QP Code : 31352

(REVISED COURSE)

(2½ Hours) **[Total Marks : 75**

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. Attempt **any three** of the following :—
   (A) Define crystal field stablisation energy (CFSE). Calculate crystal field stabilisation energy for d^6 and d^7 configurations in strong field octahedral complexes. **5**
   (B) Discuss crystal field splitting of d orbitals in tetrahedral complexes. **5**
   (C) Explain the effect of the following on the magnitude of 10Dq : **5**
      (a) Charge on metal ion.
      (b) Nature of the ligand.
   (D) Write a short note on "ESR spectra-a direct evidence of covalent bonding in coordination compounds. **5**
   (E) Discuss the construction of ligand group orbitals in an octahedral complex. **5**
   (F) Construct a neat labelled molecular orbital energy level diagram for an octahedral complex considering σ bonding. **5**

2. Attempt **any three** of the following :—
   (A) Explain the charge transfer transitions occuring in metal complexes. **5**
   (B) Determine the terms for p^2 configuration as in carbon atom. **5**
   (C) Draw and explain the Orgel diagram for d^2 configuration in octahedral complexes and assign the electronic transitions. **5**
   (D) What is chelate effect ? Explain the role of chelate effect on the stability of the complexes with the help of suitable examples. **5**
   (E) Discuss the possible mechanism involved in the acid hydrolysis of cobalt ammine complexes, with the help of any two evidences. **5**
   (F) Explain the following :– **5**
      (a) $\left[V(H_2O)_6\right]^{2+}$ is inert
      (b) Stepwise stability constant.

3. Attempt **any three** of the following :—
   (A) With reference to organometallics of elements of main groups, discuss the method of preparation involving **5**
      (a) Metallation reaction
      (b) Metal-metal exchange reaction

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(B) Discuss the following chemical reactions of organometallic compounds of main group elements. 5
(a) alkylation or arylation
(b) redistribution reactions.

(C) With reference to ferrocene, discuss the following:
(a) Alkylation 2
(b) Acylation 3

(D) (a) Describe preparation of ferrocene by using Grignard reagent. 3
(b) Discuss the physical properties of ferrocene. 2

(E) Explain the coupling reactions using Palladium catalyst. 5

(F) (a) Discuss the hydroformylation of alkenes. 3
(b) Define organometallic compounds. 2

4. Attempt **any three** of the following :—

(A) (a) What are nanomaterials ? 2
(b) State the advantages of chemical methods for preparation of nanomaterials. 3

(B) (a) Describe the optical properties of nanomaterials. 3
(b) With reference to nanomaterials, discuss any two applications in various fields. 2

(C) How can we characterize nanomaterials using UV-visible spectroscopy method? 5

(D) Discuss the following radiopharmaceuticals. 5
(a) Cobalt – 57 and Cobalt – 60
(b) Iodine 125 and 131

(E) (a) Define coenzymes. 2
(b) Name any three metalloenzymes. 3

(F) Write note on cis platin in medicinal field. 5

5. Attempt the following :—

(A) Select and write the appropriate answer. 4

(a) In square planar complexes d orbitals of central metal split into_____levels.
(i) 2 (ii) 3 (iii) 4

(b) The ligand having strong ability to expand d election cloud of metal is _____.
(i) F^- (ii) H_2O (iii) CN^-

(c) In an octahedral complex, the ionic radii of metal ion _____ when the electron enters e_g orbital.
(i) decreases (ii) increases (iii) does not change

(d) Only _____of the d^5sp^3 orbitals of a metal ion can form σ and in an octahedral complex.
(i) three (ii) six (iii) nine

OR

(A) State whether the following statements are **true** or **false**. **4**

(p) Crystal field theory (CFT) assumes the interaction between metal and ligand is purely ionic.

(q) Δ_{sp} is much smaller than Δ_0.

(r) The triply degenerate set of d orbitals (t_{2g}) are suitable for π bonding.

(s) Jahn-Teller distortions are common among octahedral complexes with unsymmetrically filled e_g level.

(B) Select and write the appropriate answer. **4**

(a) The total number of micorstates for d^2 configuration is _____.
(i) 35 (ii) 40 (iii) 45

(b) The ground state term for d' configuration is_____.
(i) ^4F (ii) ^1D (iii) ^2D

(c) The stability of complexes should _____ with the increase in the ionic radii.
(i) increase (ii) decrease (iii) remain same

(d) The reactions of the complexes in which oxidation state of the central metal changes with the change in the co-ordination sphere are called_____ reactions.
(i) substitution (ii) redox (iii) racemization

OR

(B) State whether the following statements are **true** or **false** :— **4**

(p) The total spin multiplicity is given by 2S–1.

(q) The total degeneracy of a term is given by (2S + 1) (2L + 1).

(r) In thermodynamic sense complexes are termed as labile or inert.

(s) The main feature of S_N2 mechanism is bond making.

(C) Select and write the appropriate answer. **4**

(a) Among the following which is not an organometallic compound.
(i) NaCN (ii) $Fe(CO)_5$ (iii) C_6H_5Li

(b) $Be(CH_3)_2$ an organometallic compound is
(i) an electron deficient molecule and is Lewis base.
(ii) an electron deficient molecule and is Lewis acid.
(iii) an electron rich molecule and is oxidising agent.

(c) The organometallic compound in which a metal atom is between two planar _____ ligands are called metallocences.
(i) ambidentate (ii) monodentate (iii) polyhapto

(d) In _____ reactions, a C - C bond is formed under palladium catalysis.
(i) Heck reaction (ii) Sandmeyer reacion (iii) Cannizzaro reaction.

OR

(C) State whether the following statements are **true** or **false**. **4**

(p) Alkyl $Al(C_2H_5)_2$ is dimeric only in benzene solution.

(q) Cyclopentadienyl ion is a pentahapto ligand.

(r) Ferrocene generally undergoes electrophilic substitution reactions.

(s) Hydrolysis of ester using acid / alkali is an example of homogeneous catalysis.

(D) Select and write the appropriate answer. **3**

(a) Gels are _____ system in which sol particles are interlinked and forms continuous network.
(i) sols (ii) jelly like colloidal (iii) colloidal

(b) _____ can be used in space craft and defence equipment because of its light weight.
(i) Light weight oxide (ii) Calcium oxide (iii) Nanomaterials

(c) The molecule on which the enzyme acts is called the_____.
(i) substrate (ii) catalyst (iii) product.

OR

(D) State whether the following statements are **true** or **false**. **3**

(p) Fullerenes, dendrimers and quantum dots are three dimensional nanomaterials.

(q) Nanoparticles of ZnO are used to develop self cleaning glass.

(r) In apoenzyme like haemoglobin magnesium is prosthetic group.
