Q.P. Code :03322

[Time: $2^1/_2$ Hours] **[Marks:75]**

Please check whether you have got the right question paper.

N.B: 1. All questions are compulsory.
2. Figures to the right indicate full marks
3. Use of log table / non- programmable calculator is allowed

1 Answer **any three** of the following:

A. Discuss crystal field splitting of d-orbitals in octahedral complexes. 05

B. What do you mean by crystal field stabilization energy (CFSE)? Calculate CFSE for d^3 and d^5 configurations in strong field octahedral complexes. 05

C. Explain how Nephelauxetic effect supports the presence of covalent bonding in coordination compounds? 05

D. Discuss the effect of crystal field splitting on colour and magnetic properties of transition metal complexes. 05

E. On the basis of symmetry considerations, how will you identify the central metal orbitals and ligand orbitals that are suitable for bonding? 05

F. Draw a labelled molecular orbital energy level diagram for octahedral complex $[ML_6]$ considering only sigma bonding. 05

2 Answer **any three** of the following :-

A. Explain-'Orgel energy diagram of d^9 configuration is inverse of d^1 configuration'. 05

B. Discuss spin selection rule which governs electronic transitions. 05

C. Deduce the terms for p^2 configuration as in carbon atom. 05

D. Explain in brief the role of "size and charge of central metal ion" on stability of complexes. 05

E. Discuss the base hydrolysis reaction with reference to octahedral complexes of cobalt. 05

F. Explain the following :- 05
i) Anation reaction
ii) Chelate effect

3 Answer any three of the following :-

A. Discuss the following chemical reactions of organometallic compounds of main group elements. 05
i) Alkylation and arylation.
ii) Reactions with oxygen and halogens.

B. With reference to organometallics of elements of main groups, discuss the method of preparation involving- 05
i) Oxidative addition.
ii) Metallation.

C. Discuss the structure and bonding of ferrocene. 05

D. With reference to ferrocene discuss the following. 05
i) Acylation reactions
ii) Sulphonation reactions.

E. What is coupling reactions? Explain the mechanism of Heck coupling reaction. 05

F. a) Explain the requirements of a good catalyst. 03
b) What are organometallic compounds? 02

4. Answer **any three** of the following :- 05

A. Discuss the preparation of nanomaterials by colloidal route method.

B. With reference to nanomaterials , discuss its 05
   i) Electrical properties
   ii) Mechanical properties

C. Explain the dimensions and different forms of nanomaterials. 05

D. Discuss the following radiopharmaceuticals. 05
   i) Chromium -51
   ii) Iron-59

E. Write note on cisplatin in medicinal field. 05

F. Both catalase and peroxidase are heme enzymes with different catalytic properties, explain. 05

5 Answer the following:-

A Select and write the most appropriate answer. 04

a. Generally weak field ligands forms_____ complexes.
   i) Low spin ii) high spin iii) zero spin
b. The ligand having strong ability to expand d-electron cloud of metal is_____.
   i) H_2O ii) Br^- iii) CN^-
c. In square planar complexes d-orbitals of central metal split into _____ levels.
   i) 2 ii) 3 iii) 4
d. The linearly combined ligand orbitals are referred as _____.
   i) Molecular orbitals ii) ligand group orbitals iii) atomic orbitals

OR

A State whether the following statements are **true or false.** 04

p. Most of the tetrahedral complexes are high spin complexes.
q. The difference in energy between t_{2g} and e_g orbitals in an octahedral complexes is called crystal field splitting energy.
r. $[IrCl_6]^{2-}$ is a high spin octahedral complex.
s. Each metal orbital is combined with its matching symmetry ligand group orbital forms one bonding and one antibonding molecular orbital.

B Select and write the most appropriate answer. 04

a. For the term F, the number of energy states are _____.
   i) 2 ii) 3 iii) 4
b. The number of micro states for p^3 configuration is _____.
   i) 10 ii) 15 iii) 20
c. Larger the number of chelate rings,_____ is the stability of the complex.
   i) greater ii) lesser iii) similar.
d. In complexes involving S_N^2 mechanism, the main feature is bond_____.
   i) making ii) breaking iii) stabilization.

OR

B State whether the following statements are **true or false.** 04

p. Charge transfer bands are much more intense compared to d-d transitions.
q. 'J' known as total angular momentum quantum number takes positive values only.
r. A chelate complex is less stable than its analogous monodentate complex.
s. Inert complexes undergo ligand substitution in less than one minute.

C Select and write the most appropriate answer. 04

a. Metal or non-metal halides when treated with diazomethane under suitable conditions, methylene insertion takes place in _____ bond.
   i) M- Cl ii) M – C iii) M- M
b. In metathesis, organometallic compound when treated with a binary halide, exchange of a formal carbanion R^- with a _____ takes place.
   i) halide ion ii) carbon iii) metal
c. Ferrocene obeys_____ rule and _____ rule.
   i) Effective atomic number,18 electron
   ii) Pauli's , 16 electron
   iii) Hunds, 16 electron
d. Heck and Suzuki reactions are_____
   i) Pd catalyzed C-C coupling reactions,
   ii) In both reactions last step is reductive elimination
   iii) Both i. and ii.

OR

C State whether the following statements are true or false. 04

p. Organometallic compound, $Be(CH_3)_2$ is an electron deficient molecule and is Lewis acid.
q. Ferrocene is diamagnetic molecule.
r. Ferrocene is insoluble in water but readily dissolves in organic solvents like benzene and alcohol.
s. Homogeneous catalysts are present in the same phase as the reagents.

D Select and write the most appropriate answer. 03

a. _____nanoparticles are used in air purifiers and water purifier.
   i) Silver ii) titanium iii) zinc
b. Magnetic materials made from nanomaterial are used in analytical instrument like _____ used in hospitals.
   i) magnetic resonance imaging
   ii) sonography
   iii) X- ray
c. Complexes of gold are _____.
   i) effective against rheumatoid arthritis.
   ii) effective against tooth decay
   iii) used in killing the cancerous cells.

Or

D State whether the following statements are **true or false**. 03

p. Nanomaterials are tiny particles of material that have size 1 to 1000 nanometer.
q. In nanomaterials, surface to bulk atom ratio decreases with decrease in particle size.
r. The activity of a radioactive isotope is expressed in terms of curie 'C'.

****