



THE OPEN UNIVERSITY OF SRI LANKA

B.Sc & B.Ed DEGREE/ STAND ALONG COURSES IN SCIENCE

LEVEL 5 – ASSESMENT TEST II (NBT) 2006/2007

CHU3127/CHE 5127 ORGANOMETALLIC CHEMISTRY

TIME 1 ½ HOURS

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Date 28<sup>th</sup> August 2006

Time: 3.30 – 5.00 pm

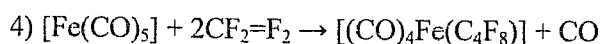
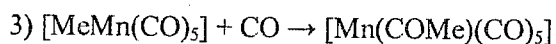
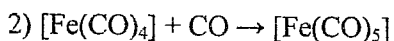
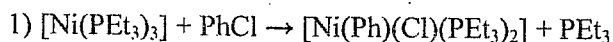
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**Answer All Questions**

Choose 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 countered and 1/5<sup>th</sup> of the mark will be deducted for each incorrect answer.

**Part A (60 marks)**

(1.) Which one is an example for oxidative-addition reaction?



2. Consider following statement/s regarding reductive elimination reactions.

(a) The two groups (to be eliminated) must be in the *trans* position before elimination can occur.

(b) The two groups (to be eliminated) must be in the *cis* position before elimination can occur.

(c) It proceeds via 3-centre transition state.

The correct statement/s is/are

1) (a) only

2) (a) and (b) only

3) (b) and (c) only

4) (a) and (c) only

3. Consider the following statements regarding oxidative addition.

- (a) Coordinatively unsaturated compounds can undergo oxidative addition.
- (b) Oxidative-addition is facile if the metal center is  $\pi$ -basic.
- (c) Coordination number of the metal is reduced by two units during oxidative-addition.

The correct statement/s is/are

- 1) (a) only
- 2) (a) and (b) only
- 3) (b) and (c) only
- 4) (a) and (c) only

4. During reductive elimination, oxidation number is reduced by

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

5.  $\beta$ -hydride abstraction occurs in

- 1) compounds where the metal is coordinatively unsaturated
- 2) compounds where the metal is coordinatively saturated
- 3) compounds having  $\alpha$ -hydrogens
- 4) compounds having  $\gamma$ -hydrogens

6. Which one is an example for one-electron oxidative-addition reactions?

- 1)  $[\text{Os}(\text{CO})_5] + \text{I}_2 \rightarrow [\text{OsI}_2(\text{CO})_4] + \text{CO}$
- 2)  $2[\text{Co}(\text{CN})_5]^{3-} + \text{H}_2 \rightarrow 2[\text{HCo}(\text{CN})_5]^{3-}$
- 3)  $[(\eta^5\text{-C}_5\text{H}_5)\text{Rh}(\text{PPh}_3)(\text{CO})] + \text{MeI} \rightarrow [(\eta^5\text{-C}_5\text{H}_5)\text{Rh}(\text{Me})(\text{PPh}_3)(\text{CO})]\text{I}$
- 4)  $[\text{MeMn}(\text{CO})_5] + \text{CO} \rightarrow [\text{Mn}(\text{COMe})(\text{CO})_5]$

7. Consider following statement/s regarding the oxidation state of metal in a complex in migratory insertion reactions.

- (a) There is no overall change in the oxidation number.
- (b) The oxidation number increases by two.
- (c) The oxidation number decreases by two.

The correct statement/s is/are

- 1) (a) only                      2) (b) only  
3) (b) and (c) only            4) (a) and (c) only

8. The CO stretching frequency generally follows the following order,

- 1)  $M_3((\mu_3\text{-CO}) > M_2(\mu_2\text{-CO}) > M\text{-CO}$   
2)  $M_2((\mu_2\text{-CO}) > M_3(\mu_3\text{-CO}) > M\text{-CO}$   
3)  $M\text{-CO} > M_2(\mu_2\text{-CO}) > M_3((\mu_3\text{-CO})$   
4)  $M_3(\mu_3\text{-CO}) > M\text{-CO} > M_2((\mu_2\text{-CO})$

9. Which statement is true about IR stretching frequencies of *fac*-[Mo(CO)<sub>3</sub>(PCl<sub>3</sub>)<sub>3</sub>] and *fac*-[Mo(CO)<sub>3</sub>(PEt<sub>3</sub>)<sub>3</sub>].

