Organometallic Chemistry - 4571 **Name:** _____

Homework # 3 **(Due: Nov 11, 2008)** **Group:** _____

Check the box to the right if you want your graded homework to be placed out in the public rack outside Prof. Stanley's office. Otherwise you will have to pick up your homework from Prof. Stanley in person: ☐

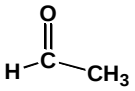
1. (40 pts) Identify the following reactions by their type (migratory insertion, elimination, oxidative addition, reductive elimination, substitution, ligand addition, ligand dissociation, β-hydride elimination, ligand coordination change, etc.). Note that one may have to use more than one description for a reaction that may have several steps. For reactions with several steps, if the order is important you must list the steps in the correct order.

a) $Cp^*Ir(CO)_2 + CH_4 \xrightarrow{h\nu} Cp^*Ir(CO)(H)(CH_3) + CO$

b) $RhCl(PPh_3)_3 + dppe + CO \longrightarrow RhCl(CO)(dppe) + 3PPh_3$

c) $H_2RhCl(PPh_3)_2(CH_2CH_3) \longrightarrow HRhCl(PPh_3)_2 + CH_3CH_3$

d) $[Co(CO)_4]^- + CH_3Br \quad Co(CO)_4(CH_3) + Br^-$

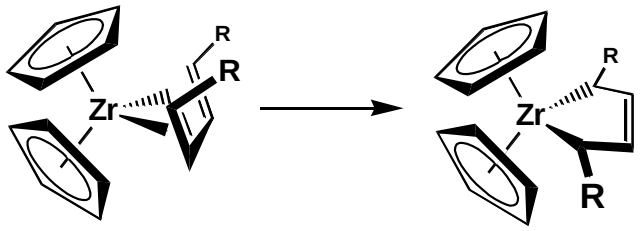
e) $Mn(acyl)(CO)_5 + H_2 \longrightarrow HMn(CO)_5 +$ 

f) $(\eta^5\text{-indenyl})Re(PMe_3)_3 + CO \longrightarrow (\eta^5\text{-indenyl})Re(CO)(PMe_3)_2 + PMe_3$

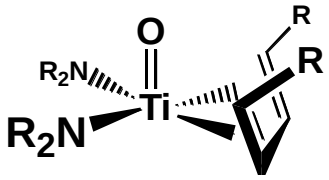
g) $Cp_2Hf(CH_3)_2 + H_2 \longrightarrow Cp_2Hf(H)(CH_3) + CH_4$

h) $H_2Ru(CO)_4 + CH_2{=}CH_2 \longrightarrow HRu(CH_2CH_3)(CO)_3 + CO$

2. (20 pts) Consider the reaction shown below. Clearly describe what is happening from a reaction viewpoint. What kind of electronic effect R groups (electron-withdrawing or electron-donating) on the diene ligand will favor formation of the product? Why?



b) Why won't the following complex undergo the same transformation?

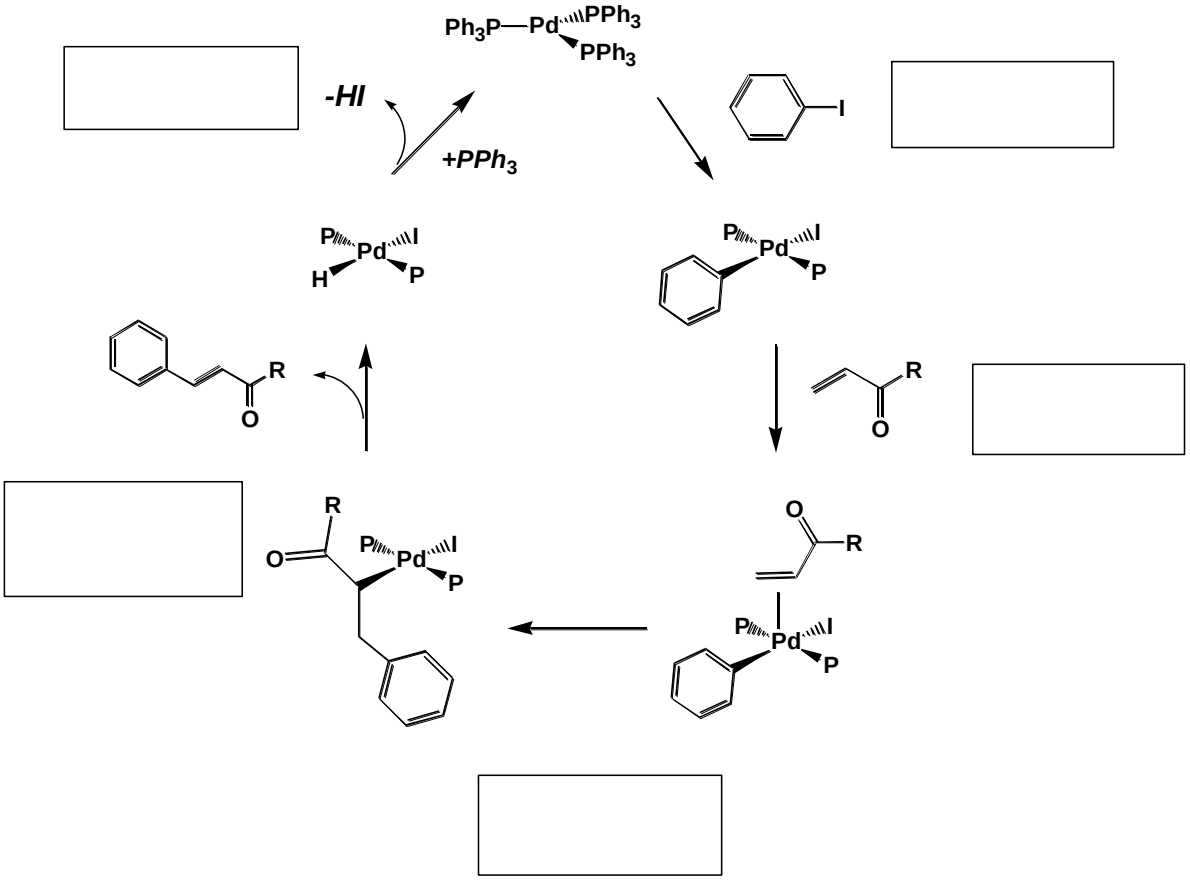


3. (20 pts) Consider the following reaction:

$$PtCl_2(CH_2CH_3)_2(dmpe) \longrightarrow PtCl_2(dmpe) + CH_2{=}CH_2 + CH_3CH_3$$

Show in detail each mechanistic step in the conversion to the products shown. Label and clearly identify each step. The order of the steps may be important – if so list them in the correct order when necessary.

4. (10 pts) Label and clearly identify each step (i.e., migratory insertion, elimination, oxidative addition, reductive elimination, substitution, ligand addition, ligand dissociation, β-elimination, etc.) in the following catalytic reaction (called a Heck arene-alkene coupling reaction). Please write your answer(s) in the box next to the step. If there is more than one step occurring, please list them in the correct order if important. PPh_3 is abbreviated as P for most of the complexes in the diagram.



5. (10 pts) Which of the following products will be the most likely formed from the reaction shown. Circle the best choice and give a brief explanation/justification for your choice.

a) $OsO_2Me_4 + I_2 \longrightarrow OsO_2Me_4I_2$ -or- no reaction

b) $[Re(CO)_5]^- + CH_2{=}CHCH_2Br \longrightarrow [(\eta^2\text{-}CH_2{=}CHCH_2Br)Re(CO)_5]^-$ or $(\eta^3\text{-allyl})Re(CO)_4 + Br^-$