

CH4101

End Semester Examination

End Sem Test: Date: 26.11.18, Time 3h

Total Marks: 50

NAME:

ROLL NO:

GROUP A (15 Points)

1.  $(\text{CO})_5\text{Cr}=\text{C}(\text{OMe})\text{Ph}$  and  $\text{Np}_3\text{Ta}=\text{CH}-\text{C}(\text{Me})_3$  (1 point)

- A. Both are Fischer carbene complex
- B. Both are Schrock carbene type
- C. Fischer and Schrock type, respectively
- D. Schrock and Fischer type, respectively

2. When butadiene binds with metal (1 point)

- A. C1-C2 distance shortens and C2-C3 distance increases
- B. C1-C2 distance increases and C2-C3 distance shortens
- C. C1-C2 distance stays same and C2-C3 distance increases
- D. C1-C2 distance increases and C2-C3 distance stays same

3. The solid state structure of  $\text{LiCp}$  is (1 point)

- A. Monomeric
- B. Dimeric
- C. Tetrameric
- D. Polymeric

4. The SHOP process utilizes (1 point)

- A. Only oligomerization reaction
- B. Only olefin metathesis
- C. Only isomerization and olefin metathesis Oxidative addition and elimination
- D. Only oligomerization, olefin metathesis and isomerization steps

5. Which two ligand you would prefer if you are asked to replace CO from  $\text{Mo(CO)}_6$  among  $\text{NR}_3$ , OR,  $\text{CH}_2=\text{CH}_2$ ,  $\text{PR}_3$  (1 point)

- A.  $\text{NR}_3$  and OR
- B.  $\text{PR}_3$  and  $\text{CH}_2=\text{CH}_2$
- C. OR and  $\text{CH}_2=\text{CH}_2$
- D.  $\text{NR}_3$  and  $\text{PR}_3$

6. The nucleophilic attack on olefins under mild conditions: (1 point)

- A. Is always facile
- B. Is more facile than electrophilic attack on olefins
- C. Is facile for electron-rich olefins
- D. Requires activation by coordination to metal.

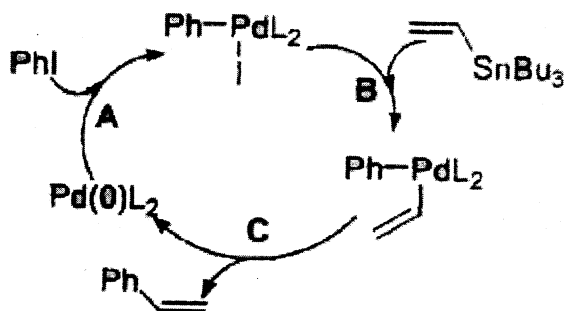
7. In the cluster  $[\text{Co}_3(\text{CH})(\text{CO})_9]$  obeying 18e rule, the number of metal-metal bonds and the bridging ligands respectively, are: (1 point)

- A. 3 and 1 CH
- B. 3 and 1 CO
- C. 3 and 3 CO
- D. 0 and 1 CH

8. In hydroformylation reaction using  $[\text{Rh}(\text{PPh}_3)_3(\text{CO})(\text{H})]$  as the catalyst, addition of excess  $\text{PPh}_3$  would (1 point)

- A. increase the rate of reaction
- B. decrease the rate of reaction.
- C. not influence of the rate of reaction
- D. stop the reaction

9. Consider the following reaction mechanism. The steps A, B and C, respectively, are (1 point)



- A. Oxidative addition; transmetalation; reductive elimination.
- B. Oxidative addition; carbopalladation;  $\beta$ -hydride elimination.
- C. Carbopalladation; transmetalation; reductive elimination.
- D. Metal halogen exchange; transmetalation; metal extrusion

