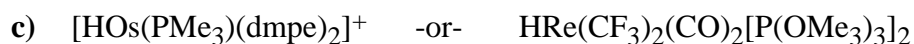
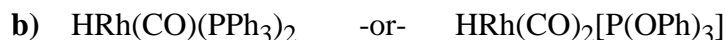
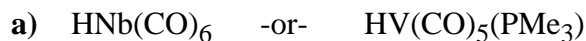


Please answer all questions!

Check this box if you want your graded test put out
in the public boxes outside Prof. Stanley's office:

☐

1. (20 pts) Which of the following metal hydrides should be the most acidic? Clearly explain your reasoning.

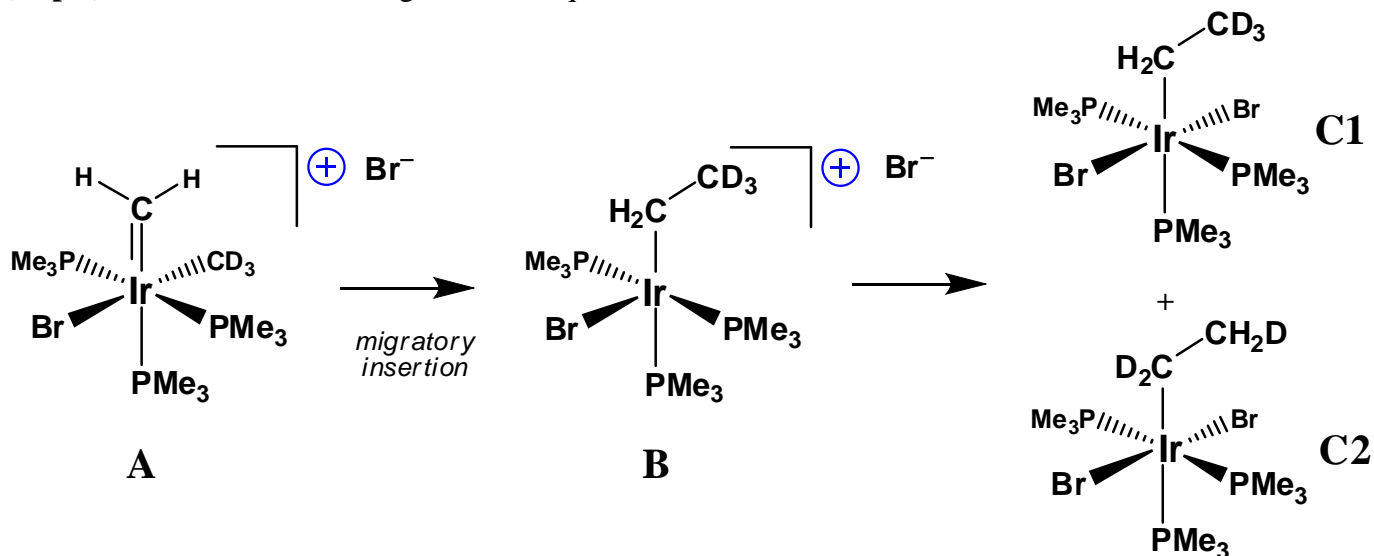


2. (10 pts) a) (5 pts) Electron-count $\text{W(NMe}_2)_6$ clearly showing the W oxidation state, ligand charges, and # of electrons donated from the ligands to the metal center.

b) (5 pts) Based on your electron-counting, what feature(s) about the W-NMe₂ bonding/geometry might you expect to show up in an X-Ray structure of this complex?

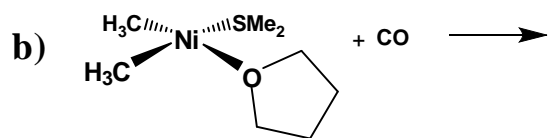
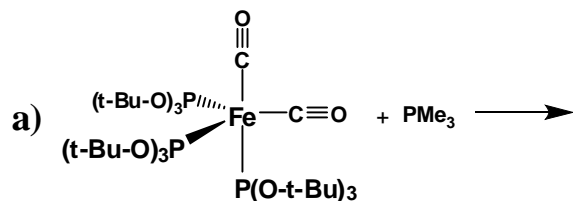
- c) (5 pts BONUS) How would you explain the structure of $W(NMe_2)_6$ if it showed all approximately planar W-NMe₂ ligands (trigonal planar geometry about the nitrogen center)?

3. (15 pts) Consider the following reaction sequence:



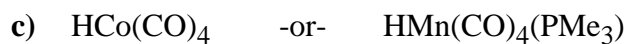
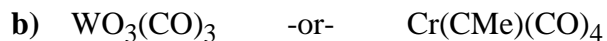
The deuterated methyl group in the complex **A** does a migratory insertion with the carbene ligand to form the ethyl group in **B**. Migratory insertion is the reaction of an anionic ligand with a neutral ligand to produce a new anionic ligand (examples: $M\text{-carbene} + M\text{-}CD_3 \longrightarrow M\text{-}CH_2CD_3$; $M\text{-ethylene} + M\text{-}H \longrightarrow M\text{-Et}$). The product **C2**, however, shows that one can get some scrambling of the deuterium labels from the original CD_3 methyl group. Clearly explain and show the properly labeled reaction steps that convert **B** to **C2**. Don't worry about bromide coordination till the last step. [Hint: an ethylene ligand can freely rotate about the metal-ethylene bond]

4. (20 pts) Consider the following two substitution reactions. Sketch out the most likely reaction steps to produce the most stable product (substitute only one ligand with that shown). Briefly & clearly state your reasoning/explanation for each reaction and the final product shown.



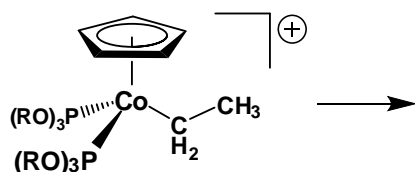
5. (10 pts) Explain why square-planar d^8 complexes of $\text{Rh}(+1)$, $\text{Ir}(+1)$, $\text{Ni}(+2)$, $\text{Pd}(+2)$, $\text{Pt}(+2)$, and $\text{Au}(+3)$ are stable with $16e^-$ configurations and why they only bind a fifth ligand weakly (to moderately).

6. (15 pts) Circle the complex that should have the weakest M-CO bonding. Clearly explain your answer.



7. (10 pts) $[\text{CpIr}(\text{dmpe})(\text{Et})]^+$ is quite stable while $[\text{CpCo}[\text{P}(\text{OMe})_3]_2(\text{Et})]^+$ readily reacts with one equivalent of PMe_3 to produce $\{\text{CpCo}(\text{H})(\text{PMe}_3)[\text{P}(\text{OMe})_3]\}^+$ plus a gas that bubbles off the solution.

a) (5 pts) Write out a mechanism for the reaction of $[\text{CpCo}[\text{P}(\text{OMe})_3]_2(\text{Et})]^+$ to form $\{\text{CpCo}(\text{H})(\text{PMe}_3)[\text{P}(\text{OMe})_3]\}^+$.



b) (5 pts) Why is $[\text{CpIr}(\text{dmpe})(\text{Et})]^+$ considerably more stable?