

**PSG COLLEGE OF ARTS & SCIENCE**  
(AUTONOMOUS)  
**MSc DEGREE EXAMINATION MAY 2025**  
(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	The organometallic compound $[W(C_5H_5)_2(CO)_2]$ follows the 18-electron rule. The hapticities of the two cyclopentadienyl groups are a) 5 and 5      b) 3 and 5      c) 3 and 3      d) 1 and 5	K1	CO1
	2	What is the hybridization of the carbon atom in a carbene complex? a) sp      b) $sp^2$ c) $sp^3$ d) $dsp^3$	K2	CO1
2	3	The catalyst used in the conversion of ethylene to acetaldehyde using Wacker process is a) $HCo(CO)_4$ b) $[PdCl_4]^{2-}$ c) $V_2O_5$ d) $TiCl_4$ in the presence of $Al(C_2H_5)_3$	K1	CO2
	4	An efficient catalyst for hydrogenation of alkenes is $[Rh(PPh_3)_3Cl]$ . However, $[Ir(PPh_3)_3Cl]$ does not catalyze this reaction, because a) $PPh_3$ binds stronger to Ir than to Rh b) Cl binds stronger to Ir than to Rh c) $PPh_3$ binds stronger to Rh than to Ir d) Cl binds stronger to Rh than to Ir	K2	CO2
3	5	Ferrocene in solid phase has the structure a) chain      b) eclipsed      c) bent      d) staggered	K1	CO3
	6	Which one of the following can be easily hydrogenated? a) $Mn(\eta^5-C_5H_5)_2$ b) $Fe(\eta^5-C_5H_5)_2$ c) Zeise's salt      d) $Fe(CO)_5$	K2	CO3
4	7	Which of the following complexes does NOT follow EAN rule? a) $Cr(CO)_6$ b) $Co(CO)_4$ c) $Ni(PF_3)_4$ d) $Fe(CO)_5$	K1	CO4
	8	Number of terminal hydrogen atoms in $B_4H_{10}$ molecule is a) 4      (b) 6      (c) 8      (d) 2	K2	CO4
5	9	Which of the following is an example of a supramolecular host-guest complex? a) A salt crystal      b) A covalent bond c) A micelle      d) A crown ether binding a cation	K1	CO5
	10	What distinguishes supramolecular chemistry from traditional covalent chemistry? a) Supramolecular chemistry focuses on reversible interactions. b) Supramolecular chemistry involves stronger bonds. c) Supramolecular chemistry is not based on chemical bonding. d) Supramolecular chemistry only deals with organic compounds.	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.	Identify the first-row transition metal for the following 18-electron species: a. $[M(CO)_3(PPh_3)]^+$ b. $HM(CO)_5$ c. $(\eta^4-C_8H_8)M(CO)_3$ d. $[(\eta^5-C_5H_5)M(CO)_3]_2$ (assume single M-M bond)	K4	CO1
		(OR)		
	11.b.	Illustrate the bonding in Fischer-type carbene and a Schrock-type carbene.		

Cont...

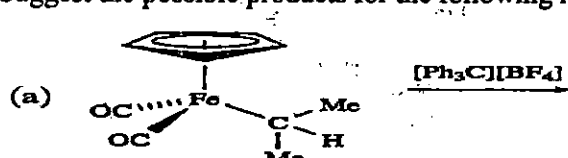
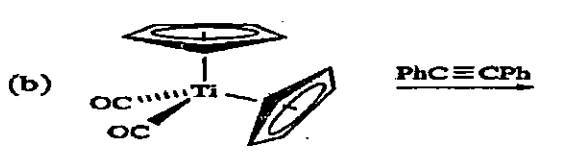
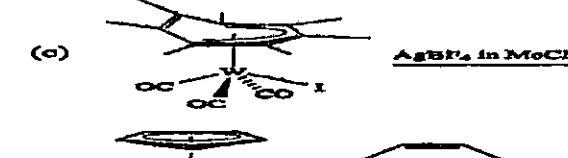
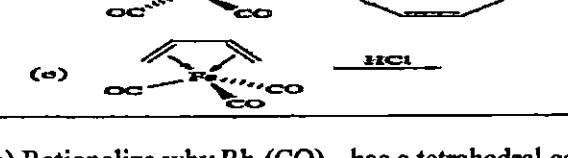
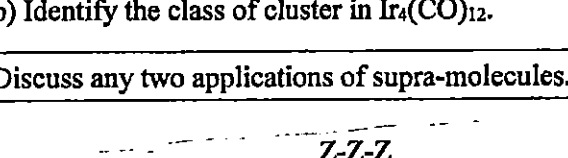
2	12.a.	Apply Wacker process in the oxidation of alkene to aldehyde. Propose the mechanism for it through a catalytic loop.	K3	CO2
	(OR)			
	12.b.	With the help of Oxo process, how will you carry out hydrocarbonylation of olefins? Give suitable mechanism for it.		
3	13.a.	Give any two synthesis and structure of arene half-sandwich complex.	K2	CO3
	(OR)			
	13.b.	Give any two synthesis and structure of allyl complex.		
4	14.a.	Classify the nitrosyls based on bonding mode. Illustrate it with suitable example.	K4	CO4
	(OR)			
	14.b.	Classify the following boranes by structural type a. $B_{11}H_{13}^{2-}$ b. $B_5H_8^-$ c. $B_7H_7^{2-}$		
5	15.a.	Differentiate between cavitand and clathrand.	K3	CO5
	(OR)			
	15.b.	Compare the thermodynamic selectivity with kinetic selectivity.		

**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	Show that the metal centres in the following complexes obey the 18-electron rule: a) $(\eta^5\text{-Cp})\text{Rh}(\eta^2\text{-C}_2\text{H}_4)(\text{PMe}_3)$ b) $(\eta^3\text{-C}_3\text{H}_5)\text{Rh}(\eta\text{-Cl})_2\text{Rh}(\eta^3\text{-C}_3\text{H}_5)_2$ c) $\text{Cr}(\text{CO})_4(\text{PPh}_3)_2$ d) $\text{Fe}(\text{CO})_3(\eta^4\text{-CH}_2\text{CHCHCH}_2)$ e) $\text{Fe}_2(\text{CO})_9$	K4	CO1
2	17	Illustrate, with examples, what is meant by (a) oxidative addition, (b) reductive elimination, (c) $\alpha$ -hydrogen abstraction, (d) $\beta$ -hydrogen elimination and (e) alkyl migration	K4	CO2
3	18	Suggest the possible products for the following reactions: <div style="display: flex; flex-direction: column; align-items: center;"> <div>(a) </div> <div>(b) </div> <div>(c) </div> <div>(d) </div> <div>(e) </div> </div>	K4	CO3
4	19	a) Rationalize why $\text{Rh}_4(\text{CO})_{12}$ has a tetrahedral core [6] b) Identify the class of cluster in $\text{Ir}_4(\text{CO})_{12}$ . [4]	K4	CO4
5	20	Discuss any two applications of supra-molecules.	K4	CO5