



THE OPEN UNIVERSITY OF SRI LANKA
B.Sc. & B. Ed. DEGREE / STAND ALONG COURSE IN SCIENCE - LEVEL 5
ASSIGNMENT TEST II (NBT) 2015/2016
CMU3122/CME5122 – Organometallic Chemistry

11th May 2016 (Wednesday)

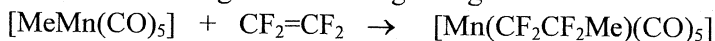
4.15 – 5.15 p.m.

ANSWER ALL QUESTIONS

Select the most correct answer/choice to each question given below. Mark a cross (X) over the most suitable answer on the **given answer script**. Any answer with more than one cross will not be counted.

PART A (45 marks)

1. Consider the following statements regarding



- (i) Oxidation number of the metal is not changed.
- (ii) Valence Electron Count of the metal is not changed.
- (iii) It can be classified as “1,1-insertion”.

The **correct** statement/s is/ are

- 1) (i) only.
- 2) (i) & (iii) only.
- 3) (i) & (ii) only.
- 4) (ii) & (iii) only.
- 5) (i), (ii) & (iii).

2. Wilkinson's Catalyst is

- 1) $[\text{PdCl}_2(\text{PPh}_3)_3]$
- 2) $[\text{RhCl}(\text{PPh}_3)_3]$
- 3) $[\text{RuCl}_2(\text{PPh}_3)_3]$
- 4) $[\text{PdCl}_4]^{2-}$
- 5) $[\text{RuHCl}(\text{PPh}_3)_3]$

3. Most **unlikely** reaction that would take place is

- 1) $[(\eta^5\text{-C}_5\text{H}_5)\text{IrCl}_2(\eta^2\text{-CH}_2=\text{CH}_2)]^+ + \text{Ph}^- \rightarrow [(\eta^4\text{-C}_5\text{H}_5)\text{IrCl}_2(\eta^1\text{-CH}_2\text{CH}_2\text{Ph})]$
- 2) $[\text{Ni}(\text{PPh}_3)_4] + 4 \text{NH}_3 \rightarrow [\text{Ni}(\text{NH}_3)_4] + 4 \text{PPh}_3$
- 3) $[\text{MnMe}(\text{CO})_5] + \text{CO} \rightarrow [\text{Mn}(\text{COMe})(\text{CO})_5]$
- 4) $[\text{Ni}(\text{CO})_4] + \text{CH}_2=\text{CH}_2 \rightarrow [(\text{OC})_3\text{Ni}(\text{CH}_2=\text{CH}_2)] + \text{CO}$
- 5) $[\text{Pt}(\text{Ph})(\text{H})(\text{PPh}_3)_2] + 2 \text{PPh}_3 \rightarrow [\text{Pt}(\text{PPh}_3)_4] + \text{C}_6\text{H}_6$

4. Pick the **incorrect** statement regarding **oxidative addition** reaction?

- 1) Coordinatively saturated metal centres can undergo oxidative addition reaction.
- 2) In most cases, coordination number of the metal is increased by 2 units.
- 3) Oxidation number of the metal is **always** increased by 2 units.
- 4) Oxidative addition is facile if the metal centre is coordinatively unsaturated.
- 5) $[\text{Co}_2(\text{CO})_8] + \text{H}_2 \rightarrow 2 [\text{HCo}(\text{CO})_4]$

5. Which statement is **not true** about $[\text{Fe}(\text{PMe}_3)_2(\text{CO})_3]$?

- 1) The IUPAC name is tricarbonylbis(trimethylphosphine)iron.
- 2) CO is a good π -acceptor ligand.
- 3) It shows only one IR band.
- 4) The coordination number of iron is 5.
- 5) The $\nu(\text{CO})$ of $[\text{Fe}(\text{PMe}_3)_2(\text{CO})_3]$ is lower than that of $[\text{Fe}(\text{CO})_5]$.

6. $[\text{Fe}(\text{CO})_5]$ can be converted into $[\text{HFe}(\text{CO})_4]^-$ by reacting it with

