

Organic Synthesis Problems (Section 9.9 in McMurry)

These problems can be done by using a series of reactions, one step at a time, to create a product, often from a specific reactant. First, look at the reactant and product, and note the differences between the molecules. For instance, note if more carbons or a substituent have been added. Then, determine which reactions can be useful for the conversion. This can be done by examining the summaries of reactions at the ends of chapters 8 and 9. Note the chemical changes produced by these reactions, as well as the necessary reactants, solvents, and conditions. Carefully consider if the reactions will produce the desired change (without an undesirable change). Next, determine the sequence in which to order the reactions. For example, you cannot hydrogenate an alkyne prior to alkylation because alkylation requires a terminal alkyne, as in example 9.1.

One technique that is often applied is to consider the *retrosynthetic* pathway, which is to work backwards from product to reactant. This allows you to determine what reactant and reaction would be needed immediately prior to obtaining a compound.

After reviewing examples 9.1 – 9.3, along with the notes below, you should be prepared to work through homework problems 7 and 8.

Example 9.1

- Note how the product has one more C than the reactant. Review how the chain can be lengthened in “Alkylation of Acetylide Anions” of the chapter 9 notes.
- Review “Reduction of Alkynes” in the chapter 9 notes to understand how hydrogenation can convert the lengthened alkyne to an alkane.
- Note that hydrogenation must be done *after* the alkylation.
- The Lindlar hydrogenation catalyst can be used to create a cis alkene. Pd/C could not be used, because it would create an alkane.

Example 9.2

- Here an alkyne is converted to a brominated alkene with a longer parent chain.
- As in the prior example, alkylation must be done before the additions of H₂ and HBr.
- Although H₂ and HBr could hypothetically be used in either order, halogenation of the alkyne could produce a mixture of products. See “Addition of HX and X₂” in the chapter 9 notes. So, hydrogenation to an alkene is done before addition of HBr.

Example 9.3

- A 1° alcohol with a longer parent chain is created here from an alkyne.
- The alcohol can be created from anti-Markovnikov addition of borane to an alkene, but not to an alkyne.
- The alkene can be produced by hydrogenation of the alkyne.
- But, the alkyne must be longer than acetylene, which is the starting material. So, just like the preceding examples, alkylation must be done first.