

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  $\text{PO}_4^{3-}$  group should be removed before proceeding to analysis is

- (i) group IV
- (ii) group V
- (iii) group III
- (iv) group II

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(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)  $[Cr(CO)_6]$

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(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)  $Zr(CH_3)ClPh_2$

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UNIT—I

2. (a) What is common-ion effect? Discuss the role of  $\text{NH}_4\text{Cl}$  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

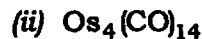
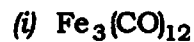
3. (a) What is soda extract? Discuss the chemistry of soda extract with suitable example. 1+3=4

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

UNIT—II

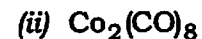
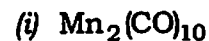
4. Answer any three of the following : 2×3=6

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



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- (b) Write down the structures of the following :



- (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.  $1\frac{1}{2}+1\frac{1}{2}=3$

- (b) Explain  $\pi$ -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.  $1\frac{1}{2}+1\frac{1}{2}=3$

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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 :  $1\frac{1}{2}+1\frac{1}{2}=3$ 
  - (i) Charge on the complex
  - (ii) Chelation
- (e) Discuss the base hydrolysis reaction of a cobalt complex. 3

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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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