



# Chem 341 • Organic Chemistry I

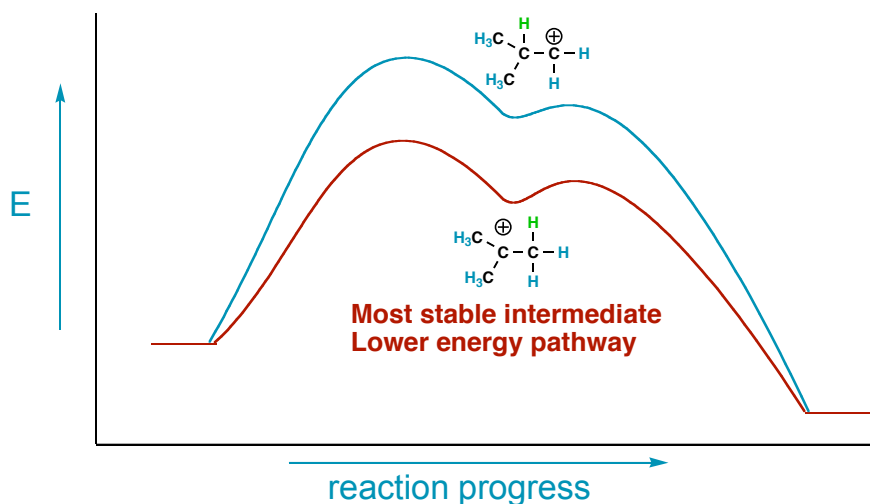
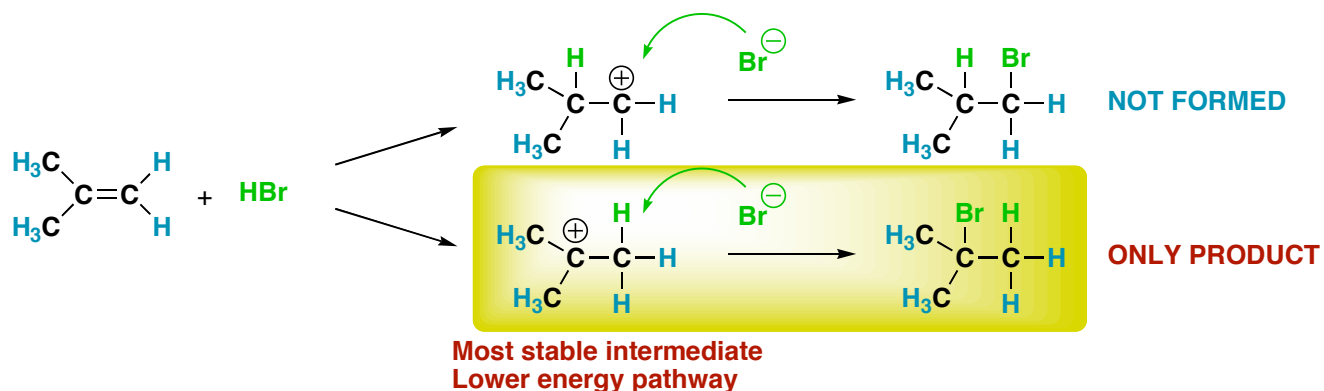
Lecture Summary 17 • October 03, 2007

## Chapter 6 - Alkenes: Structure and Reactivity

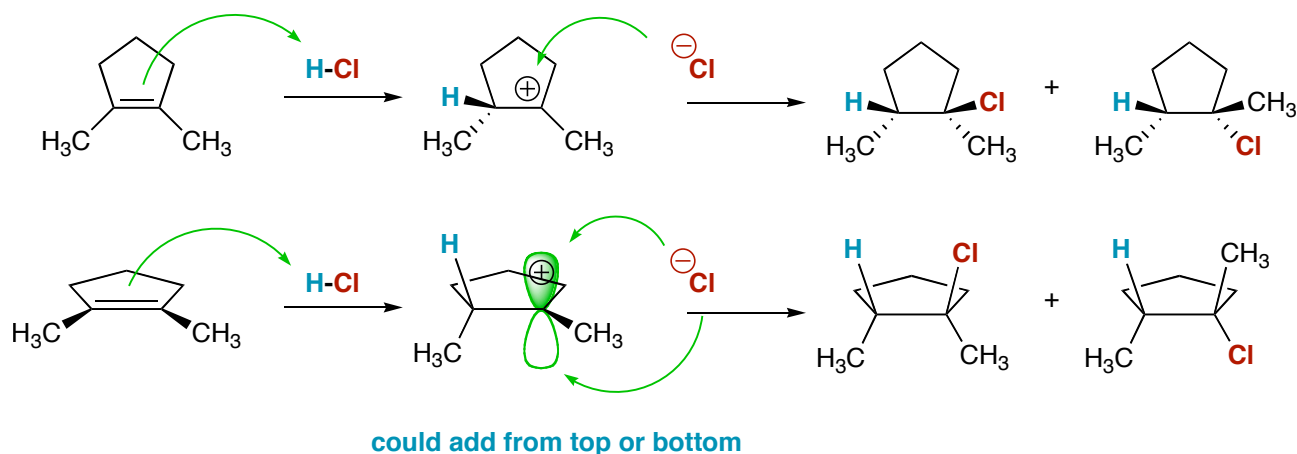
### Electrophilic Addition to Alkenes

We have discussed the reaction of HBr to ethane previously. This is called an electrophilic addition to an alkene because in the first step, a pi bond gets protonated by the electrophile ( $H^+$ ). If the double bond is not symmetrically substituted then there exists the possibility of producing two different constitutional isomers. In fact, the reaction is **REGIOSPECIFIC**. In the example below, only the product with the Br attached to the more substituted  $3^\circ$  carbon is produced. Again, the more substituted carbocation is more stable. The reaction will proceed by the lowest energy pathway available.

