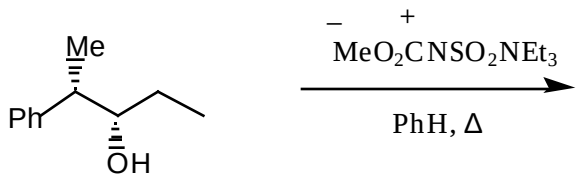
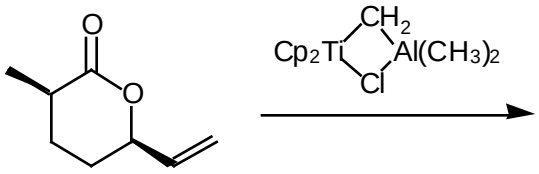
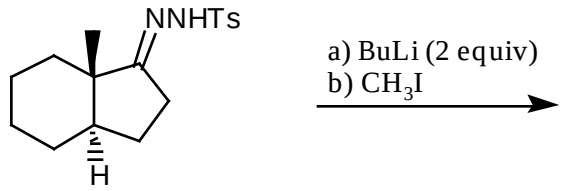
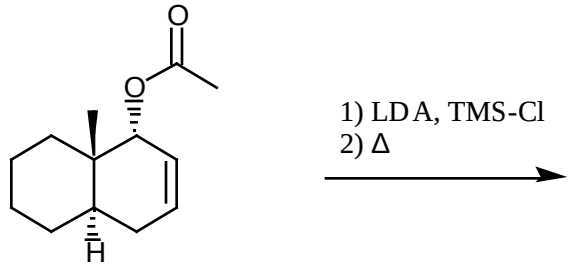
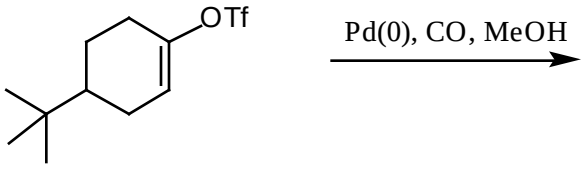
1. Give the product of the following reactions. The stereochemistry of the reactant is as shown. Give the proper sterochemistry of the major stereoisomer of the product. (24 pts)

