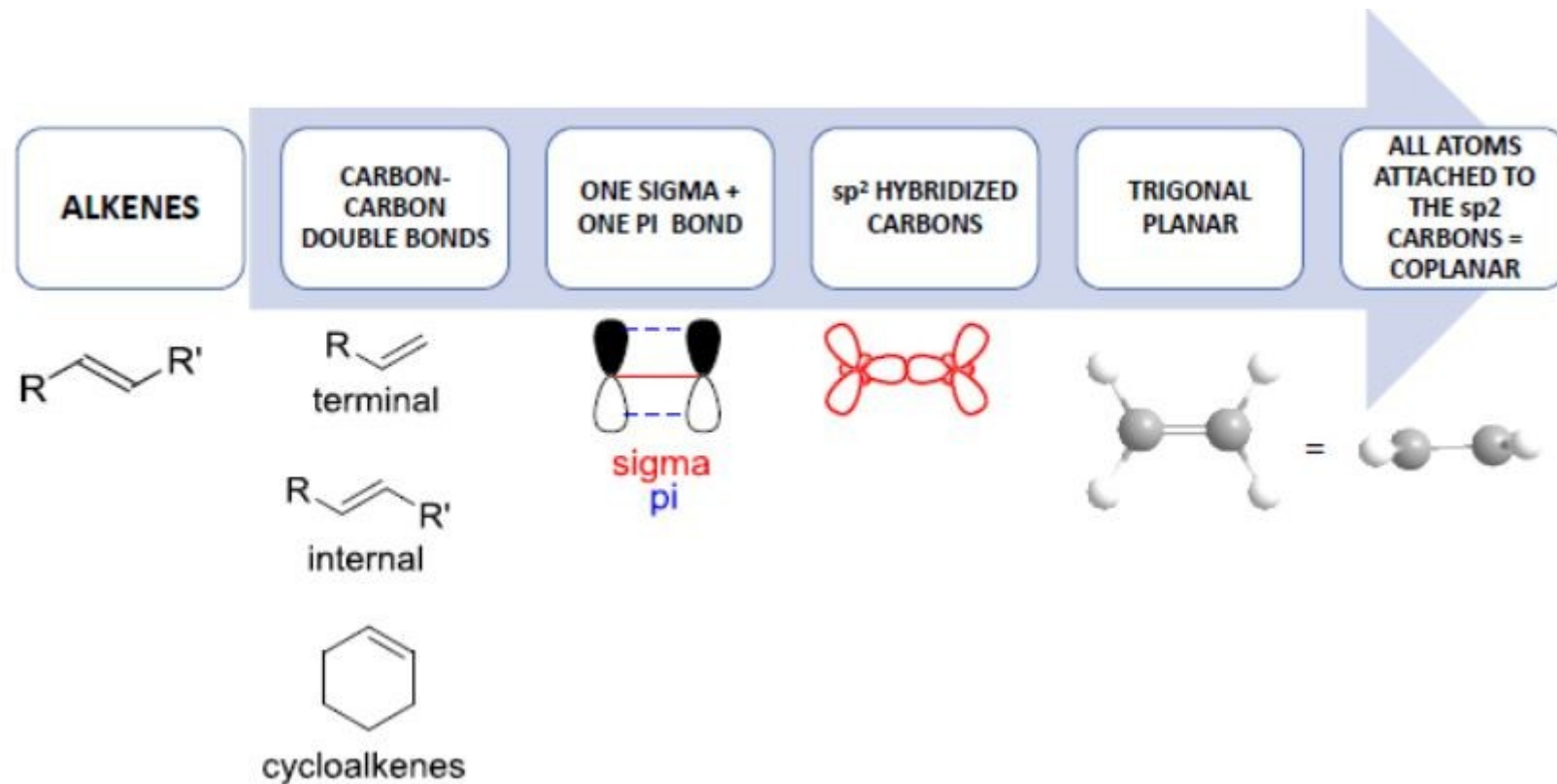


# Alkenes

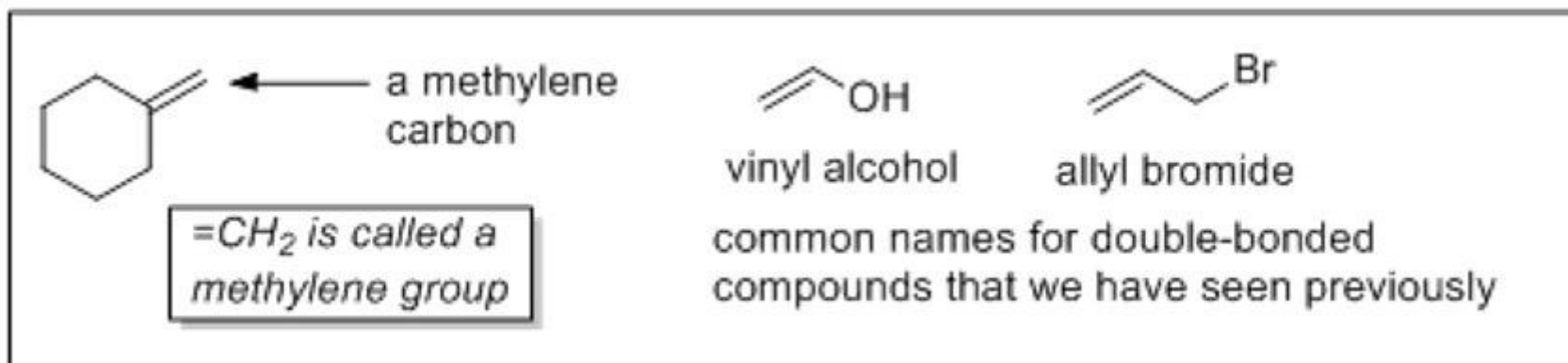
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# Properties of Alkenes



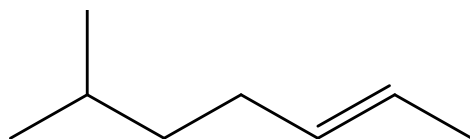
# Different Terminal Alkenes

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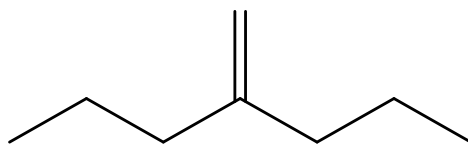


# Naming Alkenes

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The longest chain containing the double bonds is 7 carbons and methyl is at 6.  
So name is (trans)-6-methyl-2-heptene



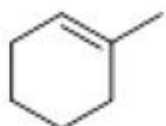
2-propyl-1-pentene

# Naming Alkene Rings

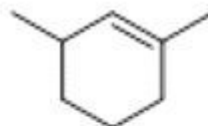
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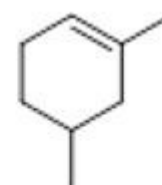
cyclohexene



1-methylcyclohexene



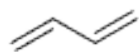
1,3-dimethylcyclohexene



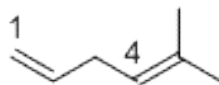
1,5-dimethylcyclohexene  
