

THE OPEN UNIVERSITY OF SRI LANKA
B. Sc. & B. Ed. DEGREE/STAND ALONE
COURSES IN SCIENCE 2009/2010– Level 5
ASSIGNMENT TEST I (NBT)
CHU3127/CHE5127 – Organometallic Chemistry



DURATION : 1.5 hours

DATE: 15th September 2009

TIME : 4.00 p.m. to 5.30 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 and 1/5th of the mark will be deducted for each **incorrect** answer.

PART A (60 marks)

1. Consider the following organic ligands,

(i) vinyl (ii) =CH₂ (iii) ≡CH

The possible *monohapto* ligands are

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

2. The possible **coordination mode(s)** of the allyl group (C₃H₅⁻) is/are

- 1) η¹ only. 2) η³ only.
3) η¹ and η³ only. 4) η² only.

3. The IUPAC name of [(η⁵-C₅H₅)FeCl₂(η²-C₂H₄)] is

- 1) (η⁵-cyclopentadienyl)dichloro(η²-ethene)ferrous(III)
2) dichloro(η⁵-cyclopentadienyl)(η²-ethene)iron
3) (η⁵-cyclopentadienyl)dichloro(η²-ethene)iron(III)
4) dichloro(η²-ethene)(η⁵-cyclopentadienyl)ferrate

4. What is the **Valence Electron Count (VEC)** of Fe in [(η⁵-C₅H₅)FeCl₂(η²-C₂H₄)]?
(Atomic number of Fe is 26)

- 1) 16 2) 17 3) 18 4) 35

5. The **strongest σ-donor** ligand among the following ligands is

- 1) NMe₃ 2) NH₃ 3) NH₂NH₂ 4) NO

6. According to the ionic model, which one of the following is a 6e-donor ligand?

- 1) η⁷-C₇H₇⁻ 2) η⁵-Cp⁻ 3) cyclopentadiene (C₅H₆) 4) 1,3-cyclohexadiene (C₆H₈)

7. The **coordination number** of Fe in [(η⁵-C₅H₅)FeCl₂(η²-C₂H₄)] is

- 1) 3 2) 4 3) 5 4) 6

8. An L_3X type ligand is
 1) $\eta^7-C_7H_7^-$ 2) $\eta^6-C_6H_6$ 3) $\eta^3-C_3H_3^-$ 4) $\eta^5-C_5H_5^-$
9. What is true about PF_3 ?
 1) It stabilises the metal centres in higher oxidation states.
 2) It is a good σ -donor.
 3) It is a good π -acceptor.
 4) It is a good σ -donor and a good π -acceptor.
10. According to the ionic model, the d^n electron configuration and the oxidation number of iron in $[(\eta^5-C_5H_5)FeCl_2(\eta^2-C_2H_4)]$ (atomic number of Fe is 26) respectively are
 1) $d^8, +2$ 2) $d^6, +2$
 3) $d^5, +3$ 4) $d^5, +2$
11. Consider the following statements about $[(\eta^3-C_3H_5)NiCl(CO)]$ (Group number of Ni is 10),
 (i) It shows the trigonal-planar geometry.
 (ii) It does not give geometrical isomers.
 (iii) It is a 16e-compound.
 The correct statement/s is/are
 1) (iii) only. 2) (i) & (iii) only.
 3) (ii) & (iii) only. 4) (i), (ii) & (iii).
12. Consider the following statements about carbenes.
 (i) In Schrock carbenes, the carbene carbon is nucleophilic.
 (ii) Carbene ligand is a 3e-donor.
 (iii) Carbene ligand is a *monohapto* ligand.
 The correct statement/s is/are
 1) (i) & (iii) only. 2) (iii) only.
 3) (ii) & (iii) only. 4) (i), (ii) & (iii).
13. Which one of the following ligands is **not** isoelectronic with ethene.
 1) CN^- 2) $C\equiv O$ 3) N_2 4) NO
14. Which one of the following statements is **not** true about Fischer carbenes?
 1) Hetero-atoms are attached to the carbene carbon.
 2) Carbene carbon contains a $-\delta$ charge.
 3) Carbene carbon is readily attacked by nucleophiles.
 4) Metal is in a low oxidation state.
15. What is **not** true about the dinitrogen ligand?
 1) It can act as a *dihapto* ligand.
 2) It can act as a terminal ligand.
 3) It can act as a 4e-donor.
 4) It is a better σ -donor than CO.