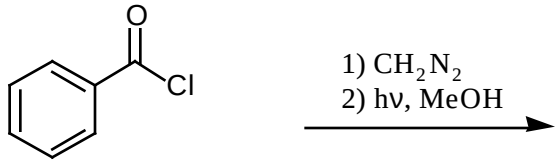




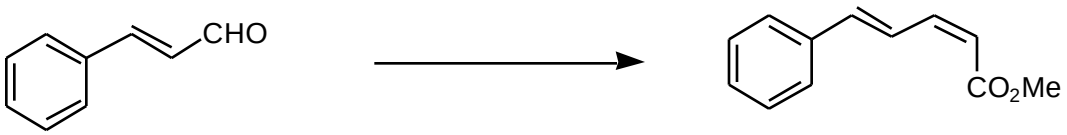


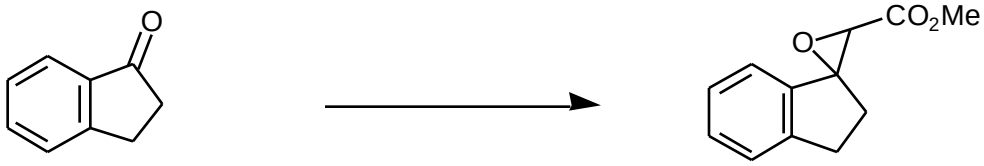


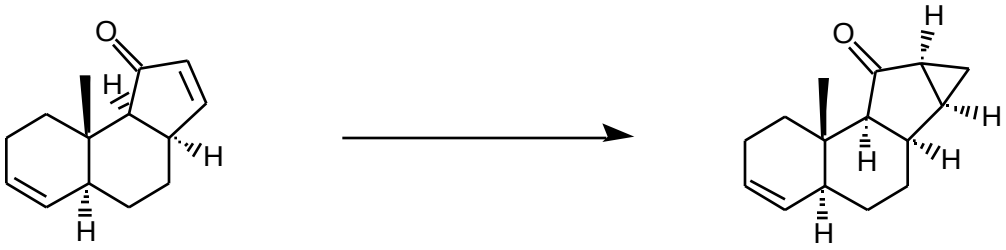


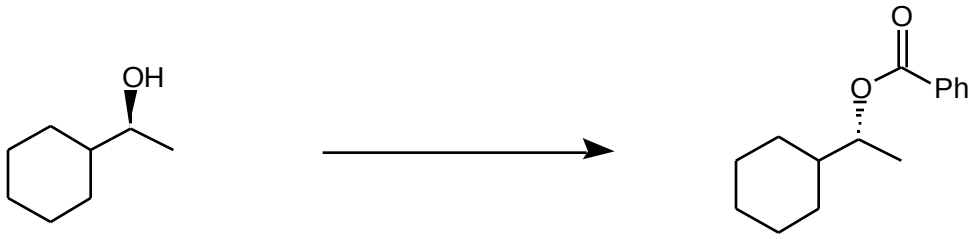


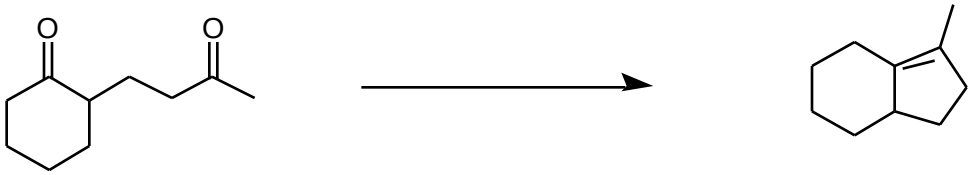
2. Give the reagent(s) necessary to carry out the following transformations. The stereochemistry of the products and reactants is as shown. (24 pts)

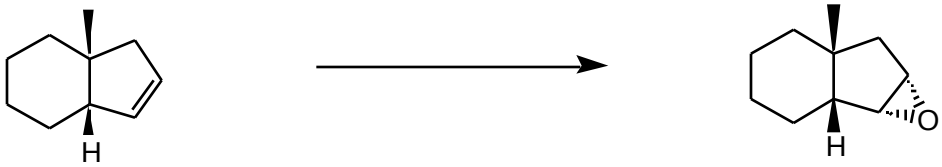




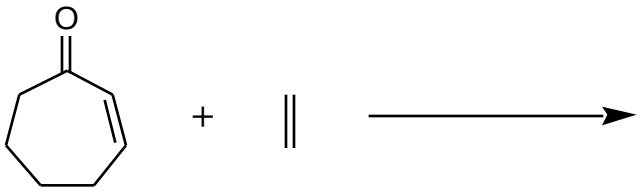




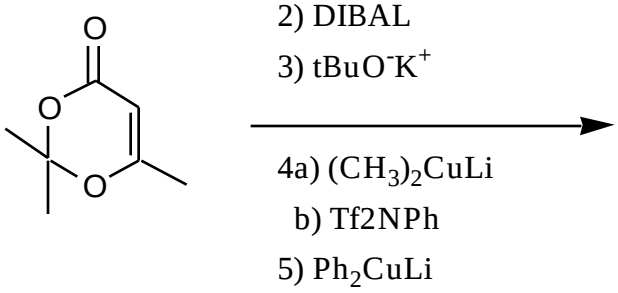




3. Give the expected product from a thermal and photochemical [2+2] cycloaddition of cycloheptenone with ethylene. Using MO's, clearly show why the photochemical and thermal pathways give different stereochemical outcomes. (12 pts)



4. Provide the product and all intermediates for the following sequence of reactions. (20 pts)



5. Complete the synthesis for the target shown. Give all reagents and intermediates. (20 pts).