[Time : 3Hours] **[Total marks :100]**

N.B. : (1) All questions are compulsory.

(2) Figures to the right indicate full marks.

(3) Use of logarithmic table/non-programmable calculator is allowed .

1. Attempt **any four** of the following**:**

A. What is crystal field splitting? Explain with reference to square planar complexes. **5**

B. Explain why [Fe $(H_2O)_6]^{3+}$ is a high spin and [Fe $(CN)_6]^{3-}$ is a low spin complex. **5**

C. Explain the following with respect to the factors affecting crystal field splitting parameter.
i] Geometry of the complex **2*1/2***
ii] Nature of the ligands . **2*1/2***

D. Explain the term crystal field stabilization energy [CFSE]. **5**
Calculate CFSE for d^3 and d^8 configurations in strong field octahedral complexes.

E. Discuss in brief the merits and demerits of Crystal Field theory. **5**

F. Discuss any two experimental evidences which proves covalent bonding in the metal complexes. **5**

2. Attempt **any four** of the following**:**

A. Draw and explain a neat labelled molecular orbital diagram for hexacyano ferrate (II) ion. $[Fe(CN)_6]^{4-}$ **5**

B. Discuss the effect of π bonding on Δ_0 values of octahedral complexes with ligands having filled π orbital. **5**

C. What are chelating agents? Discuss their effect on stability of complexes. **5**

D. Write a note on the Associative mechanism for ligand substitution reaction. **5**

E. What is Russell-Saunders (*LS*) coupling? Explain with suitable example. **5**

F. i. Calculate the ground state term for 'd^1' configuration of Ti^{3+}. **3**
ii. Explain spin multiplicity for two electrons. **2**

3. Attempt **any four** of the following**:**

A. Write a note on ionic organometallic compound. **5**

B. How will you prepare organometallic compound by Transmetallation reaction? **5**

C. Explain the complex formation reaction for the organometallic compound. **5**

D. What is ferrocene? Explain structure of ferrocene according to valence bond theory. **5**

E. Discuss homogeneous catalysis with suitable example. **5**

F. Discuss the following steps involved in hydrogenation of alkene using Wilkinson's catalyst. a) oxidative addition b) alkene coordination. **5**

4. Attempt **any four** of the following**:**

A. What is meant by term metallurgy? Explain self-reduction process in pyrometallurgy. **5**

B. Define roasting. Explain different types of roasting methods used for extraction of ore. **5**

C. Describe electrolytic refining of copper with suitable diagram. **5**

D. Explain with suitable diagram Froth floatation process for concentration of ore. **5**

E. Discuss the structure of $XeOF_4$ molecules on the basis of VSEPR theory. **5**

F. Give an account of Na+ - K+ ion pump with suitable diagram. **5**

5. Answer the following:

A. Select whether the following statements are **true** or **false (Any five)** **5**

a. Splitting of d - orbitals is maximum in tetrahedral complexes.

b. Triply degenerate set of dxy, dyz, dxz are called as t_{2g} orbitals.

c. The value of 10Dq does not depend on the nature of central metal atom.

d. In octahedral complexes, due to the crystal field splitting, orbital with maximum energy is $dx^2 - y^2$.

e. In the absorption spectrum of $[Ti (H_2O)_6]^{3+}$, one transitions are possible.

f. In an octahedral complex, metal ion with d^2 configuration has CFSE value - 8 dq.

g. Electrons prefer to pair up in eg orbital when $\Delta_0 < P$.

h. The effect of ligands in expanding the d-electron cloud is called Jahn -Teller effect .

B. Fill in the blank with appropriate words given in the bracket **(Any five)** **5**
[weakening, isomerization, unpaired electrons, microstates, even and symmetrical, less stable, two, bonding]

a. The term gerade corresponds to _____

b. If the matching orbitals overlap combines with maximum positive overlap, they form _____ molecular orbitals.

c. Presence of bulky ligands in a chelate results in _____ of metal ligand bond.

d. The complexes with forced configurations are _____

e. The reactions which involve structural changes are called _____ reactions.

f. With respect to octahedral complexes, dissociative mechanism can be considered as _____ step mechanism.

g. The allowed combinations of m_l and m_S for electrons are called _____

h. A transition is said to be spin forbidden, if it involves different number of _____

C. Select and write the appropriate answer . **(Any five)** **5**

a. _____ is the example of organometallic compound.
a) CH_4 b) H_2O c) CH_3MgCl d) CH_3Cl

b. In preparation of organometallic compound by metallation reaction, Hydrogen from R-H is replaced by _____
a) carbon b) metal c) non-metal d) nitrogen

c. In the complex formation reaction of organometallic compound, organometallic compound acts as_____
a) Lewis acid b) Lewis base c) Arrhenius acid d) Arrhenius base

d. _____is the best example of metallocene.
a) Ferrocene b) Ferric chloride c) Ferrous sulphate d) Ferric Hydroxide

e. According to valence bond theory, ferrocene is _____
a) Diamagnetic b) paramagnetic c) ferromagnetic d) antiferromagnetic

f. _____ is known as Wilkinson's Catalyst Rh Cl_3 (PPh_3)
a) Rh Cl_3(P.Ph_3) b) Rh Cl(P.Ph_3)$_3$ c) Rh Cl_2(P.Ph_3)$_2$ d) Rh (P.Ph_3)$_4$

g. In Homogeneous catalysis, if reactants and products are in gaseous phase then catalyst may be in _____phase only
a) solid b) liquid c) gaseous d) changing

h. Ferrocene can be prepared by oxidation of cyclopentadienyl Grignard Reagent with_____
a) KOH b) HCl c) $FeCl_3$ d) NaCl

D. **Match the column: (Any five)** **5**

a.	Azurite	**i.**	Pyramidal geometry
b.	Gangue	**ii.**	Calcium deficiency
c.	Smelting	**iii.**	Square Planar Geometry
d.	XeF4	**iv.**	Used in electronic tubes
e.	XeO_3	**v.**	Pyrometallurgical reduction
f.	Krypton-85	**vi.**	Purification of metal
g.	Rickets	**vii.**	Copper Ore
h.	Oxygen transfer	**viii.**	Concentration of Ore
		ix.	Non-Metallic Impurities
		x.	Heamoglobin

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