16. Consider the following statements,

- (i) N_2 is a weaker π -acceptor than PF_3 .
- (ii) CO is a stronger σ -donor than CN^- .
- (iii) NO^+ is a stronger π -acceptor than NO.

The correct statement/s is/are

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

17. According to the **Ionic Model**, what is the **oxidation number** of Co in

$[\text{CoCl}(\eta^2\text{-C}_2\text{H}_4)(\eta^5\text{-C}_5\text{H}_5)(\text{CO})]$ (Group number of Co is 9) ?

- 1) 1
- 2) 2
- 3) 3
- 4) 4.

18. Consider the following statements.

- (i) CO is a good π -acceptor ligand.
- (ii) The back bonding increases the M-CO bond strength.
- (iii) CO stabilises metal centres in lower oxidation states.

The correct statement/s is/are

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

19. Consider the Pt(II) complex $[\text{Pt}_2\text{Cl}_2(\mu\text{-Cl})_2(\text{PPh}_3)_2]$. Which one of the following statements is **not true** about the above complex? (Group number of Pt is 10)

- 1) Each platinum centre has 16 valence electrons.
- 2) It is not a symmetrical molecule.
- 3) There is no Pt-Pt bond.
- 4) Each platinum centre has one terminal chloride ligand.

20. In metal carbonyls, when **back donation** is increased

- 1) the M-CO bond order is decreased.
- 2) the bond strength of $\text{C}\equiv\text{O}$ is increased.
- 3) the $\nu(\text{CO})$ value is decreased.
- 4) the M-CO bond length is increased.



THE OPEN UNIVERSITY OF SRI LANKA
B.Sc. DEGREE PROGRAMME 2009/2010
CHU3127/CHE5127 – ORGANOMETALLIC CHEMISTRY- LEVEL 5
ASSIGNMENT TEST I - MCQ TEST

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

Name:-

Reg. No.

	Marks
Part A	
Part B	
Total %	

FOR EXAMINER'S USE		Marks
Unanswered		
Correct Answers		
Wrong Answers		
Total		

1.

1	2	3	4
---	---	---	---

2.

1	2	3	4
---	---	---	---

3.

1	2	3	4
---	---	---	---

4.

1	2	3	4
---	---	---	---

5.

1	2	3	4
---	---	---	---

6.

1	2	3	4
---	---	---	---

7.

1	2	3	4
---	---	---	---

8.

1	2	3	4
---	---	---	---

9.

1	2	3	4
---	---	---	---

10.

1	2	3	4
---	---	---	---

11.

1	2	3	4
---	---	---	---

12.

1	2	3	4
---	---	---	---

13.

1	2	3	4
---	---	---	---

14.

1	2	3	4
---	---	---	---

15.

1	2	3	4
---	---	---	---

16.

1	2	3	4
---	---	---	---

17.

1	2	3	4
---	---	---	---

18.

1	2	3	4
---	---	---	---

19.

1	2	3	4
---	---	---	---

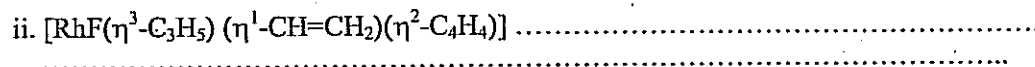
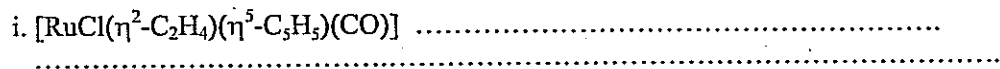
20.

1	2	3	4
---	---	---	---

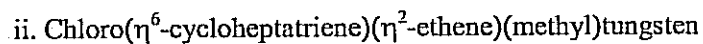
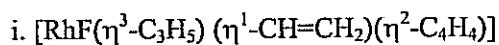
Part B (40 marks)

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

1. (a) Give IUPAC names for the following complexes.



(b) Draw the structures of the following complexes.