- 1) HCl
- 2) H_2
- 3) OH^-
- 4) H^-
- 5) HOAc

7. What is the **major product** of the reaction between $[\text{RhCl}(\text{PPh}_3)_3]$ and AlMe_3 ?
- 1) $\text{AlClMe}_2(\text{PPh}_3)_3$
 - 2) $[\text{RhMe}(\text{PPh}_3)_3]$
 - 3) $\text{Al}[\text{RhClMe}_3(\text{PPh}_3)_2]$
 - 4) $[\text{RhMe}_3(\text{PPh}_3)_3]$
 - 5) $\text{AlMe}(\text{PPh}_3)_3$
8. Which metal carbonyl has got **bridging** carbonyl ligands?
- 1) $[\text{Os}_3(\text{CO})_{12}]$
 - 2) $[\text{Ir}_4(\text{CO})_{12}]$
 - 3) $[\text{Ru}_3(\text{CO})_{12}]$
 - 4) $[\text{Re}_2(\text{CO})_{10}]$
 - 5) $[\text{Fe}_3(\text{CO})_{12}]$
9. γ -Hydride abstraction could take place in
- 1) *trans*- $[\text{NiBr}(\text{OMe})(\text{PMe}_3)_2]$
 - 2) $[\text{Ni}(\text{PMe}_3)_4]$
 - 3) $[\text{EtCo}(\text{CO})_3]$
 - 4) $[\text{Me}_3\text{SiOMn}(\text{CO})_4]$
 - 5) $[(\eta^5\text{-C}_5\text{H}_5)\text{Co}(\text{OMe})(\text{PMe}_3)(\text{CO})]\text{I}$
10. Consider the following statements about $[\text{PtCl}_2(\text{dppe})]$. $\text{dppe} = \text{PPh}_2\text{CH}_2\text{CH}_2\text{PPh}_2$
- (i) It could undergo oxidative addition with Cl_2 to give $[\text{PtCl}_4(\text{dppe})]$.
 - (ii) It reacts with excess MeLi to give $[\text{PtMe}_2(\text{dppe})]$.
 - (iii) $[\text{PtMe}_2(\text{dppe})]$ reacts with MeI to give $[\text{PtIme}_3(\text{dppe})]$.
- The **correct statement/s is/are**
- 1) (ii) only.
 - 2) (i) & (iii) only.
 - 3) (i) & (ii) only.
 - 4) (ii) & (iii) only.
 - 5) (i), (ii) & (iii).
11. Consider the following complexes.
- (i) $[\text{EtORh}(\text{CO})_3]$
 - (ii) $[\text{MeCo}(\text{PPh}_3)_3]$
 - (iii) $[(\eta^5\text{-C}_5\text{Ph}_5)\text{Ta}(\text{OCH}_2\text{Ph})_3]$
- γ -Agostic (gamma agostic) interaction could be seen in
- 1) (i) only.
 - 2) (i) & (ii) only.
 - 3) (i) & (iii) only.
 - 4) (ii) & (iii) only.
 - 5) (i), (ii) & (iii).
12. What is the product formed when $[\text{Mn}(\eta^1\text{-allyl})(\text{CO})_5]$ is warmed in hexane?
- 1) $[\text{Mn}_2(\text{CO})_8]$
 - 2) $[\text{Mn}(\eta^2\text{-allyl})(\text{CO})_5]$
 - 3) $[\text{Mn}(\text{CO})_5]$
 - 4) $[\text{Mn}(\eta^3\text{-allyl})(\text{CO})_4]$
 - 5) $[\text{Mn}(\eta^3\text{-allyl})(\text{CO})_5]$
13. Electrophilic attack of Br_2 on a coordinated $\text{CH}_2=\text{CH}_2$ is facilitated if
- 1) the metal is coordinatively unsaturated.
 - 2) the metal is in high oxidation state.
 - 3) the metal is coordinated to good sigma donor ligands.
 - 4) electron withdrawing groups are on coordinated ligands.
 - 5) the metal is positively charged.
14. How many IR bands does $[\text{V}(\text{CO})_6]^-$ show?
- 1) 1
 - 2) 2
 - 3) 3
 - 4) 4
 - 5) 5
15. Consider the following statements about metal carbonyls.
- (i) Back bonding weakens the CO bond strength.
 - (ii) Back bonding increases the M-C bond strength.
 - (iii) The CO stretching frequency varies in the following order,
 $\text{M}_3(\mu_3\text{-CO}) > \text{M}_2(\mu_2\text{-CO}) > \text{M-CO}$.
- The **correct statement/s is/are**
- 1) (i) only
 - 2) (i) & (ii) only
 - 3) (i) & (iii) only
 - 4) (ii) & (iii) only
 - 5) (i), (ii) & (iii)

THE OPEN UNIVERSITY OF SRI LANKA
 B. Sc DEGREE PROGRAMME 2015/2016
 CMU3122/CME5122 – ORGANOMETALLIC CHEMISTRY- LEVEL 5
 ASSIGNMENT TEST-II (Part A)

MCQ ANSWER SHEET: Mark a cross (X) over the most suitable answer.

Reg. No.

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For Examiners Use

Part A	
Part B	
Total %	

Marks

Correct Answers		
Wrong Answers		
Total		

- | | | | | | | | | | | | | | | | | | |
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| 1. <table border="1" style="display: inline-table; text-align: center; width: 50px; height: 20px;"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr></table> | 1 | 2 | 3 | 4 | 5 | 2. <table border="1" style="display: inline-table; text-align: center; width: 50px; height: 20px;"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr></table> | 1 | 2 | 3 | 4 | 5 | 3. <table border="1" style="display: inline-table; text-align: center; width: 50px; height: 20px;"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr></table> | 1 | 2 | 3 | 4 | 5 |
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| 1 | 2 | 3 | 4 | 5 | | | | | | | | | | | | | |

Part B (55 marks)

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

1. (a) (i) What is the **molecular formula** of the product (**A**) formed due to oxidative addition of dioxygen to $[\text{IrCl}(\text{PPh}_3)_3]$?