10. Grubbs and Schrock's olefin metathesis catalysts are based on (1 point)
- A. Ru and Mo, respectively
  - B. Mo and Fe, respectively
  - C. Mo and Ru, respectively
  - D. W and Ru, respectively
11. The product of the reaction between propene, CO and H<sub>2</sub> in the presence of CO<sub>2</sub>(CO)<sub>8</sub> as a catalyst is (1 point)
- A. Butanoic acid
  - B. Butanal
  - C. 2-butanone
  - D. Methylpropanoate
12. In Ziegler-Natta catalysis the commonly used catalyst system is: (1 point)
- A. TiCl<sub>4</sub>, Al (C<sub>2</sub>H<sub>5</sub>)<sub>3</sub>
  - B.  $\eta^5$ -Cp<sub>2</sub>TiCl<sub>2</sub>, Al(OEt)<sub>3</sub>
  - C. VO(acac)<sub>2</sub>, Al<sub>2</sub>(CH<sub>3</sub>)<sub>6</sub>
  - D. TiCl<sub>4</sub>, BF<sub>3</sub>
13. Compound which obeys 18-electron rule is (1 point)
- A. Ni(CO)<sub>3</sub>Ph<sub>3</sub> *dm*
  - B. Fe(CO)<sub>4</sub>
  - C. Cr(CO)<sub>5</sub>
  - D. Cr(C<sub>2</sub>H<sub>5</sub>)<sub>2</sub>
14. For metal olefin complexes (i) [PtCl<sub>3</sub>(C<sub>2</sub>F<sub>4</sub>)]<sup>-</sup> and (ii) [PtCl<sub>3</sub>(C<sub>2</sub>H<sub>4</sub>)]<sup>-</sup>, which of the following is the correct statement? (1 point)
- A. C-C bond length is same both in (i) and (ii)
  - B. C-C bond length in (i) is smaller
  - C. C-C bond length in (ii) is smaller
  - D. None of the above
15. Mn(CO)<sub>5</sub> is isolobal with which of the following? (1 point)
- A. CH<sub>4</sub>
  - B. CH<sub>3</sub>
  - C. CH<sub>2</sub>
  - D. CH

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GROUP B (35 points)

16. Out of carbinol and silanol which one do you prefer as a better  $H^+$  donor. Why? (2 points)

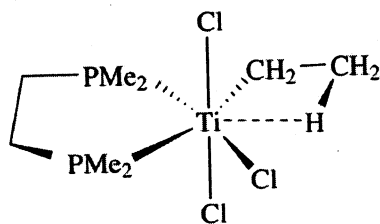
17. Hydrogenation reaction is carried out using Wilkinson catalyst where Rh metal is bound with  $PPh_3$  ligand. The use of heavier congener Ir instead of Rh makes the catalyst inactive. Also replacement of  $PPh_3$  ligand by  $PEt_3$  ligand makes the Wilkinson catalyst inactive for hydrogenation reaction. Explain this observation. (2 points)

18.  $Mn(CO)_5$  and  $V(CO)_6$  are examples of  $17e^-$  complexes.  $Mn(CO)_5$  can exist as dimer; but  $V(CO)_6$  cannot. Why? (2 points)

19. Identify the given statements as True or False. Justify your answer. (4 points)

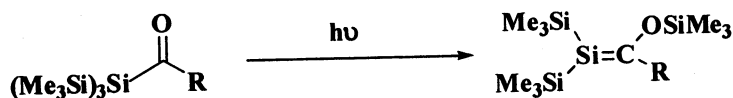
- Square planar complexes obey  $18e^-$  rule.
- For a M-dihydrogen complex ligand should be electron withdrawing.
- $MeLi$  is soluble in hydrocarbon solvents.
- $(tBu)_2Be$  exist in polymeric form.

20. How can you prove *agostic interaction* for the given complex experimentally using NMR spectroscopy? (2 points)

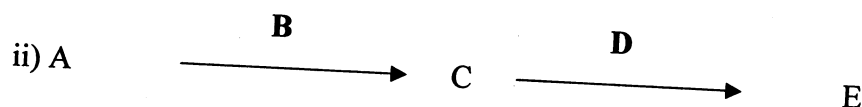
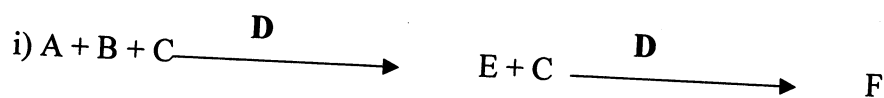


21.  $:CH_2$  is EPR active whereas  $:SiH_2$  is EPR inactive. Why they are so? (2 points)

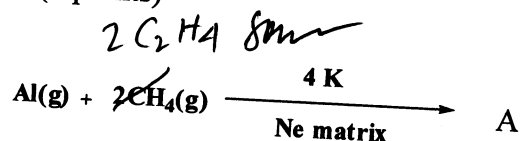
22. In order to isolate  $Si=C$  compound which R group you would prefer. Why? (1 point)