Carbocation stability has a direct influence on the energy of the intermediate in the electrophilic addition of HX to alkenes. That is because the transition state resembles the structure of the carbocation intermediate (the Hammond Postulate). Thus, the more stable intermediate can be formed by a lower energy pathway than the less stable intermediate.

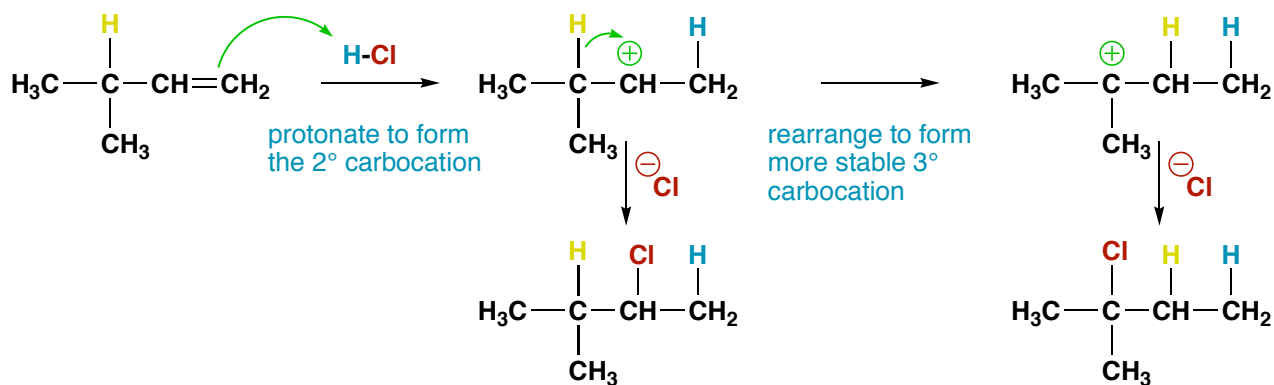


In the case of cycloalkenes, there are cases where more than one stereoisomer may be formed. These reactions are not selective due to the carbocation intermediate being  $sp^2$ -hybridized and planar. That is, the halide can form a bond from either the top or the bottom face of the ring.



## Carbocation Rearrangements

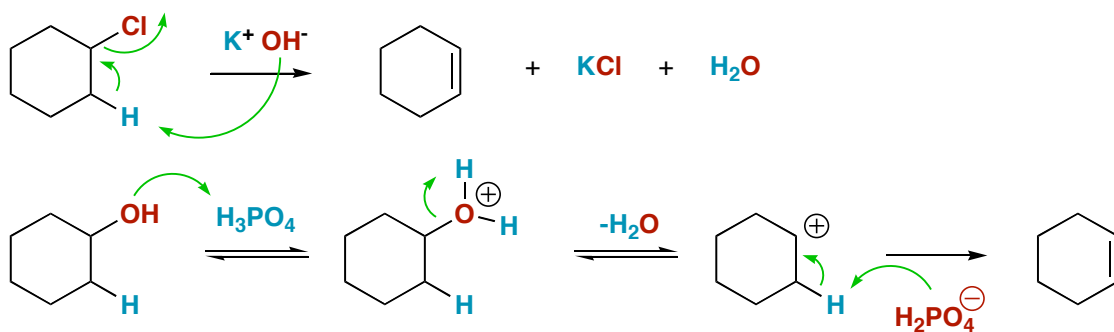
Evidence for carbocation intermediates in the electrophilic addition to alkenes is found in the fact that products of rearrangements are obtained. Hydrogen (with its electrons) or even methyl groups and other carbon groups can move one position over to an adjacent empty orbital. This shifts the carbocation to the position the migrating group just left. Carbocations will rearrange IF they form more stable carbocations in the process. For example, the  $2^\circ$  carbocation shown below will rearrange to the more stable  $3^\circ$  carbocation by shifting a hydrogen over one position. In the reaction of 2-methyl-1-butene with HCl, a mixture of products is obtained.



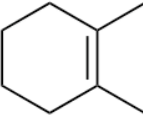
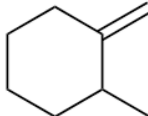
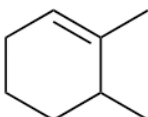
## Chapter 7 - Alkenes: Reactions and Synthesis

### Preparation of Alkenes

Alkenes are most commonly prepared by elimination reactions. Note that these are the opposite of additions reactions. For example, a halogenated alkane will undergo a dehydrohalogenation reaction in the presence of a good base. Alcohols, in the presence of a strong acid, will also undergo a stepwise elimination of water (dehydration) to produce an alkene.



### Quiz of the day

<b>Q:</b> Which of the following alkenes would have the most stable pi-bond?	<input checked="" type="checkbox"/> <b>1:</b>	
	<input type="checkbox"/> <b>2:</b>	
	<input type="checkbox"/> <b>3:</b>	
	<input type="checkbox"/> <b>4:</b>	