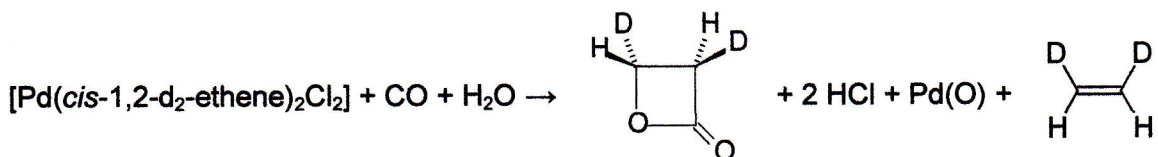
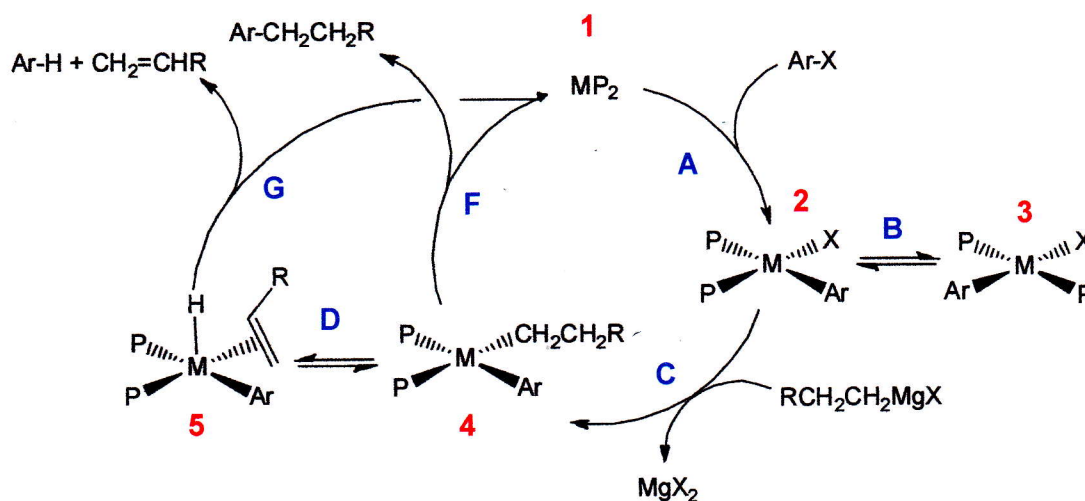


3. Dissolution of $[\text{Pd}(\text{cis-1,2-d}_2\text{-ethene})_2\text{Cl}_2]$ (stereochemistry at Pd is unknown) reacts with water and CO in acetonitrile according to the following stoichiometry



Suggest a mechanism for this reaction that accounts for the composition and stereochemistry of the lactone product.

4. Shown below is catalytic cycle for cross-coupling of a Grignard reagent with an aryl halide (Ar-X). Some catalysts are highly selective for the desired cross-coupling product while others may catalyze other undesirable reactions such as **G**.



a) What is the valence electron count for **5** when $\text{M} = \text{Ni}$?

b) When hydrogenolysis (reaction **G**) competes in such cross-coupling reactions loss of regioselectivity in the cross-coupling reaction is also generally observed, which would result in the formation of the secondary alkyl product $\text{Ar-CH}(\text{CH}_3)\text{R}$ in the current example. Show how the above catalytic cycle can be modified/expanded to account for the formation of this secondary alkyl product.

c) Choose from the list of organometallic reactions to the right to identify the following reactions

C

D ($4 \rightarrow 5$)

F

d) How might the participation of reaction **B** impact the overall catalytic process?

electrophilic attack at coordinated ligand
α -elimination
β -elimination
1,1-insertion (also known as alkyl migration and migratory insertion)
1,1-deinsertion (migratory deinsertion)
ligand addition
ligand dissociation
nucleophilic attack at coordinated ligand
olefin or alkyne insertion (1,2-insertion)
oxidative-addition
reductive-elimination