(alkene carbons **must** be one and two-note that the more substituted carbon is assigned number one)

# Nomenclature

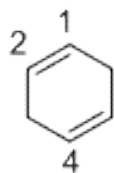
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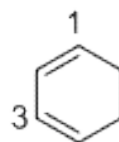
1,3-butadiene (not 2,4)



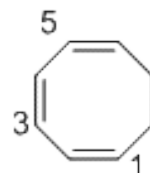
5-methyl-1,4-hexadiene  
(note that giving the double bond  
carbon number one takes precedence)



1,4-cyclohexadiene  
(use the number one  
when there is > 1 double  
bond in the ring)



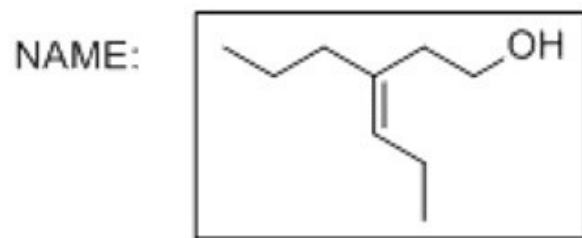
1,3-cyclohexadiene



1,3,5-cyclooctatriene  
(note: in rings > 7 carbons  
*E* and *Z* labels should be  
included - see Figure 3)

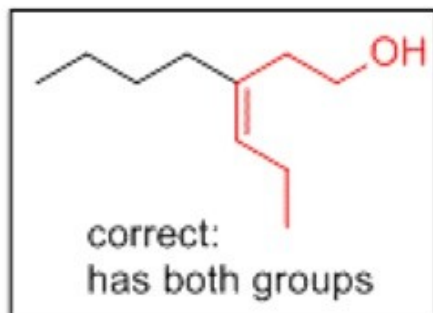
# Naming Compounds with Double Bond and Additional Functional Groups

---

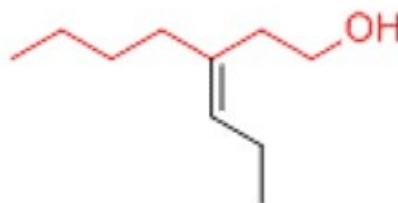


*recognize as an alkenol*

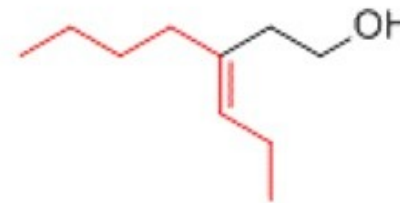
1. Assign as parent chain the longest one that include both the -OH and the double bond:



