

PSG COLLEGE OF ARTS & SCIENCE  
(AUTONOMOUS)

MSc DEGREE EXAMINATION MAY 2024  
(Second Semester)

Branch - CHEMISTRY

ORGANOMETALLIC CHEMISTRY

Time: Three Hours

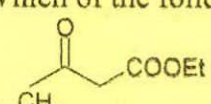
Maximum: 75 Marks

SECTION-A (10 Marks)

Answer ALL questions

ALL questions carry EQUAL marks

(10 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	Which one of the following molecule does NOT obey the 18 electron rule? a) $[\text{Mn}(\text{CO})_6]^{1+}$ b) $[\text{Fe}(\text{CO})_5]$ c) $[\text{Cr}(\text{CO})_5]^{2-}$ d) $[\text{Mn}(\text{CO})_4\text{Cl}_2]^{2-}$	K1	CO1
	2	The metal center in a carbene complex typically has a coordination number of a) 2                      b) 4                      c) 6                      d) 8	K2	CO1
2	3	The presence of back-bonding in metal-olefin complexes leads to a) Increased stability                      b) Decreased stability c) Enhanced reactivity                      d) Formation of ionic bonds	K1	CO2
	4	Which one of the following factors does NOT influence the molecular weight of polymers produced by Ziegler-Natta polymerization? a) Temperature                      b) Monomer concentration c) Catalyst structure                      d) Pressure	K2	CO2
3	5	Hapticity of $\text{C}_5\text{H}_5$ ligand in $(\text{C}_5\text{H}_5)_2\text{Fe}(\text{CO})_2$ is a) $\eta^1$ only                      b) $\eta^3$ only                      c) $\eta^1$ and $\eta^5$ d) $\eta^3$ and $\eta^5$	K1	CO3
	6	Which of the following would show fluxional behaviour?  a) $\text{CH}_3$ b) $\text{M}(\text{CO})_6$ c) $\text{CH}_3\text{-O-CH}_3$ d) $\text{M}(\text{CO})_4 (\eta^1\text{-C}_3\text{H}_5)$	K2	CO3
4	7	Number of skeletal electron pair in $\text{B}_{12}\text{H}_{12}^{2-}$ is a) 10                      b) 12                      c) 14                      d) 13	K1	CO4
	8	Which of the following IR frequencies is closest to that of a triply bridged CO group? a) $1801 \text{ cm}^{-1}$ b) $1920 \text{ cm}^{-1}$ c) $2140 \text{ cm}^{-1}$ d) $1700 \text{ cm}^{-1}$	K2	CO4
5	9	Which of the following is an example of a supramolecular assembly? a) Covalent polymer                      b) Single crystal c) Metal complex                      d) Molecular cage	K1	CO5
	10	What role do host molecules play in supramolecular chemistry? a) They serve as catalysts for chemical reactions. b) They selectively bind guest molecules through non-covalent interactions. c) They act as building blocks for covalent polymers. d) They act as surfactants in solution.	K2	CO5

SECTION - B (35 Marks)

Answer ALL questions

ALL questions carry EQUAL Marks

(5 × 7 = 35)

Module No.	Question No.	Question	K Level	CO
1	11.a.	Interpret the insertion reaction of 'CO' molecule into M-C bonds with an example.	K4	CO1
	(OR)			
	11.b.	Explain the difference between a Fischer-type carbene and a Schrock-type carbene.	K4	CO1

Cont...

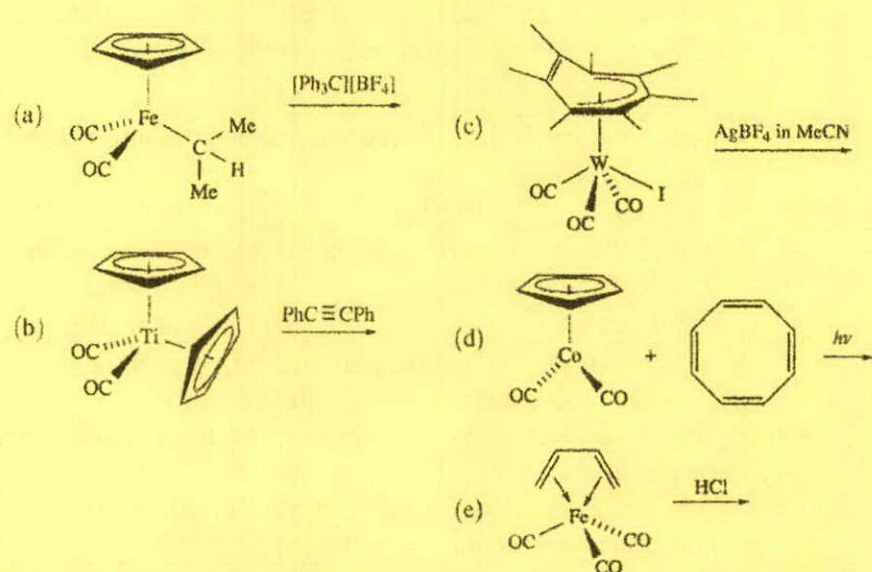
2	12.a.	Outline the mechanism of olefin polymerization using Zeigler-Natta catalyst.	K3	CO2
	(OR)			
	12.b.	With the help of Tolman catalytic loop, give the mechanism of Wacker process.		
3	13.a.	Discuss the structure and bonding in ferrocene.	K3	CO3
	(OR)			
	13.b.	With a suitable example, discuss the formation of arene complexes.		
4	14.a.	Illustrate the structure and bonding in metal carbonyls with at least one example.	K4	CO4
	(OR)			
	14.b.	Predict which of the complexes $[V(CO)_6]^-$ , $Cr(CO)_6$ , or $[Mn(CO)_6]^+$ has the shortest C-O bond.		
5	15.a.	How will you design a molecular host-guest complex? Illustrate it with suitable example.	K2	CO5
	(OR)			
	15.b.	With suitable example, illustrate the development of electrochemical sensor based on any one supra-molecule.		

**SECTION -C (30 Marks)**

Answer ANY THREE questions

ALL questions carry EQUAL Marks

(3 × 10 = 30)

Module No.	Question No.	Question	K Level	CO
1	16	Illustrate the various types of M-C bonds with suitable example.	K4	CO1
2	17	Give the mechanism of hydrogenation of olefins using Wilkinson catalyst. List out the characteristics of Wilkinson catalyst.	K4	CO2
3	18	Suggest the possible products for the following reactions: 	K4	CO3
4	19	How is IR spectroscopy useful in detecting different types of carbonyl groups in metal carbonyls?	K4	CO4
5	20	Elaborate the various types of non-covalent interactions in supra-molecules.	K4	CO5