(c) (i) Determine the VEC of Rh in $[\text{RhF}(\eta^3\text{-C}_3\text{H}_5)(\eta^1\text{-CH=CH}_2)(\eta^2\text{-C}_4\text{H}_4)]$ using **ionic model**. (Indicate your break down or the steps used; Group number of Rh is 9)

(ii) Determine the VEC of Ru in $[\text{RuCl}(\eta^2\text{-C}_2\text{H}_4)(\eta^5\text{-C}_5\text{H}_5)(\text{CO})]$ using **covalent model**. (Indicate your break down or the steps used; Group number of Ru is 8)

(d) What is meant by the "18e-rule"?

2. (a) Determine the **coordination number** of Ru in $[\text{RuCl}(\eta^2\text{-C}_2\text{H}_4)(\eta^5\text{-C}_5\text{H}_5)(\text{CO})]$.

(b) Draw the orbital diagram between a metal and a carbene ligand, indicating the σ and π -overlap.

(c) (i) Arrange CF_3CN , MeCN , CS and CO in the order of increasing π -acceptability.

(ii) Arrange PH_3 , PCl_3 , PF_3 and PMe_3 in the order of increasing σ -donor ability.

(d) (i) Draw the structures of the **three** isomers of $[\text{Fe}(\text{CO})_2(\text{PPh}_3)_3]$ with the **trigonal bipyramidal** geometry.

(ii) Draw the structures of the **three** isomers of $[\text{Fe}(\text{CO})_2(\text{PPh}_3)_3]$ with the **tetragonal pyramidal** geometry.

08 OCT 2009



THE OPEN UNIVERSITY OF SRI LANKA
B.Sc. & B. Ed. DEGREE / STAND ALONG COURSE IN SCIENCE - LEVEL 5
ASSIGNMENT TEST II (NBT) 2009/2010
CHU 3127/CHE 5127 – Organometallic Chemistry

08th October 2009

Duration: 1 ½ hours

4.00 – 5.30 pm.

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 and 1/5th of the mark will be deducted for each incorrect answer.

PART A (60 marks)

- Consider the following statements regarding **reductive elimination**.
 - Reductive elimination is facile if the metal centre is positively charged.
 - Coordinationally saturated compounds prefer to undergo reductive elimination.
 - Coordination number of the metal is reduced by two units during reductive elimination.

The correct statements are

1) (i) & (ii) only.	2) (i) & (iii) only.
3) (ii) & (iii) only.	4) (i), (ii) & (iii).
- Consider the following statements about $[\text{Fe}(\text{CO})_5]$.
 - It shows the trigonal bipyramidal geometry in the solid state.
 - It shows two carbonyl bands in its IR spectrum.
 - It can be prepared by reacting zerovalent Fe with CO at high temperatures and pressures.

The correct statements are

1) (i) & (ii) only.	2) (i) & (iii) only.
3) (ii) & (iii) only.	4) (i), (ii) & (iii).
- Pick the **incorrect** statement regarding **oxidative addition** reaction?
 - Coordinationally saturated metal centres can undergo oxidative addition reaction.
 - In most cases, coordination number of the metal is increased by 2 units.
 - Oxidation number of the metal is always increased by 2 units.
 - Oxidative addition is facile if the metal centre is coordinationally unsaturated.
- Which one is an example for **2e-oxidative-addition** reaction?
 - $[\text{MeMn}(\text{CO})_5] + \text{CF}_2=\text{CF}_2 \rightarrow [\text{Mn}(\text{CF}_2\text{CF}_2\text{Me})(\text{CO})_5]$
 - $[\text{Co}_2(\text{CO})_8] + \text{H}_2 \rightarrow 2 [\text{HCo}(\text{CO})_4]$
 - $2 [\text{Co}(\text{CN})_5]^{3-} + \text{MeI} \rightarrow [\text{MeCo}(\text{CN})_5]^{3-} + [\text{CoI}(\text{CN})_5]^{3-}$
 - $[\text{Pd}(\text{PPh}_3)_4] + \text{PhI} \rightarrow [\text{Pd}(\text{Ph})(\text{I})(\text{PPh}_3)_2] + 2 \text{PPh}_3$
- δ -Agnostic (delta agnostic) interaction could be seen in
 - $[\text{MeMn}(\text{CO})_5]$
 - $[(\text{OC})_3\text{Pd}\{\text{P}(\text{O}^i\text{Pr})_3\}]$
 - $[\text{RhI}(\text{Me})(\text{PPh}_3)(\text{CO})]$
 - $[\text{Ni}(\text{PEt}_3)_3]$