(ii) Draw the structures of the **three** isomers of (**A**).

(b) The dimer $[(\eta^5\text{-Cp})\text{Ru}(\text{CO})_2]_2$ reacts with **K** to give a mononuclear salt (**P**). (**P**) with **PhI** gives (**Q**). Under pressure, (**Q**) reacts with **CO** to give another 18e-complex (**R**). Identify (**P**), (**Q**) and (**R**).

(**P**) (**Q**)

(**R**)

(c) Arrange $\text{CH}_2=\text{CH}_2$, $\text{EtCH}=\text{CHEt}$ and $\text{CF}_2=\text{CF}_2$ in the order of increasing π -acceptability.

.....

(d) **Identify** the product(s) of the following reactions using **the hint given in the brackets**.

(i) $[(\eta^5\text{-Cp})\text{Zr}(\text{CO})_2] + 2 \text{MeC}\equiv\text{CMe} \rightarrow 16\text{e-complex (K)} + \text{gas (L)}$
(oxidative coupling)

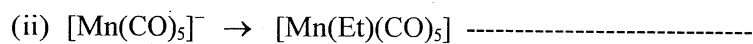
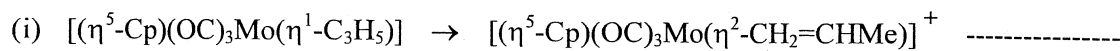
(ii) $[\text{MeMn}(\text{CO})_5] + {}^{13}\text{CO} \rightarrow 18\text{e-complex (M)}$ (migratory insertion)

(**K**)

(**L**)

(**M**)

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



(f) $[(\eta^5\text{-Cp})\text{Co}(\text{Et})(\text{PPh}_3)]^+$ undergoes β -hydride abstraction to give a 18e-olefin complex (**Z**).

Draw the **structures** of (**Z**).

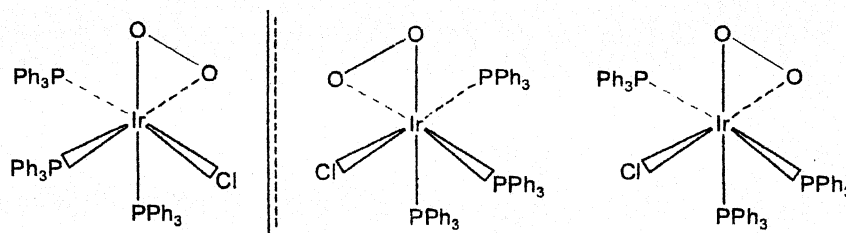
CMU3122/CME5122 – Organometallic Chemistry - Level 5
Answer Guide to Assignment Test-II held on 11-05-2016

Part A – MCQ ANSWERS

1. (3) 2. (2) 3. (2) 4. (3) 5. (3)
 6. (3) 7. (2) 8. (5) 9. (4) 10. (5)
 11. (2) 12. (4) 13. (3) 14. (1) 15. (2)

Part B

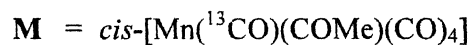
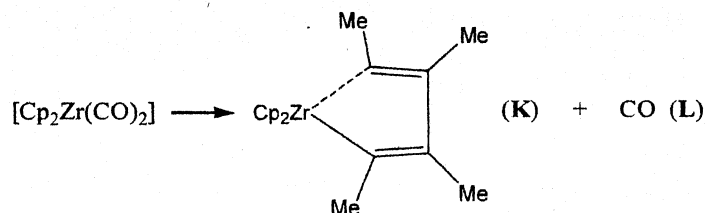
- (1) (a) (i) $[\text{IrCl}(\text{O}_2)(\text{PPh}_3)_3]$
 (ii)



- (b) $\text{P} = 2 \text{K} [(\eta^5\text{-Cp})\text{Ru}(\text{CO})_2]$
 $\text{Q} = [(\eta^5\text{-Cp})\text{Ru}(\text{Ph})(\text{CO})_2]$
 $\text{R} = [(\eta^5\text{-Cp})\text{Ru}(\text{COPh})(\text{CO})_2]$

- (c) $\text{EtCH=CHEt} < \text{CH}_2=\text{CH}_2 < \text{CF}_2=\text{CF}_2$

- (d)



- (e) (i) HBF_4 or HCl

- (ii) EtI or EtBr or EtCl

- (f) $\text{Z} =$