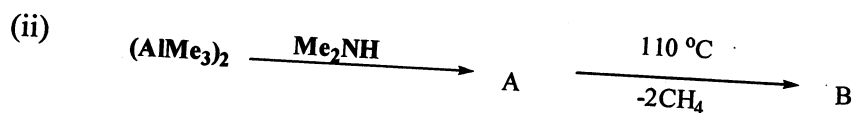
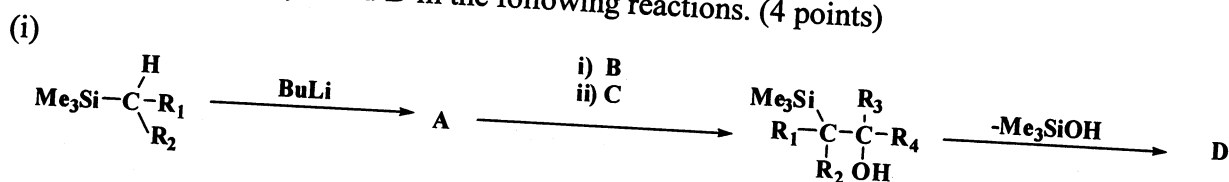
23. Identify the type of catalysis involved in the following reactions. (1 point)



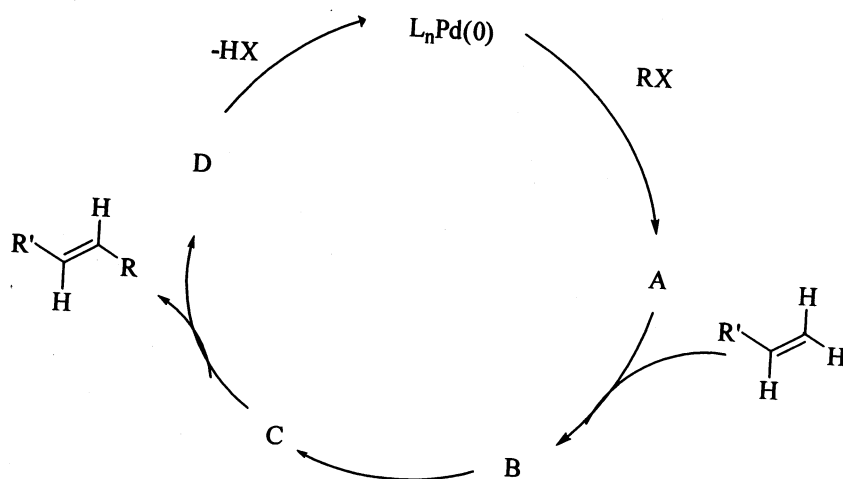
24. Identify A. Comment on the oxidation state of aluminum in A and magnetic property of A? (2 points)



25. Identify A, B, C and D in the following reactions. (4 points)



26. Identify A, B, C and D in the following catalytic cycle. (2 points)



27. M-H bonding exist in two ways, classical and non-classical. How you can distinguish both experimentally by using NMR spectroscopy? (2 points)

28. Match the following (2 points)

SHOP

Hydroformylation reaction

Fischer Carbene

Monsanto Process

$\text{Co}_2(\text{CO})_8$

Nucleophilic

Electrophilic

Olefin Metathesis

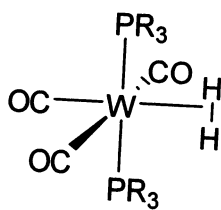
Acetic acid

Hydrosilylation

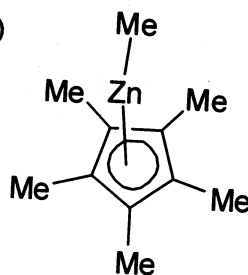
29.  $\text{L}_2\text{Pt}(\text{CH}_3)_2$  is a stable organometallic compound. Explain. (1 point)

30. Comment if the following complexes follow the 18 e rules. (2 points)

i)



ii)



31.  $2\text{RMgX} \rightleftharpoons \text{A} + \text{B}$

Identify A and B. What change you can observe when 1, 4-dioxane is added to this equilibrium? (2 points)

32. If you want to perform a decarbonylation reaction of say  $\text{Fe}_2(\text{CO})_9$ , which condition you prefer reducing environment or oxidizing? Explain why. (2 points)