6. How many IR bands does *trans*-[Cr(CO)₄(PPh₃)₂] show?
 1) 1 2) 2 3) 3 4) 4
7. Consider the following statements about [W(CO)₄(dppe)],
 (dppe = PPh₂CH₂CH₂PPh₂ is a bidentate ligand).
 (i) It can be prepared by reacting [W(CO)₆] with dppe.
 (ii) It shows the octahedral geometry.
 (iii) It shows only one carbonyl band in its IR spectrum.
 The correct statements are
 1) (i) & (ii) only. 2) (i) & (iii) only.
 3) (ii) & (iii) only. 4) (i), (ii) & (iii).
8. Nucleophilic attack on a coordinated ligand is facilitated if
 1) the metal is in a lower oxidation state
 2) the metal is coordinatively unsaturated.
 3) the metal is coordinated to good π-acceptor ligands.
 4) the metal carries a negative charge.
9. Which metal carbonyl **does not** have a **bridging** carbonyl ligand?
 1) [Rh₄(CO)₁₂] 2) [Mn₂(CO)₁₀]
 3) [Fe₃(CO)₁₂] 4) [Co₂(CO)₁₈]
10. Which one is the most likely **substitution** reaction?
 1) [Ni(CO)₄] \rightleftharpoons [Ni(CO)₃] + CO
 2) [Ni(PEt₃)₃] + PhI \rightarrow [Ni(Ph)(I)(PEt₃)₂] + PEt₃
 3) [(η¹-C₃H₅)Mn(CO)₅] \rightarrow [(η³-C₃H₅)Mn(CO)₄] + CO
 4) [Os(CO)₅] + H₂ \rightarrow [OsH₂(CO)₄] + CO
11. Consider the following statements regarding ligands,
 (i) CN⁻ is a weaker σ-donor than CO.
 (ii) PMe₃ is a better σ-donor than PPh₃.
 (iii) CS is a better π-acceptor than NO.
 The correct statement/s is/are
 1) (ii) only. 2) (ii) & (iii) only.
 3) (i) & (ii) only. 4) (i) & (iii) only.
12. Which one is an example of an **insertion** reaction?
 1) [PtH(CO)₃]I + CH₂=CH₂ \rightarrow [Pt(CH₂CH₃)(CO)₃]I
 2) [(η¹-C₃H₅)Mn(CO)₅] \rightarrow [(η³-C₃H₅)Mn(CO)₄] + CO
 3) [Fe(CO)₅] + 2 CF₂=CF₂ \rightarrow [(OC)₄Fe(C₄F₈)] + CO
 4) [Pd(PPh₃)₄] + PhI \rightarrow [Pd(Ph)(I)(PPh₃)₂] + 2 PPh₃
13. Which statement is **not true** about [Fe(CO)₄]²⁻?
 1) The coordination number of iron is 4.
 2) The oxidation number of iron is -2.
 3) The IUPAC name is tetracarbonylferrate ion.
 4) The ν(CO) of [Fe(CO)₄]²⁻ is higher than that of [Fe(CO)₄]⁻.
14. Consider the following statements,
 (i) [HCo(CO)₄] is a H⁺ donor.
 (ii) [HCo(CO)₃(PPh₃)] is a stronger acid than [HCo(CO)₄].
 (iii) [HCo(CO)₄] shows a negative proton chemical shift (in ppm) with respect to SiMe₄ (TMS).
 The correct statements are
 1) (i) & (ii) only. 2) (i) & (iii) only.
 3) (ii) & (iii) only. 4) (i), (ii) & (iii).

