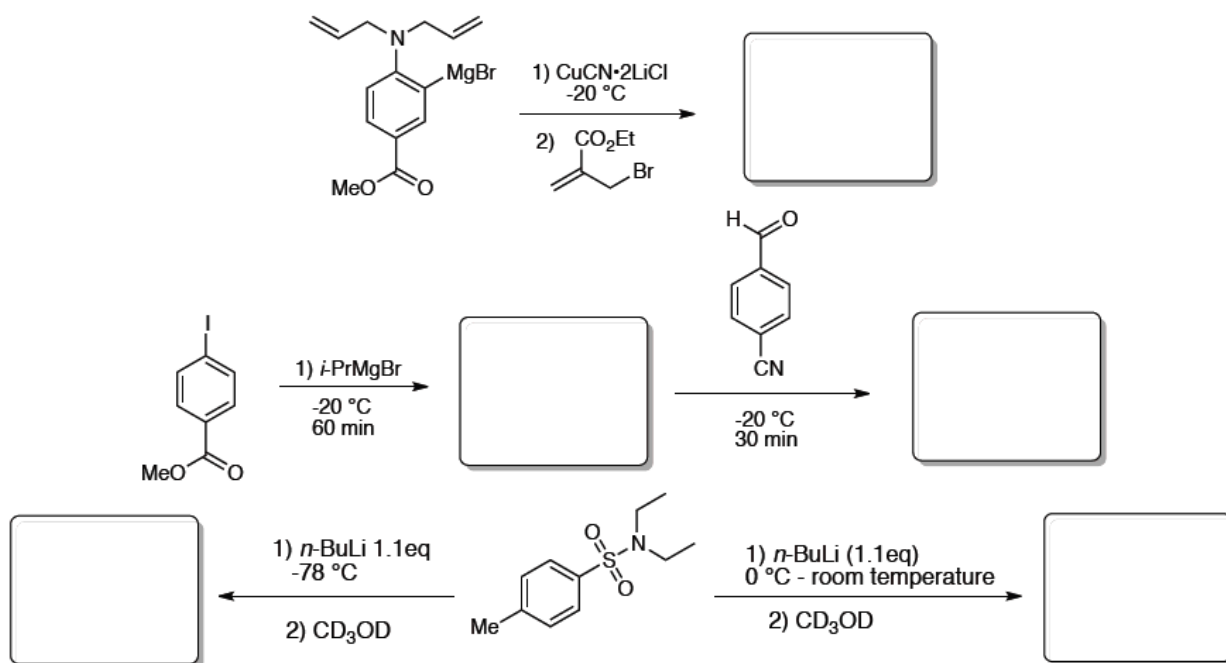


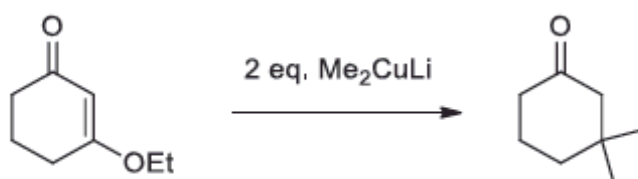
1. Give the products for the following reactions



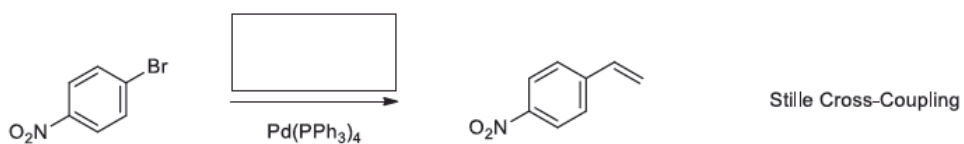
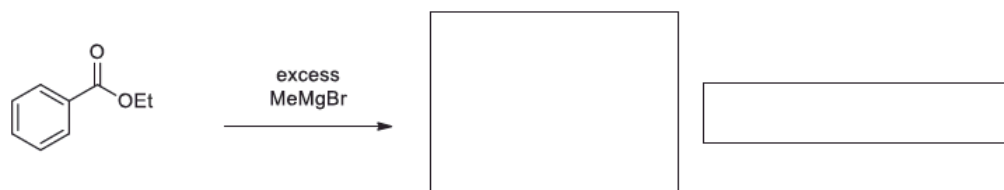
2. Provide a one-step synthesis for each of the two compounds below. Use starting materials containing not more than four carbon atoms.



