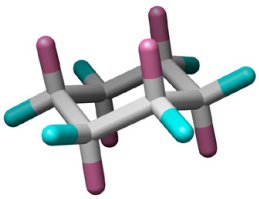


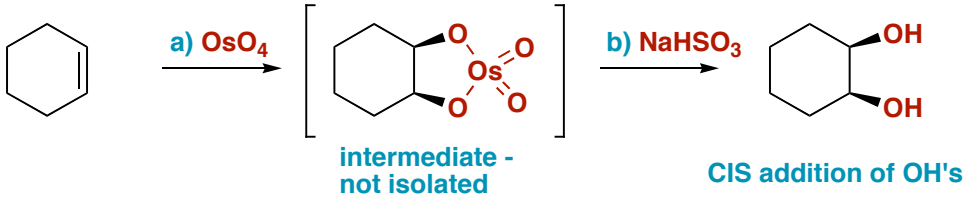
Chem 341 • Organic Chemistry I

Lecture Summary 21 • October 12, 2007

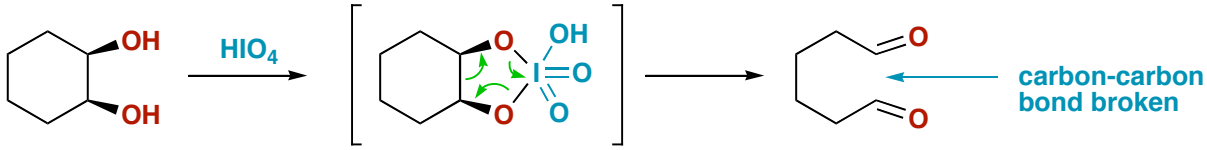
Chapter 7 - Alkenes: Reactions and Synthesis

Oxidation of Alkenes

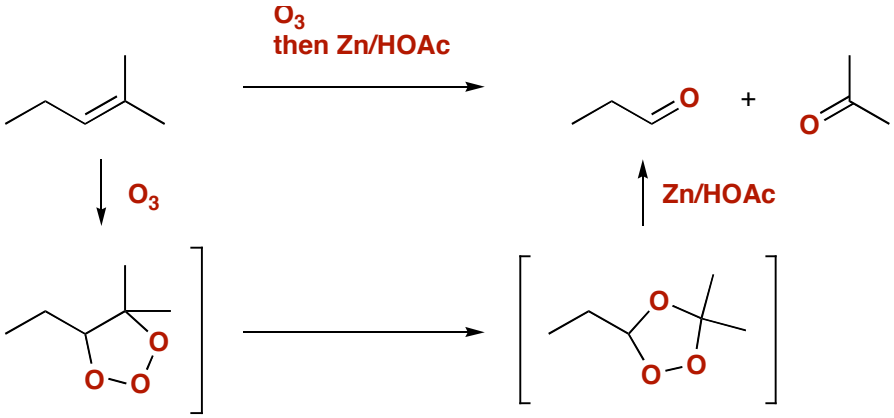
There are several oxidizing agents that will oxidize alkenes to varying levels of oxidation states. The addition of two oxygens to a double bond can be accomplished with osmium tetroxide. The result is the formation of a 1,2-diol. This reaction is stereospecific to give the cis product. Note that sodium bisulfite is required to break down the intermediate osmium complex.



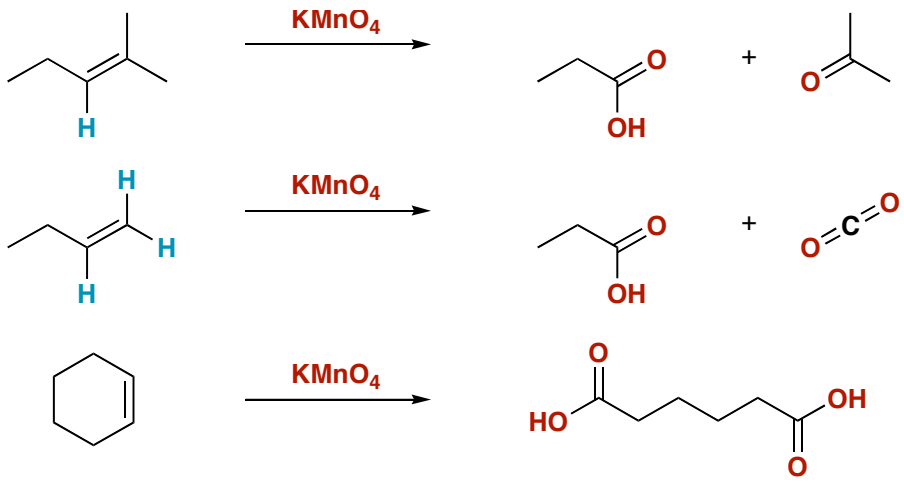
1,2-Diols are useful and can be further oxidized with periodic acid. This results in cleaving the carbon-carbon bond between the two alcohols and forming aldehydes on the end.



The cleavage of a carbon-carbon bond is useful for breaking apart molecules. A more straightforward method exists to break a double bond directly to give carbonyl functional groups on either end. This reaction involves the highly reactive ozone molecule. This reaction forms intermediates that must be broken down with zinc in acetic acid.

