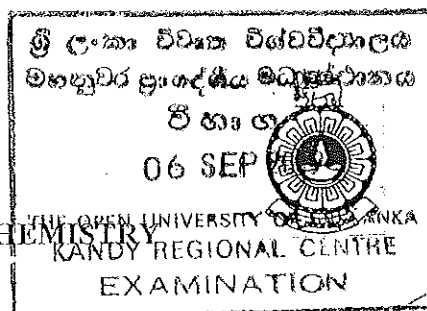


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THE OPEN UNIVERSITY OF SRI LANKA  
B. Sc. DEGREE PROGRAMME 2019/2020  
CYU5300/CMU3122 – ORGANOMETALLIC CHEMISTRY  
ASSIGNMENT TEST-II (NBT)



DATE: 06<sup>th</sup> September 2019

TIME : 4.15 p.m.- 5.15 p.m.

ANSWER ALL QUESTIONS

Mark a cross (X) over the **ENGLISH LETTER** that corresponds to most suitable answer on the given answer script. Any answer with more than one cross will not be counted.

Sample

PART A (45 marks)

- Pick the **correct** statement regarding an **oxidative addition** reaction.
  - Oxidation number of the metal is always increased by 2 units.
  - Coordination number of the metal is always increased by 2 units.
  - Coordinatively saturated metal centres cannot undergo oxidative addition reaction.
  - Oxidative addition is facile if the metal centre is coordinatively saturated.
  - Oxidative addition of MeI to Vaska's complex is *trans*.
- Which one is an example for **2e-oxidative-addition reaction**?
  - $[\text{Co}_2(\text{CO})_8] + \text{H}_2 \rightarrow 2 [\text{HCo}(\text{CO})_4]$
  - $2 [\text{Co}(\text{CN})_5]^{3-} + \text{MeI} \rightarrow [\text{MeCo}(\text{CN})_5]^{3-} + [\text{CoI}(\text{CN})_5]^{3-}$
  - $[\text{Ni}(\text{CO})_4] + \text{ICH}=\text{CH}_2 \rightarrow [(\text{OC})_3\text{Ni}(\eta^2\text{-CH}_2=\text{CH}_2)]\text{I} + \text{CO}$
  - $[\text{Ni}(\text{PEt}_3)_3] + \text{PhI} \rightarrow [\text{Ni}(\text{Ph})(\text{I})(\text{PEt}_3)_2] + \text{PEt}_3$
  - $[\text{MeMn}(\text{CO})_5] + \text{CF}_2=\text{CF}_2 \rightarrow [\text{Mn}(\text{CF}_2\text{CF}_2\text{Me})(\text{CO})_5]$
- Catalyst used in Union Carbide process is
  - $[\text{Co}_2(\text{CO})_8]$
  - $[\text{RhCl}(\text{PPh}_3)_3]$
  - $[\text{RhH}(\text{CO})(\text{PPh}_3)_2]$
  - $[\text{HCo}(\text{CO})_4]$
  - $[\text{RuHCl}(\text{PPh}_3)_3]$
- Which one is an example of an **insertion reaction**?
  - $[\text{Fe}(\text{CO})_5] + \text{CF}_2=\text{CF}_2 \rightarrow [(\text{OC})_4\text{Fe}(\text{CF}_2=\text{CF}_2)] + \text{CO}$
  - $[\text{MeMn}(\text{CO})_5] + \text{CF}_2=\text{CF}_2 \rightarrow [\text{Mn}(\text{CF}_2\text{CF}_2\text{Me})(\text{CO})_5]$
  - $[\text{Fe}(\text{CO})_5] + 2 \text{CF}_2=\text{CF}_2 \rightarrow [(\text{OC})_4\text{Fe}(\text{C}_4\text{F}_8)] + \text{CO}$
  - $[\text{Pt}(\text{PPh}_3)_4] + \text{PhI} \rightarrow [\text{Pt}(\text{Ph})(\text{I})(\text{PPh}_3)_2] + 2 \text{PPh}_3$
  - $[(\eta^1\text{-C}_3\text{H}_5)\text{Mn}(\text{CO})_5] \rightarrow [(\eta^3\text{-C}_3\text{H}_5)\text{Mn}(\text{CO})_3] + 2 \text{CO}$
- Electrophilic attack of Br<sub>2</sub> on a coordinated CH<sub>2</sub>=CH<sub>2</sub> is facilitated if
  - the metal is coordinatively unsaturated.
  - the metal is in high oxidation state.
  - the metal coordinated to good σ-donor ligands.
  - electron withdrawing groups are on coordinated ligands.
  - none of the above statements is true.