15. What would be the most likely CO stretching frequency of $[\text{Mo}(\text{CO})_6]$?
 1) 2005 2) 1900 3) 1800 4) 1650
16. Consider the following statements about cycloheptatriene (C_7H_8),
 (i) It can act as L_3 type ligand.
 (ii) It can act as a dihapto or tetrahapto ligand.
 (iii) The coordination number of Mo in $[\text{Mo}(\eta^6\text{-C}_7\text{H}_8)(\text{CO})_3]$ is 4.
 The correct statements are
 1) (i) & (ii) only. 2) (i) & (iii) only.
 3) (ii) & (iii) only. 4) (i), (ii) & (iii).
17. What is the most stable **product** formed due to 1e-oxidation of $[\text{Co}(\text{CN})_5]^{3-}$ with H_2 ?
 1) $[\text{HCo}(\text{CN})_5]^{2-}$
 2) $[\text{H}_2\text{Co}(\text{CN})_4]^{2-}$
 3) $[\text{HCo}(\text{CN})_5]^{3-}$
 4) $[\text{H}_2\text{Co}(\text{CN})_4]^{2-}$
18. Consider the following statements,
 (i) Addition of MeI to $[\text{IrCl}(\text{CO})(\text{PPh}_3)_2]$ is *trans*.
 (ii) Addition of HBr to $[\text{IrBr}(\text{CO})(\text{PPh}_3)_2]$ gives a metal hydride.
 (iii) Addition of dioxygen to $[\text{RhCl}(\text{PPh}_3)_3]$ is *cis*.
 The correct statements are
 1) (i) & (ii) only. 2) (i) & (iii) only.
 3) (ii) & (iii) only. 4) (i), (ii) & (iii).
19. What is the most stable **product** formed, when $[\text{Fe}(\text{CO})_5]$ is reacted with 1,3-butadiene (C_4H_6)?
 1) $[\text{Fe}(\text{CO})_4(\eta^4\text{-C}_4\text{H}_6)]$
 2) $[\text{Fe}(\text{CO})_3(\eta^4\text{-C}_4\text{H}_6)]$
 3) $[\text{Fe}(\text{CO})_4(\eta^2\text{-C}_4\text{H}_6)]$
 4) $[\text{Fe}(\text{CO})_2(\eta^4\text{-C}_4\text{H}_6)]$
20. The nucleophilicity of the R^- group varies in the following order,
 1) $\text{LiR} > \text{NaR} > \text{RMgX} > \text{ZnR}_2$
 2) $\text{NaR} > \text{LiR} > \text{RMgX} > \text{ZnR}_2$
 3) $\text{LiR} > \text{NaR} > \text{ZnR}_2 > \text{RMgX}$
 4) $\text{NaR} > \text{LiR} > \text{ZnR}_2 > \text{RMgX}$

THE OPEN UNIVERSITY OF SRI LANKA
B.Sc. DEGREE PROGRAMME 2009/2010
CHU3127/CHE5127 – ORGANOMETALLIC CHEMISTRY – LEVEL 5
ASSIGNMENT TEST II - MCQ TEST

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

Name:-

Reg. No.

	Marks
Part A	
Part B	
Total %	

FOR EXAMINER'S USE		Marks
Unanswered		
Correct Answers		
Wrong Answers		
Total		

- | | | | | | | | | | | | | | | |
|--|---|---|---|---|--|---|---|---|---|--|---|---|---|---|
| 1. <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"><tr><td>1</td><td>2</td><td>3</td><td>4</td></tr></table> | 1 | 2 | 3 | 4 | 2. <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"><tr><td>1</td><td>2</td><td>3</td><td>4</td></tr></table> | 1 | 2 | 3 | 4 | 3. <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"><tr><td>1</td><td>2</td><td>3</td><td>4</td></tr></table> | 1 | 2 | 3 | 4 |
| 1 | 2 | 3 | 4 | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | | | | | | | | | | | |
| 4. <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"><tr><td>1</td><td>2</td><td>3</td><td>4</td></tr></table> | 1 | 2 | 3 | 4 | 5. <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"><tr><td>1</td><td>2</td><td>3</td><td>4</td></tr></table> | 1 | 2 | 3 | 4 | 6. <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"><tr><td>1</td><td>2</td><td>3</td><td>4</td></tr></table> | 1 | 2 | 3 | 4 |
| 1 | 2 | 3 | 4 | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | | | | | | | | | | | |
| 7. <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"><tr><td>1</td><td>2</td><td>3</td><td>4</td></tr></table> | 1 | 2 | 3 | 4 | 8. <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"><tr><td>1</td><td>2</td><td>3</td><td>4</td></tr></table> | 1 | 2 | 3 | 4 | 9. <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"><tr><td>1</td><td>2</td><td>3</td><td>4</td></tr></table> | 1 | 2 | 3 | 4 |
| 1 | 2 | 3 | 4 | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | | | | | | | | | | | |
| 10. <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"><tr><td>1</td><td>2</td><td>3</td><td>4</td></tr></table> | 1 | 2 | 3 | 4 | 11. <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"><tr><td>1</td><td>2</td><td>3</td><td>4</td></tr></table> | 1 | 2 | 3 | 4 | 12. <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"><tr><td>1</td><td>2</td><td>3</td><td>4</td></tr></table> | 1 | 2 | 3 | 4 |
| 1 | 2 | 3 | 4 | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | | | | | | | | | | | |
| 13. <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"><tr><td>1</td><td>2</td><td>3</td><td>4</td></tr></table> | 1 | 2 | 3 | 4 | 14. <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"><tr><td>1</td><td>2</td><td>3</td><td>4</td></tr></table> | 1 | 2 | 3 | 4 | 15. <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"><tr><td>1</td><td>2</td><td>3</td><td>4</td></tr></table> | 1 | 2 | 3 | 4 |
| 1 | 2 | 3 | 4 | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | | | | | | | | | | | |
| 16. <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"><tr><td>1</td><td>2</td><td>3</td><td>4</td></tr></table> | 1 | 2 | 3 | 4 | 17. <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"><tr><td>1</td><td>2</td><td>3</td><td>4</td></tr></table> | 1 | 2 | 3 | 4 | 18. <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"><tr><td>1</td><td>2</td><td>3</td><td>4</td></tr></table> | 1 | 2 | 3 | 4 |
| 1 | 2 | 3 | 4 | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | | | | | | | | | | | |
| 19. <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"><tr><td>1</td><td>2</td><td>3</td><td>4</td></tr></table> | 1 | 2 | 3 | 4 | 20. <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"><tr><td>1</td><td>2</td><td>3</td><td>4</td></tr></table> | 1 | 2 | 3 | 4 | | | | | |
| 1 | 2 | 3 | 4 | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | | | | | | | | | | | |