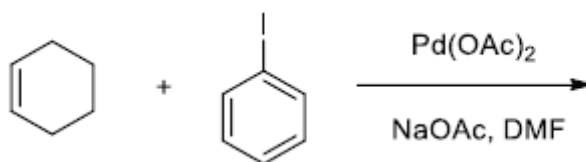
3. Draw the mechanism of the following reaction:



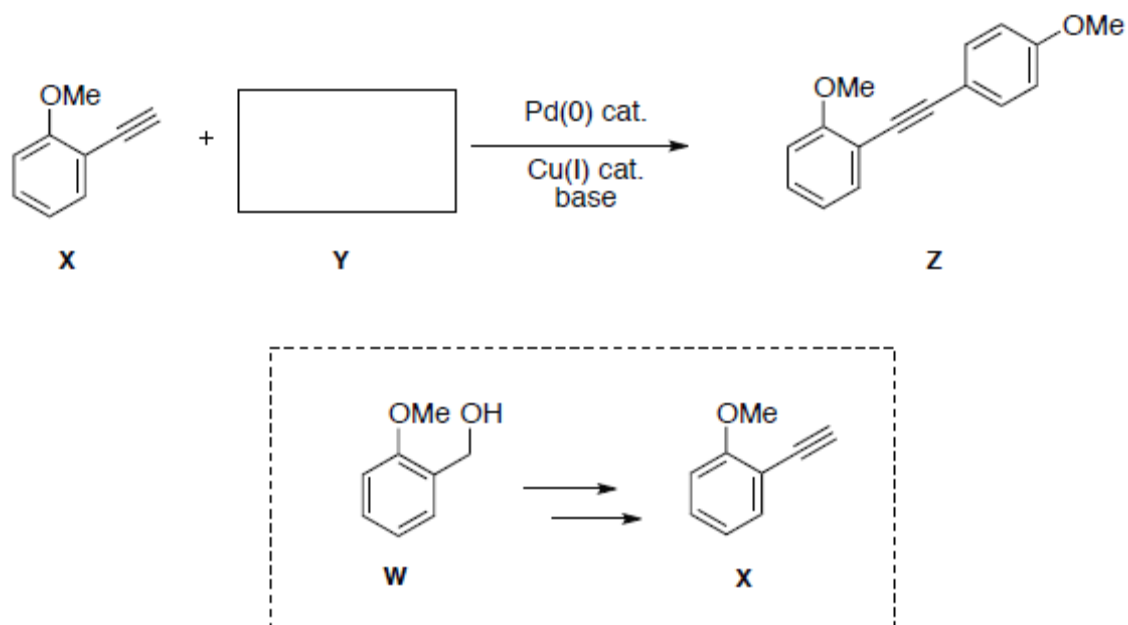
4. The following reactions involve organometallic compounds. Fill in the missing reagents, products and or reaction names.



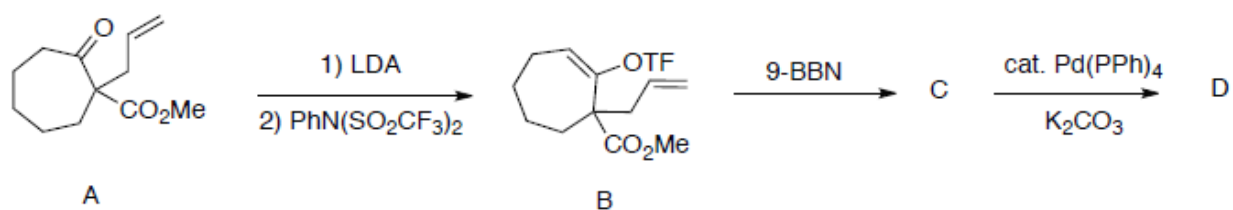
5. For cyclic alkenes, C-C bond rotation is not possible. Give the full mechanism and product of the following Heck reaction.



6. Provide reagent **Y** for the Pd-catalyzed reaction to form product **Z**. What is the name of this reaction? How would you prepare reagent **X** from alcohol **W**?



7. Substituted cycloheptanone **A** is converted to bicyclic compound **D** via the following reaction sequence:



7.1 Provide the structure of intermediate **C** and the final product (**D**). What is the name of the last reaction?

8.2 Provide a synthesis of **A** starting from cycloheptanone.