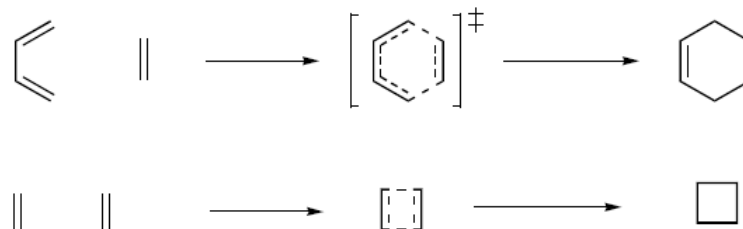


**CHM 3120 Midterm 1**  
**Friday Oct. 4, 2013**

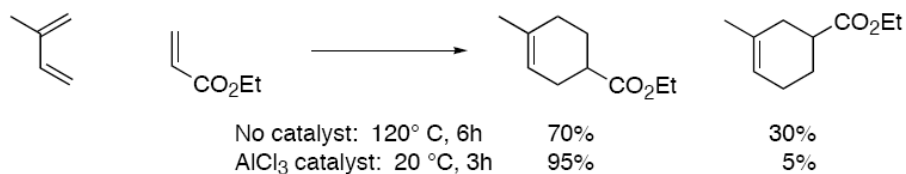
Instructions: Give the answers for all questions neatly in the booklet provided.

1. Consider the following model cycloadditions:

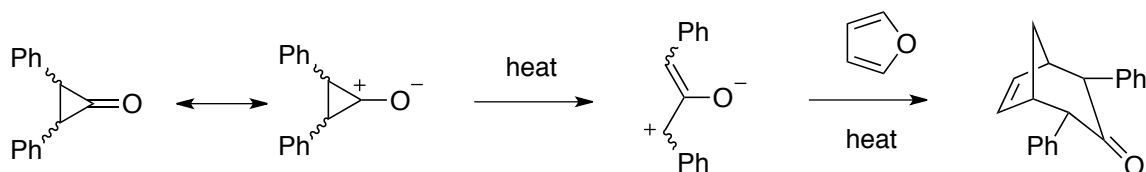


Using the FMOs of the reacting partners for both reactions explain why the [4+2] reaction is expected to occur thermally, whereas the [2+2] reaction is not.

2. Lewis acids are often used to accelerate Diels-Alder reactions. Provide a brief explanation of why the Lewis acid would accelerate the reaction shown below. Also explain why the regioselectivity of the reaction improves when  $\text{AlCl}_3$  is used.

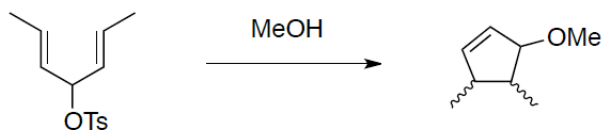


3. Cyclopropanones undergo electrocyclic ring opening to give oxyallyl species, which are useful dienophiles for [4+3] cycloadditions, such as that shown below.

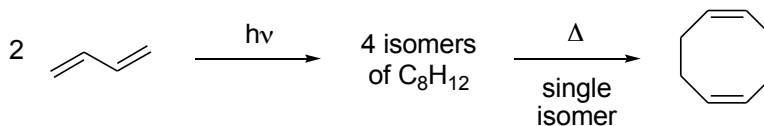


Use FMO theory to explain whether the opening of the cyclopropane will occur in a conrotatory or disrotatory fashion upon heating, and draw the stereoisomer of the 2,3-diphenylcyclopropane that is needed to yield the cycloadditions product that is shown.

4. Provide a detailed mechanism (arrow-pushing for each chemical step) and account for the stereochemistry in the following reaction, which occurs upon refluxing in methanol.



5. Photolytic reaction of two equivalents of 1,3-butadiene gives four isomeric products,  $C_8H_{12}$ . Three of these products are inert to any thermal reaction, but the fourth yields the product indicated below. What are the 4 isomers and which one leads to the product?



6. Under which conditions (i.e., thermal or photochemical) might the following reaction be expected to occur? Use FMO theory to provide a rationale for your expectation.



BONUS. Provide a mechanism and account for the stereochemistry in the following reaction.