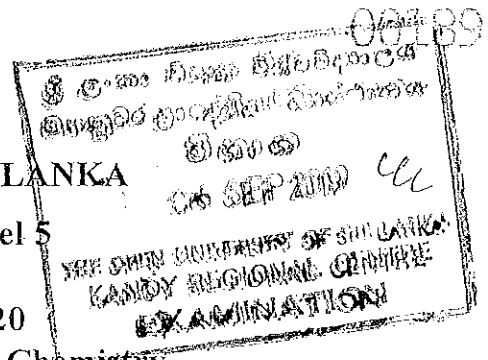
6.  $[\text{Fe}(\text{CO})_5]$  can be converted into  $[\text{HFe}(\text{CO})_4]^-$  by reacting it with  
 a)  $\text{HCl}$       b)  $\text{H}_2$       c)  $\text{OH}^-$       d)  $\text{H}^-$       e)  $\text{HOAc}$
7. What is the **major product/s** of the reaction between  $[\text{RhCl}(\text{PPh}_3)_3]$  and  $\text{AlMe}_3$  ?  
 a)  $\text{AlClMe}_2(\text{PPh}_3)_3$       b)  $[\text{RhMe}(\text{PPh}_3)_3]$   
 c)  $\text{Al}[\text{RhMe}_2(\text{PPh}_3)_2]$       d)  $[\text{RhMe}_3(\text{PPh}_3)_3]$   
 e)  $[\text{AlCl}(\text{PPh}_3)_3] + \text{RhMe}_3$
8. Which metal carbonyl has got **bridging** carbonyl ligands?  
 a)  $[\text{Fe}_3(\text{CO})_{12}]$       b)  $[\text{Ir}_4(\text{CO})_{12}]$       c)  $[\text{Ru}_3(\text{CO})_{12}]$   
 d)  $[\text{Re}_2(\text{CO})_{10}]$       e)  $[\text{Os}_3(\text{CO})_{12}]$
9.  $\alpha$ -Hydride abstraction could take place in  
 a) *trans*- $[\text{NiBr}(\text{OMe})(\text{PMe}_3)_2]$       b)  $[\text{Ni}(\text{PMe}_3)_4]$   
 c)  $[\text{EtCo}(\text{CO})_3]$       d)  $[\text{PhMn}(\text{CO})_4]$   
 e)  $[(\eta^5\text{-C}_5\text{H}_5)\text{Ta}(\text{CH}_2\text{Ph})_3]$
10. What is the product formed when  $[\text{Mn}(\eta^1\text{-allyl})(\text{CO})_5]$  is warmed in hexane?  
 a)  $[\text{MeMn}(\text{CO})_5]$       b)  $[\text{Mn}(\eta^2\text{-allyl})(\text{CO})_5]$       c)  $[\text{Mn}(\eta^1\text{-allyl})(\text{CO})_2]$   
 d)  $[\text{Mn}(\eta^3\text{-allyl})(\text{CO})_4]$       e)  $[\text{Mn}(\eta^3\text{-allyl})(\text{CO})_5]$
11. How many IR bands does  $[\text{V}(\text{CO})_6]^-$  show?  
 a) 1      b) 2      c) 3      d) 4      e) 5
12. Consider the following statements about metal carbonyls,  
 (i) The carbonyl stretching frequencies of doubly bridging metal carbonyls are higher than those of triply bridging ones.  
 (ii) CO stabilizes the metal centres in higher oxidation states.  
 (iii) The back bonding decreases the M-CO bond strength.  
 The correct statement/s is/are  
 a) (i) only.      b) (i) & (ii) only.      c) (ii) & (iii) only.  
 d) (i) & (iii) only.      e) Answer is not given.
13. The order of ease of hydrogenation of the olefins (A), (B), (C) and (D) is  
 $\text{CH}_2=\text{CH}_2$  (A) ; cyclohexene (B) ;  
*cis*- $\text{CH}_3\text{CH}=\text{CHCH}_3$  (C)    *trans*- $\text{CH}_3\text{CH}=\text{CHCH}_3$  (D) ;  
 a)  $\text{D} < \text{C} < \text{B} < \text{A}$       b)  $\text{C} < \text{D} < \text{B} < \text{A}$       c)  $\text{A} < \text{B} < \text{C} < \text{D}$   
 d)  $\text{B} < \text{D} < \text{C} < \text{A}$       e)  $\text{D} < \text{B} < \text{C} < \text{A}$
14. Which one of the following catalysts is used for **hydrocyanation** of butadiene?  
 a)  $[\text{Ni}(\text{P}(\text{O}^i\text{Pr})_3)_4]$       b)  $[\text{RuCl}_2(\text{PPh}_3)_3]$       c)  $[\text{Pd}(\text{CN})_2(\text{NCPh})_2]$   
 d)  $[\text{HCo}(\text{CO})_4]$       e)  $[\text{RhCl}(\text{PPh}_3)_3]$
15. The component **not used** or **formed** in the Monsanto process is  
 a)  $\text{MeI}$       b)  $\text{MeCOI}$       c)  $\text{MeOH}$       d)  $\text{HI}$       e)  $\text{H}_2$