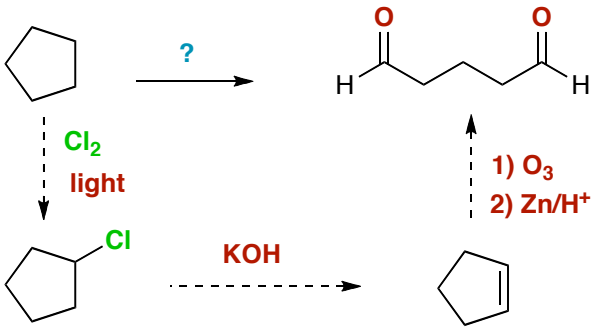


Potassium permanganate is one of the strongest oxidizing agents. Not only will it cleave apart a carbon-carbon double bond, but it will continue to oxidize any bonds to hydrogens that were present on the alkene carbons. Note that if there are no hydrogens, a ketone is produced, if one hydrogen, it will form a carboxylic acid, and if the alkene is terminal, possessing two hydrogens, it will become carbon dioxide.



Synthetic Strategy

One of the basic goals of organic chemists is to make molecules. Usually this requires a multi-step synthesis starting from materials that are readily available from petroleum products or plant materials. In order to carry a multi-step synthesis it takes strategic planning. The best way to approach a synthetic challenge is to analyze the target structure and work backwards one step at a time until you get back to your starting materials. As we build our repertoire of organic functional group transformations, we will come back to this issue of synthetic strategy.



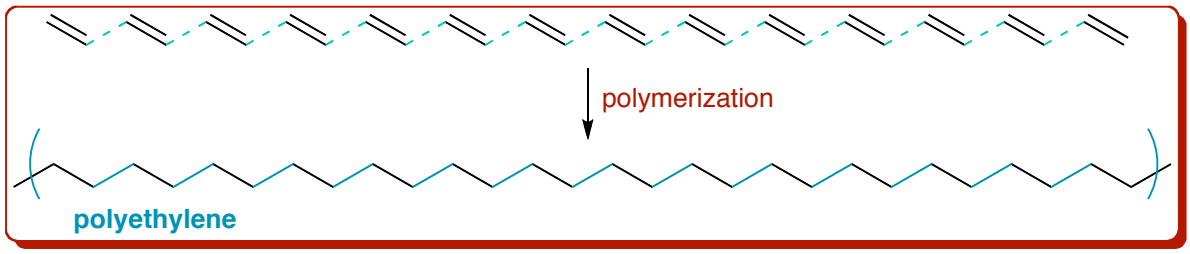
Say you were given cyclopentane as a starting material. How would you prepare 1,5-pentandialdehyde? This would require a multistep synthesis, as there are no methods to carry out this transformation in one step.

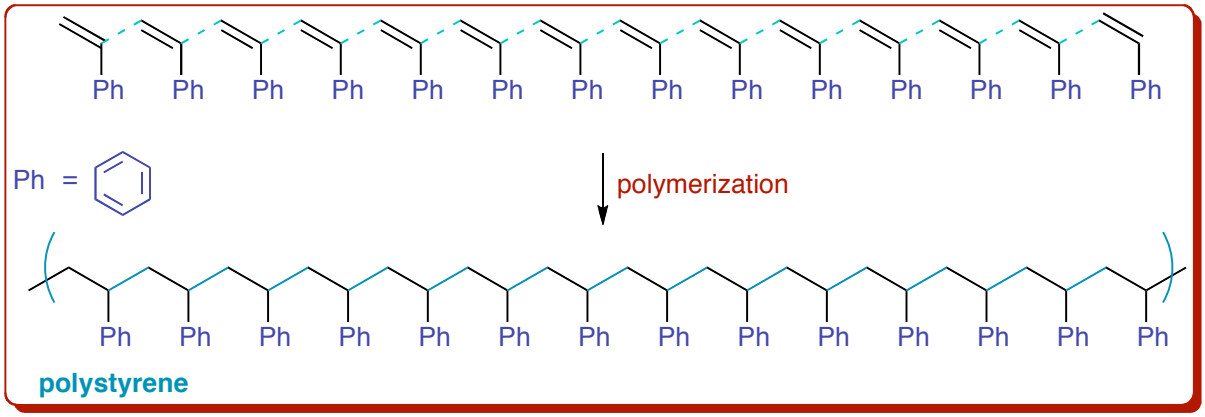
Working backwards, we could see that the diacarbonyl could be prepared in one step from cyclopentene and ozonolysis.

Cyclopentene can be prepared by elimination of chlorocyclopentane, and this can be prepared from cyclopentane by free radical chlorination.

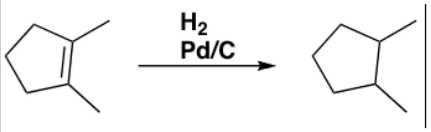
Alkene Polymerization

Polymers can be produced from alkenes by chain reactions using either radical or cationic polymerization. Through a variety of mechanisms, alkenes can be joined up into very long chains (polymers). The polymer chains reflect repeating units every two carbons and bear the substituents from the original alkenes.





Quiz of the day

Q:			
Which of the statements is FALSE about the following reaction? 	☑ 1:	The reaction produces the trans isomer of 1,2-dimethylcyclopentane.
	☐ 2:	The palladium catalyst breaks apart the H-H bond.
	☐ 3:	The reaction can be classified as a reduction.
	☐ 4:	Both hydrogens are added from the same side.