

(2½ Hours)

[ Total Marks : 60

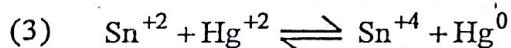
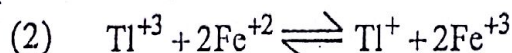
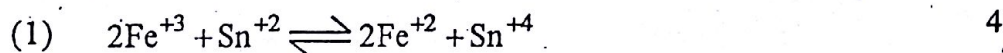
N.B. : (1) All questions are compulsory.  
 (2) Figures to the right indicate full marks.

1. (a) Attempt any two of the following.

- (i) Define rate of reaction. Discuss any two factors affecting rate of reaction. 4
- (ii) Explain the  $\pi$  bonding theory of trans effect. 4
- (iii) Discuss the mechanism of outer sphere electron transfer reaction with suitable example. 4
- (iv) Explain the mechanism of racemisation reaction in complexes. 4

1. (b) Attempt any one of the following.

- (i) Discuss the substitution reaction of octahedral complexes without breaking of metal-ligand bond. 4
- (ii) What are complementary and non complementary reactions? Classify the following as complementary and non complementary. Justify your answer. 4

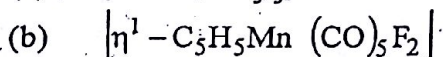


2. (a) Attempt any two of the following.

- (i) Give one method of preparation and two chemical properties of each alkyl and aryl derivatives of organometallic compounds. 4
- (ii) What are the different types of organometallic carbenes? Give resonance structures of different types of carbenes. 4
- (iii) Why are cobaltocene and nickelocene less stable than ferrocene? 4
- (iv) Write two methods of preparation of dibenzene chromium (0). Explain its structure and bonding on the basis of Valence Bond Theory. 4

2. (b) Attempt any one of the following.

- (i) Write a note on sandwich and half-sandwich complexes. 4
- (ii) State 16 electron rule. With the help of electron count, explain which of the following complexes obey the rule. 4



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3. (a) Attempt any two of the following.
- (i) Explain the origin of first Brillouin zone in K space and diffraction of electron from (100) planes with the help of a diagram. 4
  - (ii) Describe the precursor method for the preparation of inorganic materials. State its merits and demerits. 4
  - (iii) Discuss the structure and the salient features of Nickel arsenide. 4
  - (iv) How are nanomaterials prepared by using microorganisms? 4
3. (b) Attempt any one of the following.
- (i) On the basis of band theory, explain the electrical property of lithium and beryllium metal. 4
  - (ii) Write a note on applications of nanomaterials in the field of semiconductors and solar cells. 4
4. (a) Attempt any two of the following.
- (i) Discuss the mole-ratio method for the determination of stepwise formation constant of metal complexes. 4
  - (ii) Explain the nature of metal-oxygen bond with reference to IR Spectroscopy using two examples. 4
  - (iii) Discuss the ESR Spectra of octahedral Cu(II) complexes. 4
  - (iv) Describe the electronic spectra exhibited by  $[\text{Cr}(\text{NH}_3)_6]^{3+}$  4
4. (b) Attempt any one of the following.
- (i) Explain the nature of metal-sulphur bond in complexes by Raman Spectroscopy. 4
  - (ii) Discuss the electronic spectrum exhibited by square planar Ni (II) Complexes. 4
- 5 Attempt any four of the following. 12
- (a) Describe the mechanism of substitution of CO by  $\text{PPh}_3$  in  $[\text{Ni}(\text{CO})_4]$
  - (b) Explain the effect of nature of leaving group on the rate of substitution reaction of square planar complexes.
  - (c) Give one method of preparation of bis (triphenyl phosphine) diphenyl acetylene platinum (0). Describe its structure.
  - (d) How is diallyl nickel complex prepared? Explain its structure.
  - (e) Explain the ceramic method for the preparation of inorganic materials.
  - (f) Discuss the structure and the salient features of  $\text{CaI}_2$ .
  - (g) Describe Job's method for the determination of stepwise formation constant of metal complexes.
  - (h) Write a note on applications of ESR in biological systems.