

THE OPEN UNIVERSITY OF SRI LANKA
B. Sc. DEGREE PROGRAMME 2015/2016
CMU3122/CME5122 – ORGANOMETALLIC CHEMISTRY
ASSIGNMENT TEST-I (NBT)



DATE : 4th April 2016

Duration = 1 h

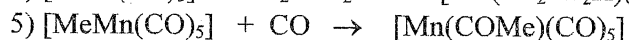
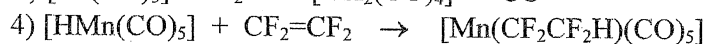
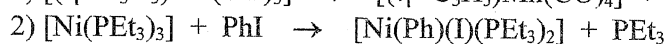
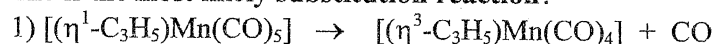
TIME : 4.15 p.m. to 5.15 p.m.

ANSWER ALL QUESTIONS

Select the **most correct answer** 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. Which one is the most likely **substitution reaction**?



2. Consider the following organic ligands.

(i) cyclobutene

(ii) π -allyl

(iii) ethenyl

The **monohapto** ligand/s is/are

1) (ii) only.

2) (i) and (ii) only.

3) (i) and (iii) only.

4) (ii) and (iii) only.

5) Answer is not given.

3. Consider the following statements

(i) CO and CS are isoelectronic.

(ii) H_2O and HF are not isoelectronic.

(iii) NO^+ and N_2 are isoelectronic.

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

1) (iii) only

2) (i) & (ii) only

3) (i) & (iii) only

4) (ii) & (iii) only

5) (i), (ii) & (iii)

4. According to the **covalent model**, a possible 4e-donor ligand is

1) σ -allyl

2) ethene

3) $\text{HC}\equiv\text{CH}$

4) π -allyl

5) C_4H_8

5. An L_3 type ligand is

1) $\eta^4\text{-C}_4\text{H}_4$

2) $\eta^4\text{-C}_6\text{H}_6$

3) cyclopentadienyl

4) $\eta^6\text{-C}_7\text{H}_8$

5) $\eta^3\text{-C}_3\text{H}_5^-$

6. The IUPAC name of $[\text{CoI}(\text{CO})(\eta^6\text{-C}_6\text{H}_6)]$ is

1) Iodocarbonyl(η^6 -benzene)cobalt

2) Carbonyliodophenylcobalt

3) (Hexahaptobenzene)carbonylcobalt iodide

4) (η^6 -benzene)carbonyliodocobaltate

5) (η^6 -benzene)carbonyliodocobalt

7. The strongest σ -donor ligand is

1) PMe_3

2) CO

3) BMe_3

4) CHCl_3

5) NO^+

8. The **coordination number** of Pd in $[\text{PdCl}(\eta^3\text{-C}_3\text{H}_5)(\eta^2\text{-C}_4\text{H}_4)]$ is
 1) 3 2) 4 3) 5 4) 6 5) 8
9. Consider the following statements about $[\text{FeCl}_2(\text{PPh}_3)(\text{CO})_3]$ (Z of Fe is 26).
 (i) It has 3 geometrical isomers. (ii) It has optical isomers.
 (iii) It is a coordinatively saturated compound.
 The **correct** statement/s is/are
 1) (iii) only. 2) (i) & (ii) only. 3) (i) & (iii) only.
 4) (ii) & (iii) only. 5) (i), (ii) & (iii).
10. According to the ionic model, the **coordination number** and the **oxidation number** of Co in $[(\eta^3\text{-C}_5\text{H}_5)\text{CoMe}(\eta^5\text{-C}_5\text{H}_5)]$ (Group number of Co is 9) are
 1) 6, +3 2) 6, +2 3) 7, +2 4) 7, +1 5) 7, +3
11. What is **not true** about **dinitrogen** ?
 1) It can act as a *dihapto* ligand. 2) It can act as a 4e-donor.
 3) It can act as a bridging ligand. 4) It is a better σ -donor than CO.
 5) It is a weak π -acceptor than NO.
12. What is the **Valence Electron Count (VEC)** of Co in $[(\eta^1\text{-C}_5\text{H}_5)\text{CoI}(\eta^6\text{-C}_6\text{H}_6)]$?
 (Group number of Co is 9)
 1) 16 2) 17 3) 18 4) 21 5) 35
13. Pick the **incorrect** statement regarding **oxidative addition** reaction.
 1) In most cases, coordination number of the metal is increased by 2 units.
 2) Coordinatively saturated metal centres can undergo oxidative addition reaction.
 3) Oxidative addition is facile if the metal centre is electron rich.
 4) Oxidative addition is facile if the metal centre is coordinatively unsaturated.
 5) Oxidation number of the metal is always increased by 2 units.
14. What is **not true** about the **carbene** ligand ?
 1) It can form a metal carbon double bond.
 2) It can act as a 2e-donor.
 3) Carbene carbon is *sp* hybridized.
 4) It can act as a monodentate ligand.
 5) It can form Fischer carbenes with Group 6 metals.
15. Consider the complex ion $[\text{PtCl}_3(\eta^2\text{-CH}_2=\text{CH}_2)]^-$. Which one of the following statements is **not true** about the above complex? (Group number of Pt is 10)
 1) It is symmetrical.
 2) The oxidation number of Pt is +2.
 3) The plane of ethene is not perpendicular to the PtCl_3 plane.
 4) It is a square planar complex.
 5) Platinum centre has 16 valence electrons.

