderately concentrated nitric acid and (c) hot and concentrated nitric acid? $4+6=10$

(d) (i) Discuss the structure and bonding of $Ni(CO)_4$. 5

(ii) The electronic spectrum of $[Cr(H_2O)_6]^+$ ions shows band at 14900cm^{-1} , $22,700\text{cm}^{-1}$ and $34,400\text{cm}^{-1}$. Interpret the spectrum using appropriate energy level diagram. 5