

Total No. of Printed Pages—7

**6 SEM TDC CHMH (CBCS) C 13**

**2 0 2 3**

( May/June )

**CHEMISTRY**

( Core )

Paper : C-13

**[ Inorganic Chemistry  
( Organometallic Chemistry ) ]**

*Full Marks : 53*

*Pass Marks : 21*

*Time : 3 hours*

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

1. Choose the correct answer from the following : 1×7=7

(a) The total electron count for the complex  $[\text{Fe}_4\text{N}(\text{CO})_{12}]^-$  is

(i) 60

(ii) 62

(iii) 72

(iv) 59

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- (b) The EAN for  $[\text{CoNO}(\text{CN})_5]^{3-}$  is
- (i) 35
  - (ii) 36
  - (iii) 37
  - (iv) 38
- (c) Which of the following has minimum *trans*-effect?
- (i)  $\text{H}_2\text{O}$
  - (ii)  $\text{NH}_3$
  - (iii) Py
  - (iv)  $\text{Cl}^-$
- (d) Which of the following complexes obeys  $18 e^-$  rule?
- (i)  $(\eta^5\text{-C}_5\text{H}_5)\text{Mn}(\text{CO})_3$
  - (ii)  $\text{Cr}(\eta^5\text{-C}_5\text{H}_5)_2$
  - (iii)  $\text{Co}_2(\text{CO})_8$
  - (iv)  $\text{Fe}(\text{CO})_3(\eta^5\text{-C}_5\text{H}_5)$
- (e) Which of the following group cations is precipitated in alkaline medium?
- (i) Group I
  - (ii) Group II
  - (iii) Group IV
  - (iv) None of the above

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- (f) Which of the following combinations of basic radicals belong to group III?
- (i) Fe, Al, Cr
  - (ii) Fe, Mg, Ba
  - (iii) Mg, Ba, Ca
  - (iv) Mg, Ba, Fe
- (g) Find the hapticity of  $\text{C}_5\text{H}_5$  ligand in  $\text{Fe}(\text{C}_5\text{H}_5)_2$  complex.
- (i) Monohapto ligand
  - (ii) Trihapto ligand
  - (iii) Pentahapto ligand
  - (iv) Dihapto ligand

2. Answer any five questions from the following : 2×5=10

- (a) Why is  $\text{H}_2\text{S}$  passed in alkaline medium for the precipitation of group IV basic radicals?
- (b) Define solubility product and ionic product of a solution.
- (c) What is the importance of Zeise's salt in organometallic chemistry? How was it prepared? 1+1=2

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- (d) Give an example of reaction in which  $\text{HCO}(\text{CO})_4$  is used as a catalyst.
- (e) What is Wilkinson's catalyst? Mention one use of this catalyst.
- (f) How is  $18 e^-$  rule helpful in determining the number of metal-metal bonds in metal carbonyl compounds?

UNIT—I

3. Answer any two questions from the following : 3×2=6

(a) How will you detect the presence of phosphate as interfering radical in a salt mixture? How does phosphate interfere in the detection of basic radicals? 1+2=3

(b) What is common-ion effect? Explain why during the precipitation of group III radicals  $\text{NH}_4\text{OH}$  is added in presence of  $\text{NH}_4\text{Cl}$ . 1+2=3

(c) What is the group reagent for group V? Write the chemical form of the precipitate of group V. How will you confirm the presence of  $\text{Ba}^{2+}$  ion in a salt mixture? 1+1+1=3

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UNIT—II

4. Answer any four questions from the following : 3×4=12

(a) The CO molecule has IR stretching frequency of  $2143 \text{ cm}^{-1}$ , but it shifts to different regions in metal carbonyls. Explain.

(b) What is Ziegler-Natta catalyst? Discuss its use in the polymerization of ethane. 1+2=3

(c) What is synergic effect in metal carbonyls? Draw the molecular orbital energy-level diagram of CO molecule. 1+2=3

(d) Compare the aromaticity of ferrocene with that of benzene. Does ferrocene obey  $18 e^-$  rule? 2+1=3

(e) Give one method of preparation for each of the following :

(i) Metal carbonyl

(ii) Zeise's salt

(iii) Ferrocene

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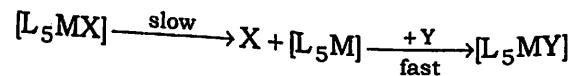
UNIT—III

5. Answer any four questions from the following : 3×4=12

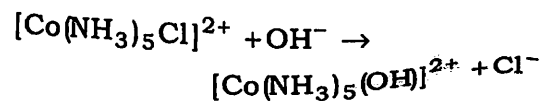
- (a) Write a note on acid hydrolysis of cobalt (III) compounds with suitable example.
- (b) Draw the structures of the intermediates that are formed in  $S_N1$  and  $S_N2$  mechanisms of the reaction between  $[MA_5X]^{n+}$  and  $[Y]$ . Compare their stability. 2+1=3

(c) What is *trans*-effect? Outline the synthesis of *cis*- and *trans*-dichloro-diammineplatinum (0). How will you distinguish between them?

(d) Explain the mechanism of the following :



(e) Explain the  $S_N1$  CB mechanism for the following reaction :



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UNIT—IV

6. Answer any two questions from the following : 3×2=6

- (a) Discuss briefly about Wacker process highlighting its mechanism.
- (b) Discuss the method of synthesis gas by metal carbonyl complexes.
- (c) Write a note on synthetic gasoline.

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