Part B (40 marks)

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

1. (a) $[\text{PdR}_2(\text{dppe})]$ ($\text{dppe} = \text{PPh}_2\text{CH}_2\text{CH}_2\text{PPh}_2$) undergoes oxidative addition with RI to give the octahedral complex (**X**).

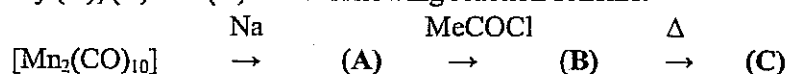
(i) Write the **molecular formula** of (**X**)

(ii) Draw and identify **two** structures of (**X**).

(b) H_2 oxidatively adds to $[\text{Os}(\text{CO})_5]$ to give *cis*- $[\text{OsH}_2(\text{CO})_4]$.

Write the mechanism of the above reaction. (Hint: $[\text{Os}(\text{CO})_5]$ is a 18e complex).

(c) Identify (**A**), (**B**) and (**C**) of the following reaction scheme.



(A) (B).....

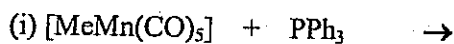
(C)

(d) How would you account for the variation in $\nu(\text{CO})$ of the following compounds?

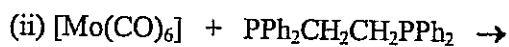
Compound	$\nu(\text{CO})$ in cm^{-1}
free CO	2143
<i>fac</i> - $[\text{Mo}(\text{CO})_3(\text{PCl}_3)_3]$	2040, 1991
<i>fac</i> - $[\text{Mo}(\text{CO})_3(\text{PEt}_3)_3]$	1937, 1841

(e) Name **three** coordination modes of the hydride ligand. Give an example each.

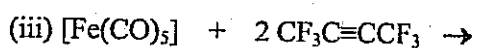
2. (a) Predict the product(s) of the following reactions using the hint given in the brackets.



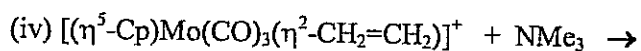
(migratory insertion)



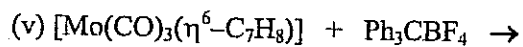
(substitution)



(oxidative coupling)

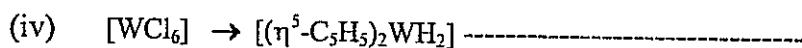
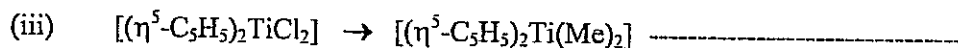
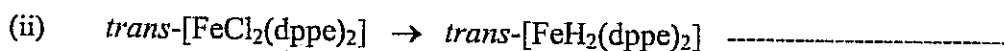
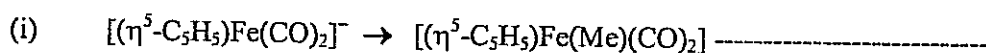


(nucleophilic attack on a coordinated ligand)



(deprotonation)

(b) Write on the dotted line the reagent(s) which can be used to carry out the following conversions.