THE OPEN UNIVERSITY OF SRI LANKA

B.Sc. Degree Programme - Level 5

Assignment Test II - 2019/2020

CYU5300/CMU3122 - Organometallic Chemistry



MCQ Answer Sheet: Mark a cross (×) over the ENGLISH LETTER that corresponds to the most suitable answer.

Reg. No.

	Marks
Part A	
Part B	
Total %	

FOR EXAMINER'S USE ONLY		
Answers	No.	Marks
Correct		
Wrong		
Total		

1	a	b	c	d	e	2	a	b	c	d	e	3	a	b	c	d	e	4	a	b	c	d	e
5	a	b	c	d	e	6	a	b	c	d	e	7	a	b	c	d	e	8	a	b	c	d	e
9	a	b	c	d	e	10	a	b	c	d	e	11	a	b	c	d	e	12	a	b	c	d	e
13	a	b	c	d	e	14	a	b	c	d	e	15	a	b	c	d	e						

**Part B (55 marks)**

*Answer all the questions in the space provided. Attached sheets will not be graded.*

1. (a) (i) *mer,cis*-[IrI Me<sub>2</sub>(CO)<sub>3</sub>] (A) undergoes reductive elimination to give an organic molecule (B) and the 16e-complex (C). Identify (B) and (C).

(ii) Draw the **structures** of the other two isomers of (A).

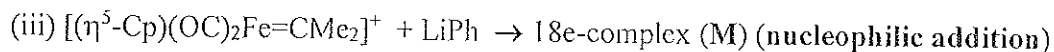
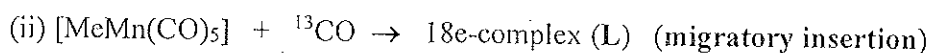
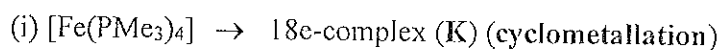
- (b) MeBr oxidatively adds to [RhBr<sub>2</sub>(CO)<sub>2</sub>]<sup>-</sup> to give (P). (P) in the presence of CO gives the acetyl complex (Q). (Q) reductively eliminates (R) to regenerate [RhBr<sub>2</sub>(CO)<sub>2</sub>]<sup>-</sup>. Identify (P), (Q) and (R).

