Total No. of Printed Pages—7

6 SEM TDC CHMH (CBCS) C 13

2024

(May)

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 PO_4^{3-} group should be removed before proceeding to analysis is

(i) group IV

(ii) group V

(iii) group III

(iv) group II

(b) Which of the following combinations of basic radicals belongs to group V ?

(i) Zn, Co, Mg

(ii) Ba, Ca, Sr

(iii) Ca, Mg, Zn

(iv) Sr, Ca, Co

(c) Considering $(C_5H_5)Fe(CO)_2Cl$ is obeying the 18-electron rule, what is the hapticity of C_5H_5 group?

(i) 3

(ii) 1

(iii) 5

(iv) 2

(d) Which of the following complexes has the lowest value of stretching frequency in the IR spectrum?

(i) $[Ti(CO)_6]^{2-}$

(ii) $[V(CO)_6]^{-}$

(iii) $[Mn(CO)_6]^{+}$

(iv) $[Cr(CO)_6]$

(e) Which of the following complexes does not obey 18 e^- rule?

(i) $Fe(\eta^5-C_5H_5)_2$

(ii) $Cr(\eta^3-C_5H_5)_2$

(iii) $Fe(CO)_5$

(iv) $[V(CO)_6]^-$

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

(i) C_2H_4

(ii) NO_2^-

(iii) NH_3

(iv) Br^-

(g) Which of the following is used in hydroformylation of unsaturated hydrocarbons?

(i) $RhCl(PPh_3)_3$

(ii) $Ir(CO)Cl(PPh_3)_2$

(iii) $HCO(CO)_4$

(iv) $Zr(CH_3)ClPh_2$

UNIT—I

2. *(a)* What is common-ion effect? Discuss the role of NH_4Cl in the precipitation of group III basic radicals. 1+2=3

Or

(b) What is interfering radical? How do they interfere in the precipitation of basic radicals in a particular group? Establish with suitable example. 1+2=3

3. *(a)* What is soda extract? Discuss the chemistry of soda extract with suitable example. 1+3=4

(b) Write down the basic radicals present in group IV and its group reagent. 1

UNIT—II

4. Answer any *three* of the following : 2×3=6

(a) Assuming 18 e^- rule is being obeyed, calculate the number of metal-metal bonds in the following two complexes :

(i) $Fe_3(CO)_{12}$

(ii) $Os_4(CO)_{14}$

(b) Write down the structures of the following :

(i) $Mn_2(CO)_{10}$

(ii) $Co_2(CO)_8$

(c) Mention the conditions necessary for isolobality of two molecular fragments.

(d) Compare the reactivity of ferrocene with that of benzene.

5. Answer any *three* of the following : 3×3=9

(a) Write down any two methods of preparation of binuclear carbonyls with suitable examples. 1½+1½=3

(b) Explain π-acceptor behaviour of CO in the light of MO diagram. 3

(c) What is Zeise's salt? Discuss its structure. 1+2=3

(d) Ferrocene shows *(i)* metalation reaction and *(ii)* Mannich condensation. Establish with suitable examples. 1½+1½=3

6. Write a short note on any *one* of the following : 2

(a) Ziegler-Natta catalyst

(b) Schlenk equilibrium

UNIT—III

7. Answer any *four* of the following : 3×4=12

(a) Discuss the associative mechanism of substitution in octahedral complex and show its reaction profile. 2+1=3

(b) How does thermodynamic stability of complex differ from its kinetic stability? Explain. 3

(c) Explain *trans*-effect in square planar complexes with suitable examples. 3

(d) Discuss the effect of the following factors on the rate of aquation of a hexacoordinated complex : 1½+1½=3

(i) Charge on the complex

(ii) Chelation

(e) Discuss the base hydrolysis reaction of a cobalt complex. 3

UNIT—IV

8. Discuss the mechanism of the following processes (any *three*) : 3×3=9

(a) Alkene hydrogenation by Wilkinson's catalyst

(b) Hydroformylation by cocatalyst

(c) Wacker process

(d) Fischer-Tropsch reaction

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