NOT



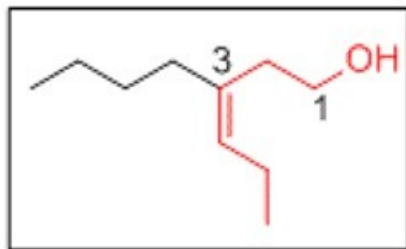
NOT



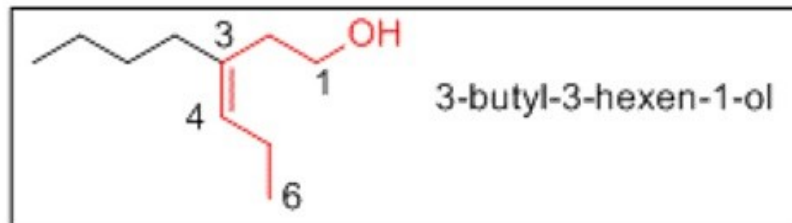
# Naming Compounds with Double Bond and Additional Functional Groups

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2. Assign the -OH carbon with lowest possible number:



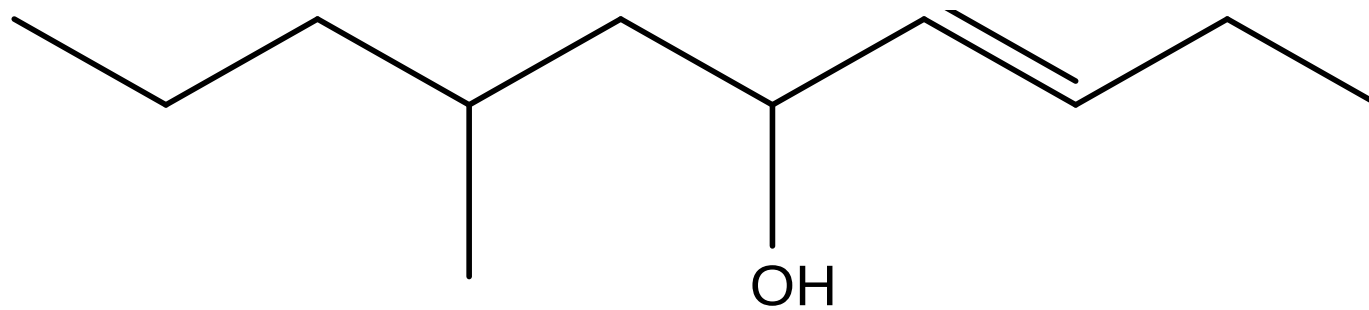
3. Write the structure with the alkene carbon number before the parent name and the -OH carbon number before the -ol suffix:





# Practice Nomenclature

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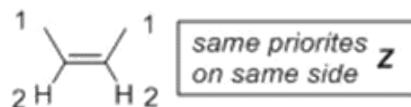
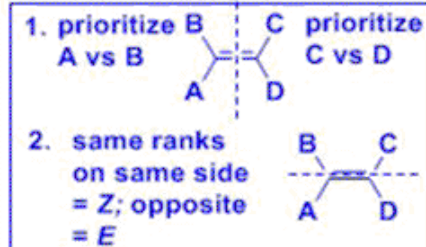


# Stereochemistry and Double Bond Nomenclature

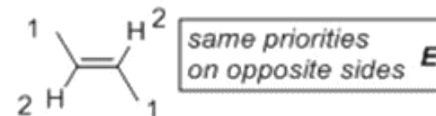
Assigning double bonds as *E* or *Z*



prioritize the two groups on the left and right "halves" of the double bond separately:  
methyl is 1 and H is 2



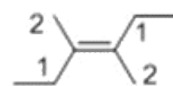
priority one (and two) groups are on the same side (i.e., point in the same direction)



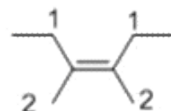
priority one (and two) groups are on opposite sides (i.e., point in the opposite directions)

name = (*E*)-2-butene

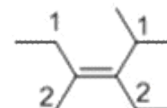
other examples:



(*E*)-3,4-dimethyl-3-hexene



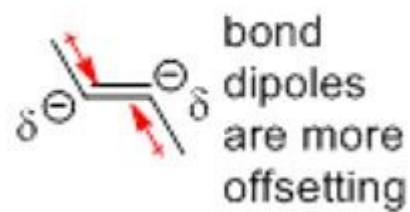
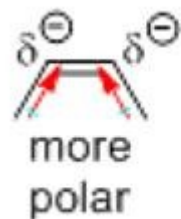
(*Z*)-3,4-dimethyl-3-hexene



