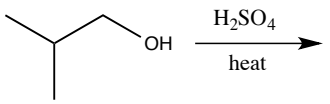
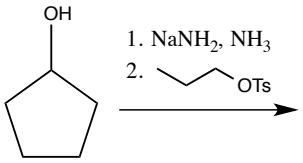
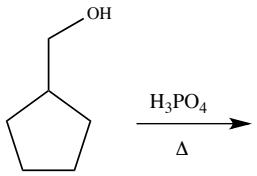
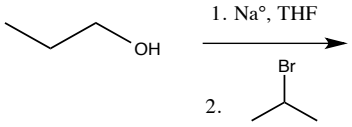
Chapter 14 Practice Problems

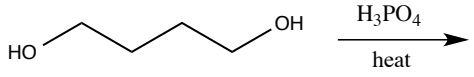
1. Ethers are typically prepared using the S_N2 reaction either via i) condensation reactions (requiring a strong acid catalyst), or ii) the William Ether Synthesis (requiring deprotonation of an alcohol with a strong base to form a strong nucleophile, followed by treatment with an alkyl halide or tosylate). **Identify which of these two methods is used** in each of the examples below and **draw the expected product**:

A. 

B. 

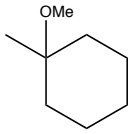
C. 

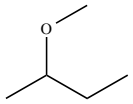
D. 

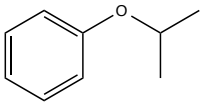
E. 

(HINT: consider a cyclization reaction in which the OH group on one end acts as a nucleophile attacking the protonated OH group on the other end)

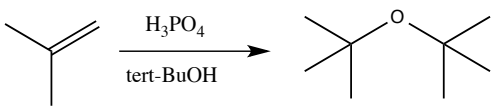
2. The William Ether synthesis is an S_N2 reaction in which one 'half' of the ether comes from an alkoxide (deprotonated alcohol) and the other 'half' comes from an alkyl halide. Since there are two 'halves' to an ether, this often means that the ether can be prepared by two routes (e.g., the right half is the nucleophilic alkoxide or the left half is). Sometimes, however, only one direction makes sense due to the limitations of SN2 reactions. For each of the following, consider the two different ways to make the ether and comment as to whether one way is better than the other:

A. 

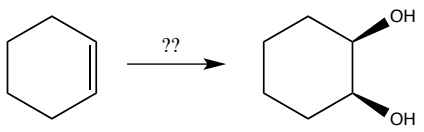
B. 

C. 

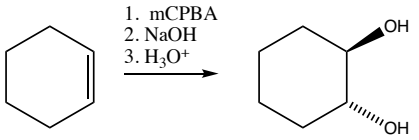
3. Di-tert-butyl ether cannot be synthesized by the Williamson ether synthesis. Why? An alternative method for its synthesis is shown below. Show the mechanism for its formation.



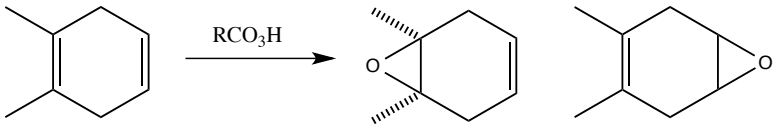
4. A. **Cis**-cyclohexane-1,2-diol (below) can be made from cyclohexene using a method we have examined earlier using what reagent?



B. **Trans**-cyclohexane-1,2-diol can be synthesized using the alternative conditions shown below. Draw a mechanism for the process.

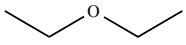


5. When the diene below was treated with ONE equivalent of a peroxyacid (i.e., enough to react with only ONE of the double bonds in the starting material), the product shown was observed. Why was none of the other possible product observed?

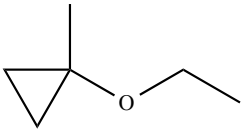


observed *not observed*

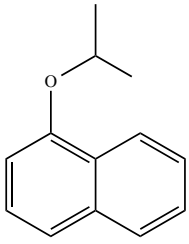
6. Synthesize the following ethers according to the prescribed method using appropriate alcohols as starting materials:

A. 

condensation reaction

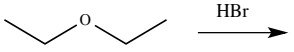
B. 

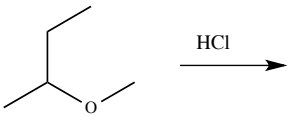
Williamson ether synthesis

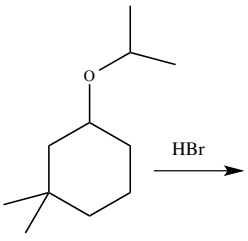
C. 

Williamson ether synthesis

7. Draw the final products resulting from reaction of the provided ethers with an *excess* of the provided hydrogen halide (HX):

A. 

B. 

C. 

D.