THE OPEN UNIVERSITY OF SRILANKA
 B.Sc. DEGREE PROGRAMME 2009/2010
 CHU3127/CHE5127-ORGANOMETALLIC CHEMISTRY-LEVEL 5
 ASSIGNMENT TEST-I
 ANSWER GUIDE

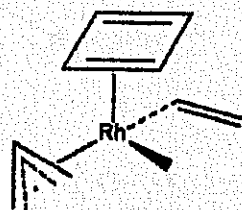
Part A - MCQ ANSWER GUIDE

- | | | | | |
|---------|---------|---------|---------|---------|
| 1. (4) | 2. (3) | 3. (2) | 4. (2) | 5. (1) |
| 6. (2) | 7. (4) | 8. (1) | 9. (3) | 10. (3) |
| 11. (3) | 12. (1) | 13. (4) | 14. (2) | 15. (4) |
| 16. (1) | 17. (2) | 18. (4) | 19. (2) | 20. (3) |

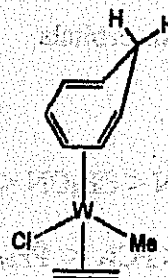
Part B

1. (a) i. Carbonylchloro(η^5 -cyclopentadienyl)(η^2 -ethene)ruthenium
 ii. (η^3 -allyl)(η^2 -cyclobutadiene)fluoro(vinyl)rhodium

(b)(i).



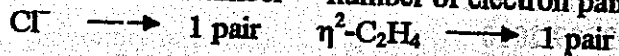
(ii)



(c) (i).	Rh^{3+}	= 6e	(ii)	Ru^0	= 8e
	F^-	= 2e		Cl^-	= 1e
	$(\eta^3-C_3H_5)^-$	= 4e		$(\eta^2-C_2H_4)$	= 2e
	$(\eta^1-CH=CH_2)^-$	= 2e		$(\eta^3-C_3H_5)$	= 5e
	$(\eta^2-C_4H_4)$	= 2e		CO	= 2e
	VEC	= 16e		VEC	= 18e

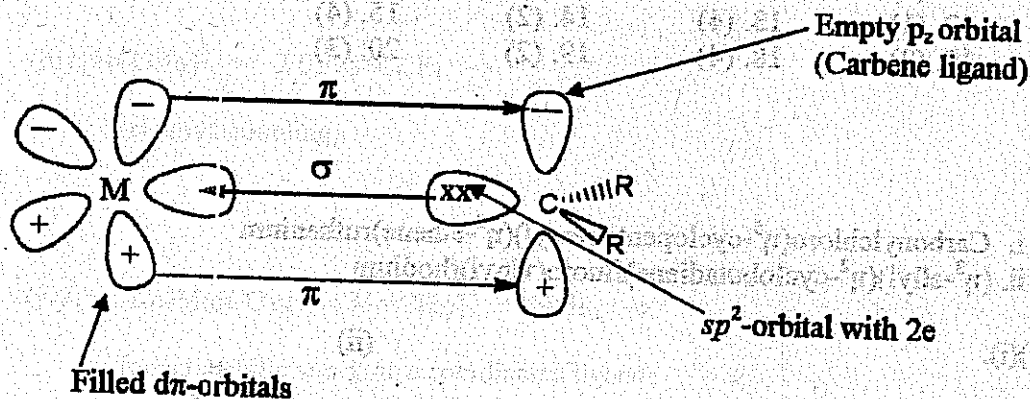
- (d) The 18e-rule says that a metal center would form a stable compound if the valence electron count of the metal is 18.

2. (a) Coordination Number = number of electron pairs donated by the ligands.