- 1) *fac*-[Mo(CO)<sub>3</sub>(PEt<sub>3</sub>)<sub>3</sub>] has higher  $\nu_{\text{CO}}$  than *fac*-[Mo(CO)<sub>3</sub>(PCl<sub>3</sub>)<sub>3</sub>]  
2) *fac*-[Mo(CO)<sub>3</sub>(PEt<sub>3</sub>)<sub>3</sub>] has lower  $\nu_{\text{CO}}$  than *fac*-[Mo(CO)<sub>3</sub>(PCl<sub>3</sub>)<sub>3</sub>]  
3) Both frequencies are same.  
4) Cannot compare.

10. How many IR bands does *fac*-[M(CO)<sub>3</sub>L<sub>3</sub>] show?

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

11. Some metals react directly with alkyl halides to form M-C  $\sigma$ - bonds. The order of reactivity of organic halide is

- 1) RCl > RBr > RI  
2) RI > RBr > RCl  
3) RBr > RCl > RI  
4) RBr > RI > RCl

12. Consider following statement/s regarding metal hydrides.

- (a) They can act as  $H^+$  donors.
- (b) They can act as  $H^-$  donors.
- (c) They can act as  $H$  donors.

The correct statement/s is/are

- 1) (a) and (b) only
- 2) (b) only
- 3) (b) and (c) only
- 4) All of above

13. Consider the following statement/s regarding dihydrogen.

- (a) Oxidative addition of  $H_2$  to  $[IrCl(CO)(PPh_3)_2]$  gives cis-dihydrides.
- (b) It can act as a good  $\sigma$ - donor.
- (c) The oxidative addition of coordinated  $H_2$  depends on the strength of back donation.

The correct statement/s is/are

- 1) (a) and (b) only
- 2) (a) and (c) only
- 3) (b) and (c) only
- 4) All of above

14. What would be the probable IR stretching frequency of terminal carbonyl ligand in a neutral metal carbonyl compound? (IR stretching frequency of free CO is  $2143\text{ cm}^{-1}$ )

- 1)  $2050\text{ cm}^{-1}$
- 2)  $1650\text{ cm}^{-1}$
- 3)  $1750\text{ cm}^{-1}$
- 4)  $1800\text{ cm}^{-1}$

15. Electrophilic attack on a coordinated ligand is facilitated if

- 1) the metal is coordinatively unsaturated.
- 2) the metal is in high oxidation state.
- 3) the metal coordinated to good  $\sigma$  - donor ligands.
- 4) electron withdrawing groups are on coordinated ligands.

16. Which one of the following metal carbonyl complex does not have a bridging carbonyl ligand?

- 1)  $[Co_2(CO)_8]$
- 2)  $[Rh_4(CO)_{12}]$
- 3)  $[Fe_3(CO)_{12}]$
- 4)  $[Mn_2(CO)_{10}]$

17. Which statement is true about  $[\text{Co}_2(\text{CO})_8]$ ?

- 1) There is no bridging carbonyl ligand in solution.
- 2) Co is a Group 8 metal.
- 3) There is no Co-Co bond in the complex.
- 4) Each Co-centre does not obey 18e rule.

18. The variation of the nucleophilicity of the R- group is

- 1)  $\text{NaR} > \text{LiR} > \text{ZnR}_2 > \text{RMgX}$
- 2)  $\text{NaR} > \text{LiR} > \text{RMgX} > \text{ZnR}_2$
- 3)  $\text{LiR} > \text{NaR} > \text{ZnR}_2 > \text{RMgX}$
- 4)  $\text{LiR} > \text{NaR} > \text{RMgX} > \text{ZnR}_2$

19. Consider following statement/s regarding dihydrogen complexes.

- a) Dihydrogen cannot bind a metal in the  $\eta^2$  - fashion.
- b) The oxidative addition of coordinated  $\text{H}_2$  depends on the strength of the back donation.
- c)  $\text{CH}_5^+$  can be considered as the dihydrogen complex of  $\text{CH}_3^+$ .

The correct statement/s is/are

- |                     |                     |
|---------------------|---------------------|
| 1) (a) and (b) only | 2) (a) and (c) only |
| 3) (b) and (c) only | 4) All of above     |

20. What is the product of the reaction?  $[\text{Mn}_2(\text{CO})_{10}] + \text{Na} \rightarrow ?$

- 1)  $\text{Na}[\text{Mn}(\text{CO})_5]$
- 2)  $\text{Mn}_2[\text{Na}(\text{CO})_5]$
- 3)  $\text{Na}[\text{Mn}_2(\text{CO})_{10}]$
- 4) No reaction occurs