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

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

Reg. No.

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For Examiners Use

Marks

Part A	
Part B	
Total %	

Correct Answers		
Wrong Answers		
Total		

- | | | | | | | | | | | | | | | | | | |
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Part B (55 marks)

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

1. (a) Give the IUPAC name for $[\text{ReH}(\text{Br})(\text{Me})(\eta^1\text{-CH}_2\text{CH}=\text{CH}_2)(\eta^5\text{-C}_5\text{H}_5)]$.
- (b) Draw the **structure** of $[\text{ReH}(\text{Br})(\text{Me})(\eta^1\text{-CH}_2\text{CH}=\text{CH}_2)(\eta^5\text{-C}_5\text{H}_5)]$.
- (c) Determine the **VEC** of Re in $[\text{ReH}(\text{Br})(\text{Me})(\eta^1\text{-CH}_2\text{CH}=\text{CH}_2)(\eta^5\text{-C}_5\text{H}_5)]$ using **ionic model**. (Indicate your break down; Group number of Re is 7)
- (d) Determine the **coordination number** of Re in $[\text{ReH}(\text{Br})(\text{Me})(\eta^1\text{-CH}_2\text{CH}=\text{CH}_2)(\eta^5\text{-C}_5\text{H}_5)]$.
- (e) (i) Draw the **structures** of all the isomers of $[\text{FeBr}_2(\text{dppe})(\text{CO})_2]$.
dppe = $\text{PPh}_2\text{CH}_2\text{CH}_2\text{PPh}_2$ is a bidentate ligand.
- (ii) Comment on the **optical** isomerism of $[\text{FeBr}_2(\text{dppe})(\text{CO})_2]$.
- (f) Arrange CO, NMe_3 , PMe_3 and $\text{P}(\text{OMe})_3$ in the order of increasing **π -acceptability**
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Answer Guide for Assignment Test - I
CMU3122/CME5122 – Organometallic Chemistry

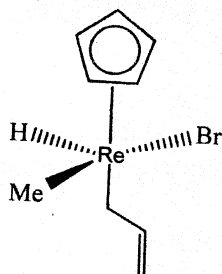
Part A – MCQ ANSWERS

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

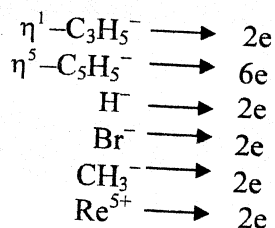
Part B

- (1). (a) $(\eta^1\text{-Allyl})\text{bromo}(\eta^5\text{-cyclopentadienyl})\text{hydromethylrhenium}$ or
 Bromo($\eta^5\text{-cyclopentadienyl})\text{hydromethyl}(2\text{-propenyl})\text{rhenium}$

(b)



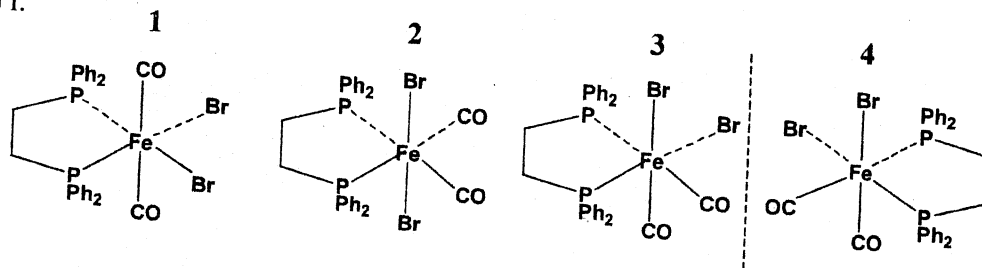
(c)



VEC = 16e

- (d) Coordination number = No. of electron pairs
 $= 1(\eta^1\text{-C}_3\text{H}_5^-) + 3(\eta^5\text{-C}_5\text{H}_5^-) + 1(\text{H}^-) + 1(\text{CH}_3^-) + 1(\text{Br}^-)$
 $= \underline{7}$

(e) i.



- ii. Structures (1) & (2) are optically inactive since each has a plane of symmetry.
 Structures (3) & (4) are optically active & are enantiomers (not superimposable).

- (f) $\text{NMe}_3 < \text{PMe}_3 < \text{P(OMe)}_3 < \text{CO}$