Total number of electron pairs = 6 = Coordinator Number

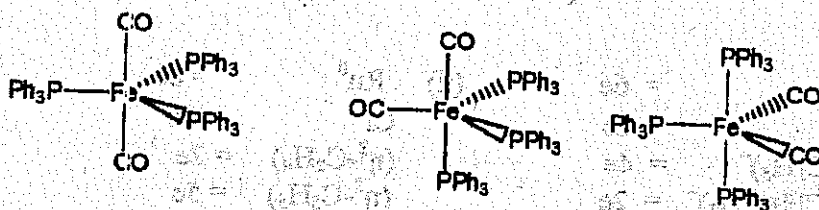
(b)



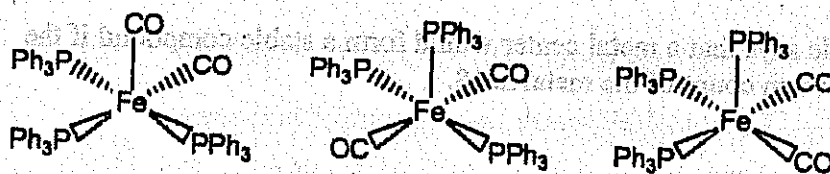
(c) (i) $\text{MeCN} < \text{CF}_3\text{CN} < \text{CO} < \text{CS}$

(ii) $\text{PF}_3 < \text{PCl}_3 < \text{PH}_3 < \text{PMe}_3$

(d)(i)



(ii)



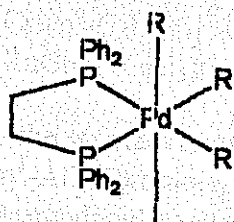
THE OPEN UNIVERSITY OF SRILANKA
 B.Sc. DEGREE PROGRAMME 2009/2010
 CHU3127/CHE5127-ORGANOMETALLIC CHEMISTRY-LEVEL 5
 ASSIGNMENT TEST II
 ANSWER GUIDE

Part A - MCQ ANSWER GUIDE

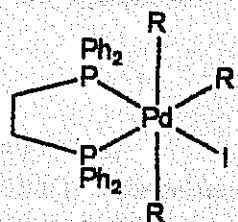
- | | | | | |
|---------|---------|---------|---------|---------|
| 1. (4) | 2. (4) | 3. (3) | 4. (4) | 5. (2) |
| 6. (1) | 7. (1) | 8. (3) | 9. (2) | 10. (3) |
| 11. (2) | 12. (1) | 13. (4) | 14. (2) | 15. (1) |
| 16. (1) | 17. (3) | 18. (4) | 19. (2) | 20. (2) |

Part B

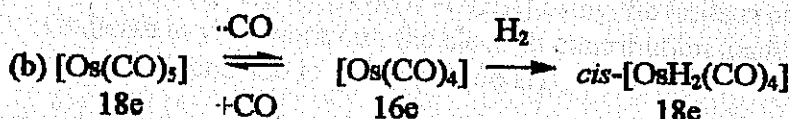
1. (a) i. $[\text{Pd}(\text{R})_3(\text{dppe})]$
 ii.



fac



mer

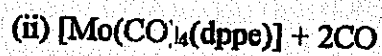


- (c) (A) $\text{Na}[\text{Mn}(\text{CO})_5]$ (B) $[(\text{MeCO})\text{Mn}(\text{CO})_5]$ (C) $[\text{MeMn}(\text{CO})_5] + \text{CO}$

- (d) $\nu(\text{CO}) \propto$ strength of the $\text{C}=\text{O}$ bond.

The bond order of $\text{C}=\text{O}$ is 3 and it has a higher frequency than of the metal complexes. Each donation weakens the $\text{C}=\text{O}$ bond order than electron donor ability of $\text{PEt}_3 > \text{PCl}_3$. Thus $\nu(\text{C}=\text{O})$ of *fac*- $[\text{Mo}(\text{CO})_3(\text{PEt}_3)_3] <$ *fac*- $[\text{Mo}(\text{CO})_3(\text{PCl}_3)_3]$. *fac*-complexes show two IR bands.

- (e) (i) Terminal hydride $[\text{CoH}(\text{CO})_4]$, $[\text{ReH}_9]^{2-}$
 (ii) Doubly bridging hydride $[\mu_2\text{-H}]$, $[(\text{OC})_5\text{W}(\mu_2\text{-H})\text{W}(\text{CO})_5]$
 (iii) Triply bridging hydride $[\mu_3\text{-H}]$, $[\text{Re}(\text{CO})_3(\mu_3\text{-H})_4]$
 (iv) Encapsulated hydride $[\text{HCo}_6(\text{CO})_{15}]$



(iii)