(P) .....

(Q) .....

(R) .....

- (c) Identify the products of the following reactions using the hint given in the brackets.



(K)

(L)

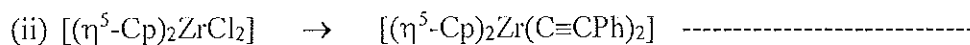
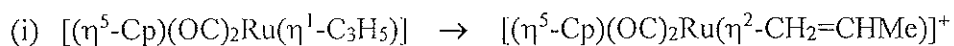
(M)

(d) What is the **active catalyst** used in the

(i) Monsanto Process .....

(ii) Roelen Process .....

(e) Write on the dotted line, the **compound/reagent(s)** which can be used to carry out the following conversions.



(f)  $[(\eta^5\text{-Cp})\text{Co}(\text{CH}_2\text{CH}_3)(\text{PPh}_3)]^+$  undergoes  $\beta$ -hydride abstraction to give the 16e-complex (**Z**) and a molecule of ethene. Draw the **structure** of (**Z**).

Name: .....

Registration No: .....

Address: .....

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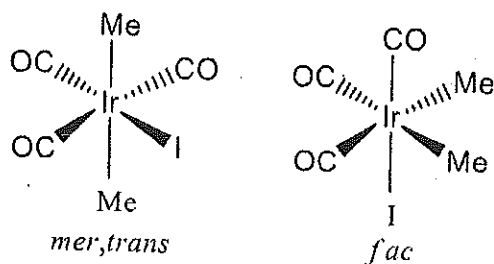
**Answer Guide**  
**ORGANOMETALLIC CHEMISTRY CYU5300**  
**CAT-2 – 2019/2020**

**Part A – MCQ Answers**

1. e    2. d    3. c    4. b    5. c    6. c    7. b    8. a  
 9. e    10. d    11. a    12. a    13. a    14. a    15. e

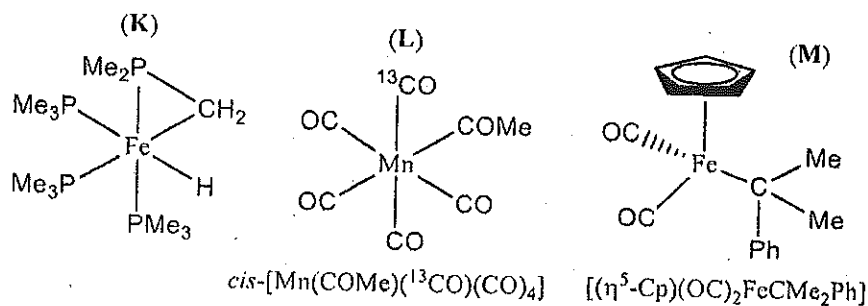
**Part B**

- 1) a) i) (B)  $\text{CH}_3\text{-CH}_3$  (C)  $[\text{Ir}(\text{CO})_3]$  OR (B)  $\text{MeI}$ , (C)  $[\text{IrMe}(\text{CO})_3]$   
 ii)



- b) (P) =  $[\text{RhBr}_3(\text{Me})(\text{CO})_2]^-$   
 (Q) =  $[\text{Rh}(\text{COMe})(\text{CO})_2\text{Br}_3]^-$   
 (R) =  $\text{MeCOBr}$

c)



- d) (i)  $[\text{Rh}(\text{CO})_2\text{I}_2]^-$   
 (ii)  $[\text{HCo}(\text{CO})_3]$

- e) (i)  $\text{HX}$  (X = Cl,  $\text{BF}_4$ ) etc  
 ii =  $\text{Na}(\text{C}\equiv\text{CPh})$

f)

