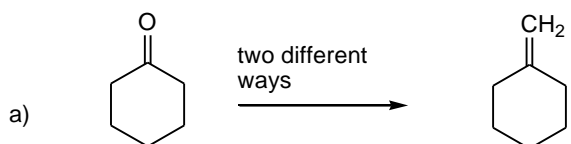
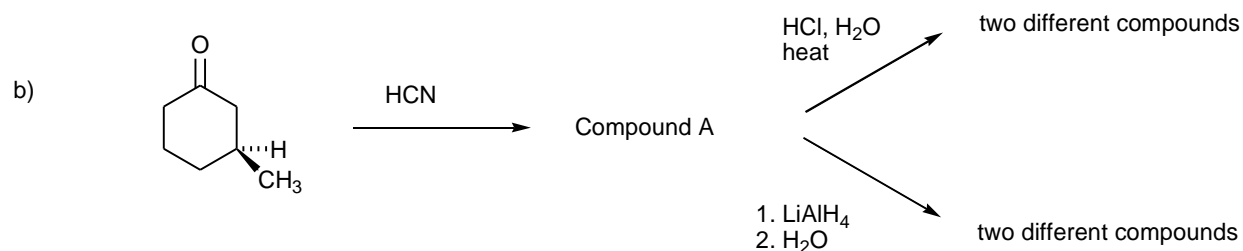
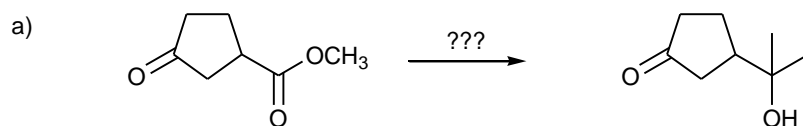


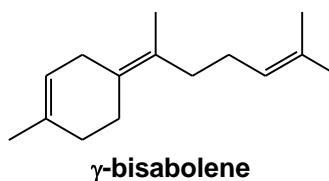
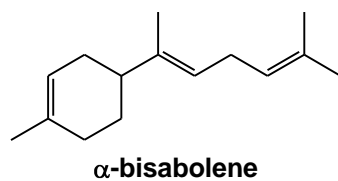
1. Give reactants and/or reagents that would give the following compounds.



2. Complete the following reaction sequences.



3. α -Bisabolene and γ -bisabolene (shown below) are derived from different types of plants. Synthesize the two bisabolenes using methods you learned from CHE 321. (From compounds of no more than five carbons.) What problems of stereochemistry might occur? Show how your new knowledge of the Wittig reaction would solve the problem and simplify the syntheses.



4. A synthesis of ascorbic acid (vitamin C, 1) starting from D-(+)-galactose (2) is shown below (Haworth, W.N., et al., *J. Chem. Soc.*, **1933**, 1419–1423.). Consider the following questions about the design and reactions used in this synthesis:

- Why did Haworth and co-workers introduce the acetal functional groups in 3?
- Write a mechanism for the formation of one of the acetals.

- c) Write a mechanism for the hydrolysis of one of the acetals (4 to 5). Assume that water was present in the reaction mixture.
- d) The compound 5, which is in equilibrium with an open chain compound, was reduced to compound 6 by the sodium amalgam in the presence of an acid. From what functional group did the reduction actually proceed?
- e) Write a mechanism for the formation of a phenylhydrazone from the aldehyde carbonyl of 7. (Do not be concerned about the phenylhydrazone group at C2. We shall study the formation of bishydrazones of this type [called an osazone] in Chapter 22).
- f) What reaction was used to add the carbon atom that ultimately became the lactone carbonyl carbon in ascorbic acid (1)?

