6 SEM TDC CHMH (CBCS) C 13

2023

(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 $[Fe_4N(CO)_{12}]^-$ is

(i) 60

(ii) 62

(iii) 72

(iv) 59

(b) The EAN for $[CoNO(CN)_5]^{3-}$ is

(i) 35

(ii) 36

(iii) 37

(iv) 38

(c) Which of the following has minimum *trans*-effect?

(i) H_2O

(ii) NH_3

(iii) Py

(iv) Cl^-

(d) Which of the following complexes obeys 18 e^- rule?

(i) $(\eta^5\text{-}C_5H_5)Mn(CO)_3$

(ii) $Cr(\eta^5\text{-}C_5H_5)_2$

(iii) $Co_2(CO)_8$

(iv) $Fe(CO)_3(\eta^5\text{-}C_5H_5)$

(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

(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 C_5H_5 ligand in $Fe(C_5H_5)_2$ 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 H_2S 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

(d) Give an example of reaction in which $HCO(CO)_4$ 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 NH_4OH is added in presence of NH_4Cl. 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 Ba^{2+} ion in a salt mixture? 1+1+1=3

UNIT—II

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

(a) The CO molecule has IR stretching frequency of 2143 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

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 (*o*). How will you distinguish between them?

(d) Explain the mechanism of the following :

$$[L_5MX] \xrightarrow{\text{slow}} X + [L_5M] \xrightarrow[\text{fast}]{+Y} [L_5MY]$$

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

$$[Co(NH_3)_5Cl]^{2+} + OH^- \rightarrow [Co(NH_3)_5(OH)]^{2+} + Cl^-$$

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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