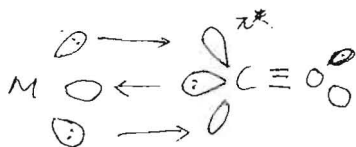
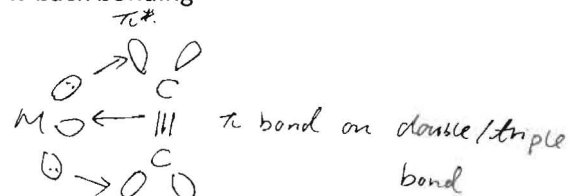


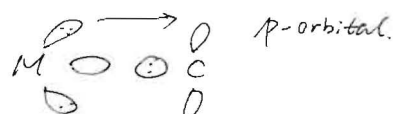
Q1:

a) Filled d-orbital and empty π^* orbital

Schrock

 π back bonding

Fisher

b) The main process is β -elimination, as shown below

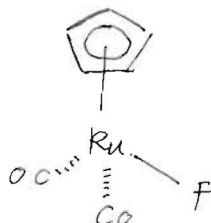
Main requirement:

- 1) Vacant site
- 2) Available e^- on molecule
- 3) Metal has less than 18 e^-
- 4) Co-planar structure
- 5) β -H on the active site

c) Because Pb is main group element, so its d-orbital is not available

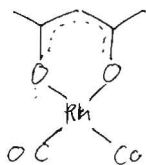
d) i) symmetric property + shape of frontier orbital + electric occupation of them are all same

ii) 2 electrons, as BF's electro-config is like

iii) as $n(\text{metal}) = 8$, $n(\text{ring}) = 5$, $n(\text{CO}) = 2$, so $n(\text{c}) = (18 - 5 - 8 - 2 \times 2) \times 2 = -2$ iv) the reaction to form complex A will generate F_2 , which can react with complex A to form complex B. the structure is:

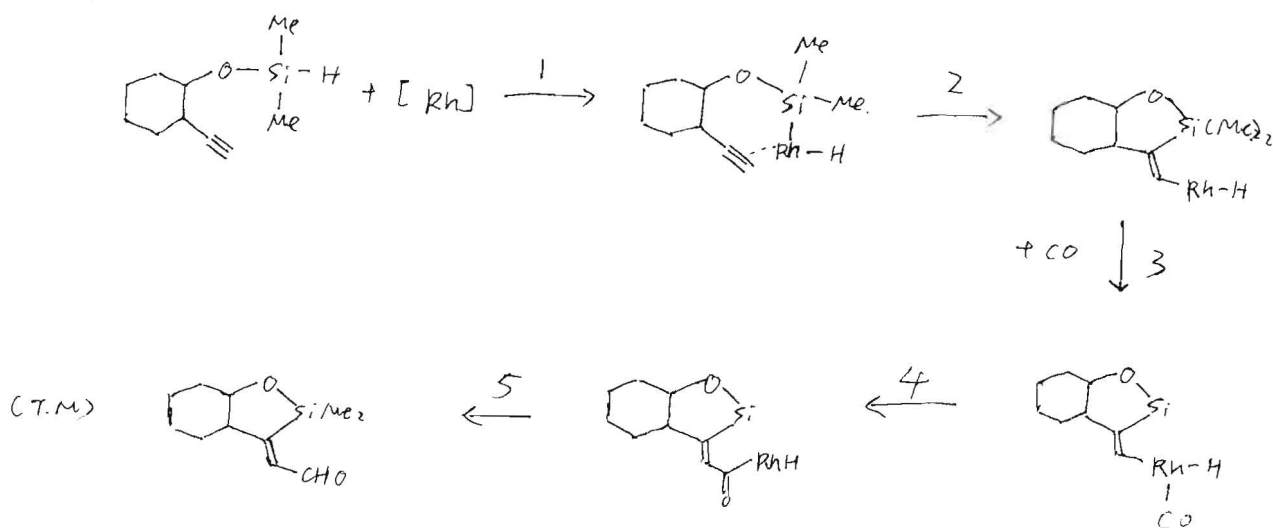
Q2:

a) this is a square-planar structure:



b) $Os = +1$ $N(e) = 8 + 2 + 2 + 2 + 2 = 16 e$

c) Mechanism:



step 1: oxidative addition

step 2 : alkyne insertion

step 3: ligand association

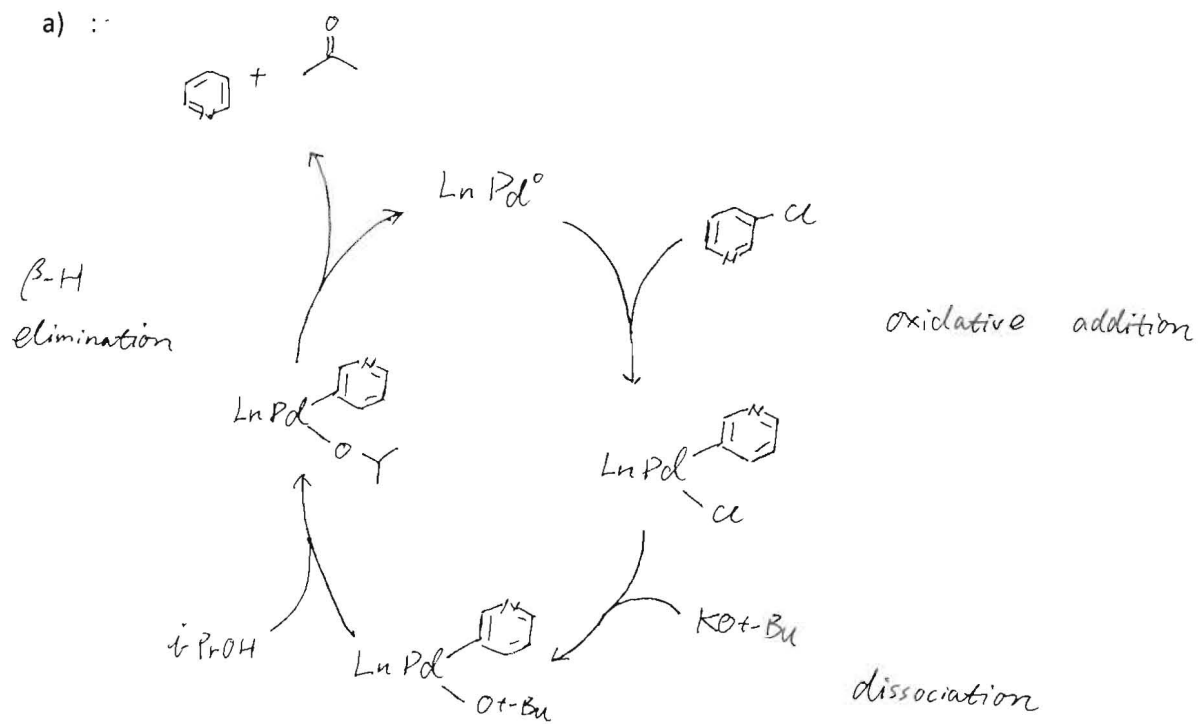
step 4: migratory insertion

step 5: reductive elimination

d) The cis-configuration is due to the syn-insertion in the step 4, as the Rh position is fix outward during the ring closing (step 2), the -CHO is also outward to form cis-olefine

Q3: ALL catalysis cycles are shown below:

a) :



b) :

