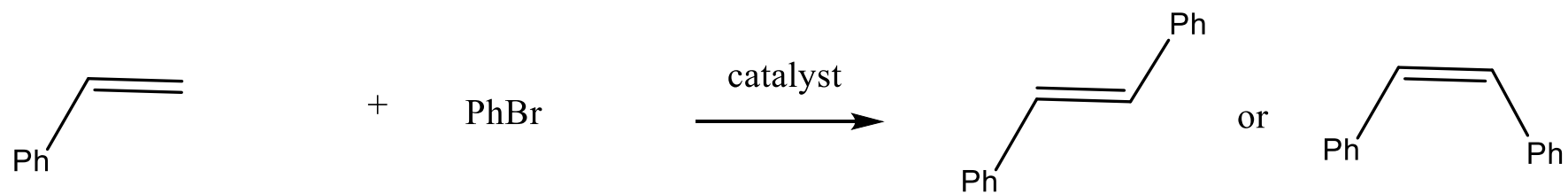
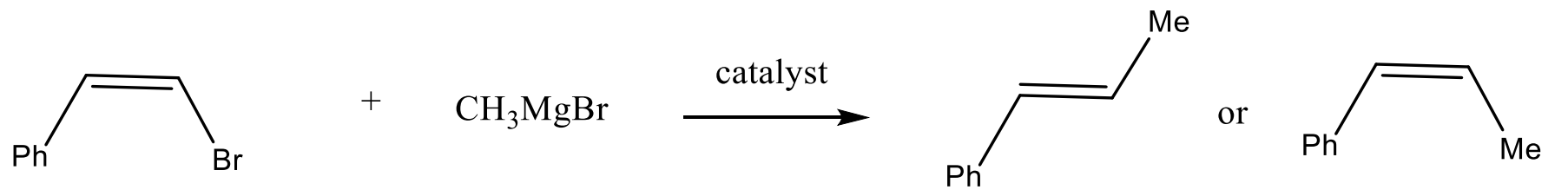
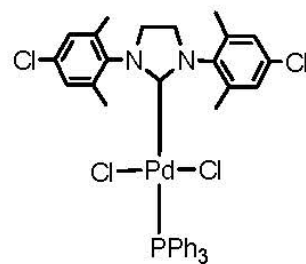
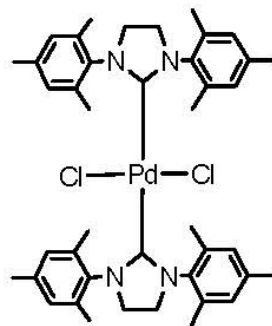
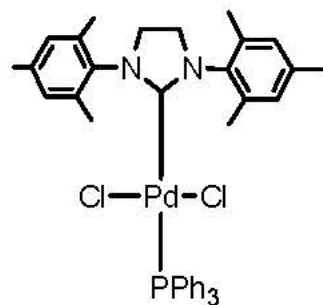




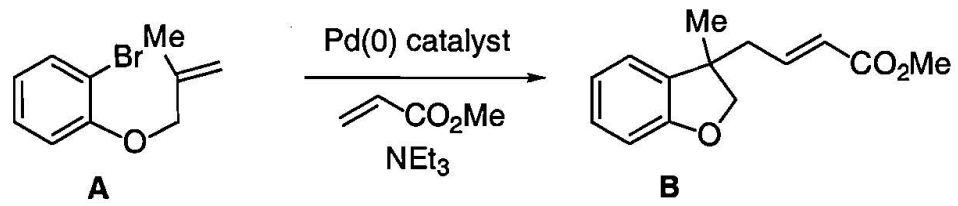
Choose the correct major product in the following cross-coupling reactions. Explain why.



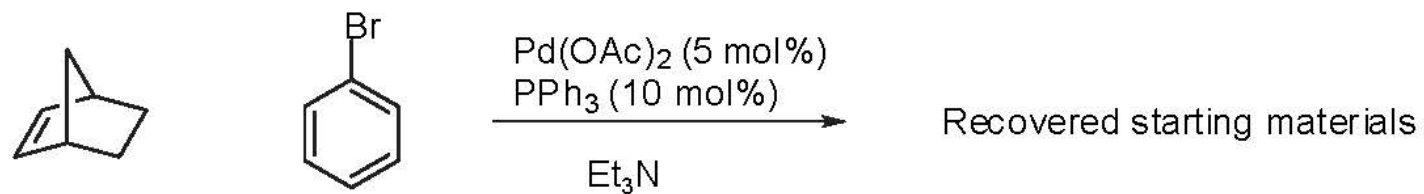
The following Pd-NHC complexes have been found to be useful in Suzuki coupling reactions. (a) Arrange them in the order of increasing reactivity for activation of alkyl halides. (b) Provide justification. Hint: A NHC ligand is more electron rich and less labile than a phosphine ligand.



Provide a catalytic cycle for the following reaction.

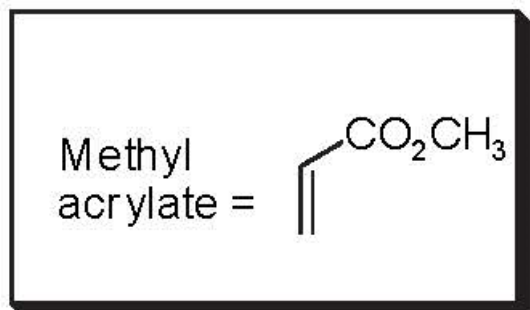


The following Heck coupling was attempted:

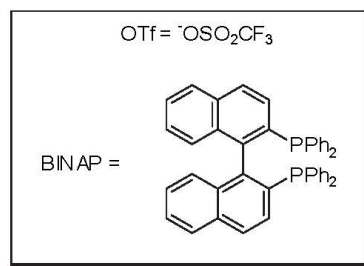
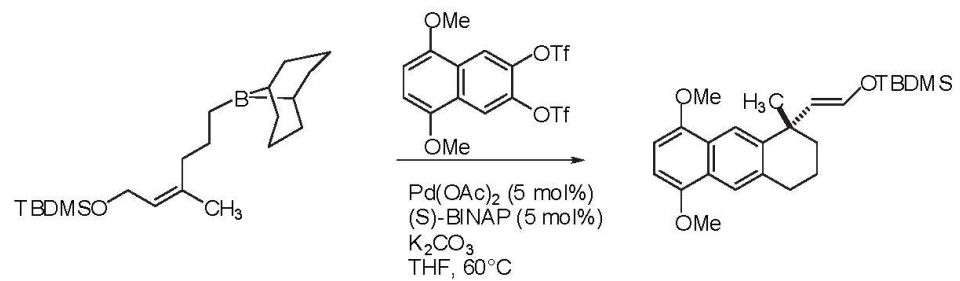


i) Provide a mechanistic explanation for the failure of this reaction.

ii) When methyl acrylate was added to the reaction mixture above, a new product was formed, in which the three organic components had been coupled. Draw the structure of this product and provide a mechanism for its formation.



. For the following reaction:



a. The reaction involves two types of cross-coupling reactions. What are they?

b. Please propose a mechanism for the reaction. You don't need to indicate oxidation state of Pd, nor rationalize the absolute stereochemistry obtained.