(*Z*)-3-ethyl-2,4-dimethyl-3-hexene

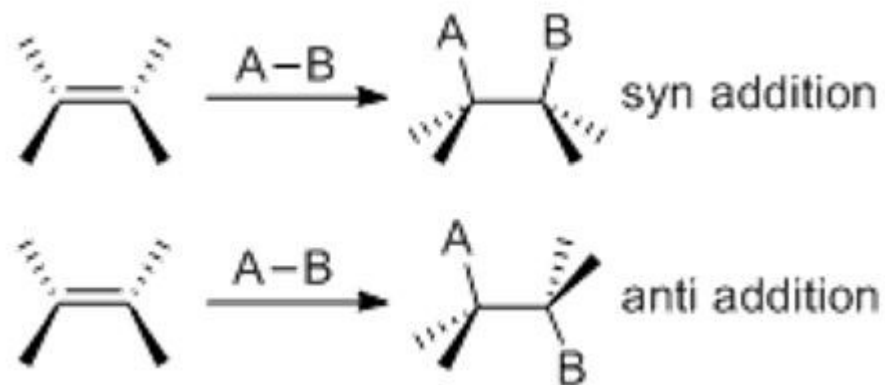
# Physical Properties of Alkenes

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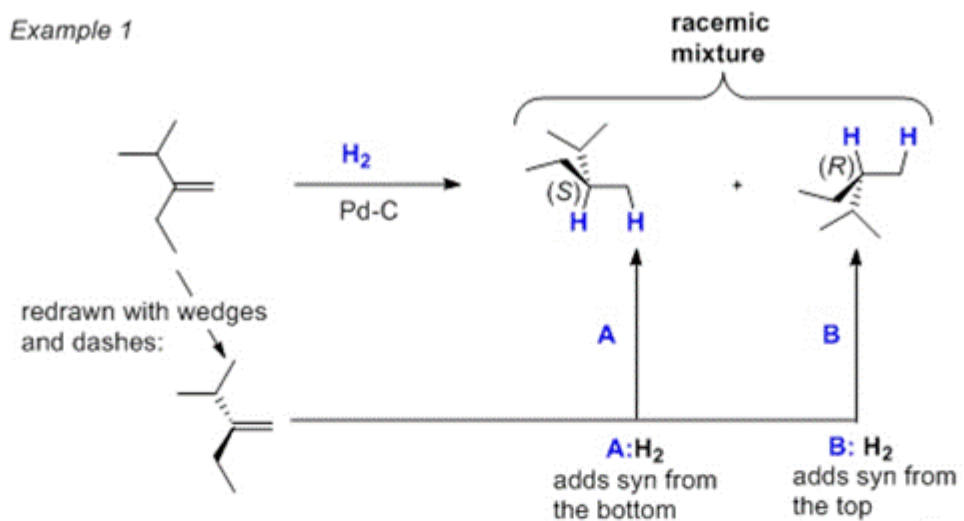
# Addition Reactions of Alkenes

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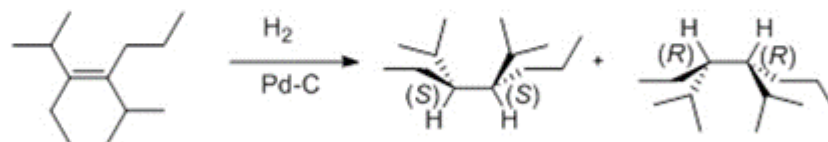


# Hydrogenation of Alkenes

Example 1

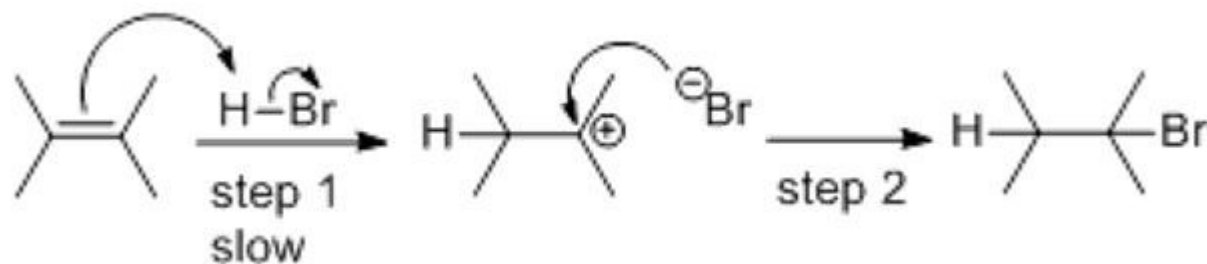


Example 2

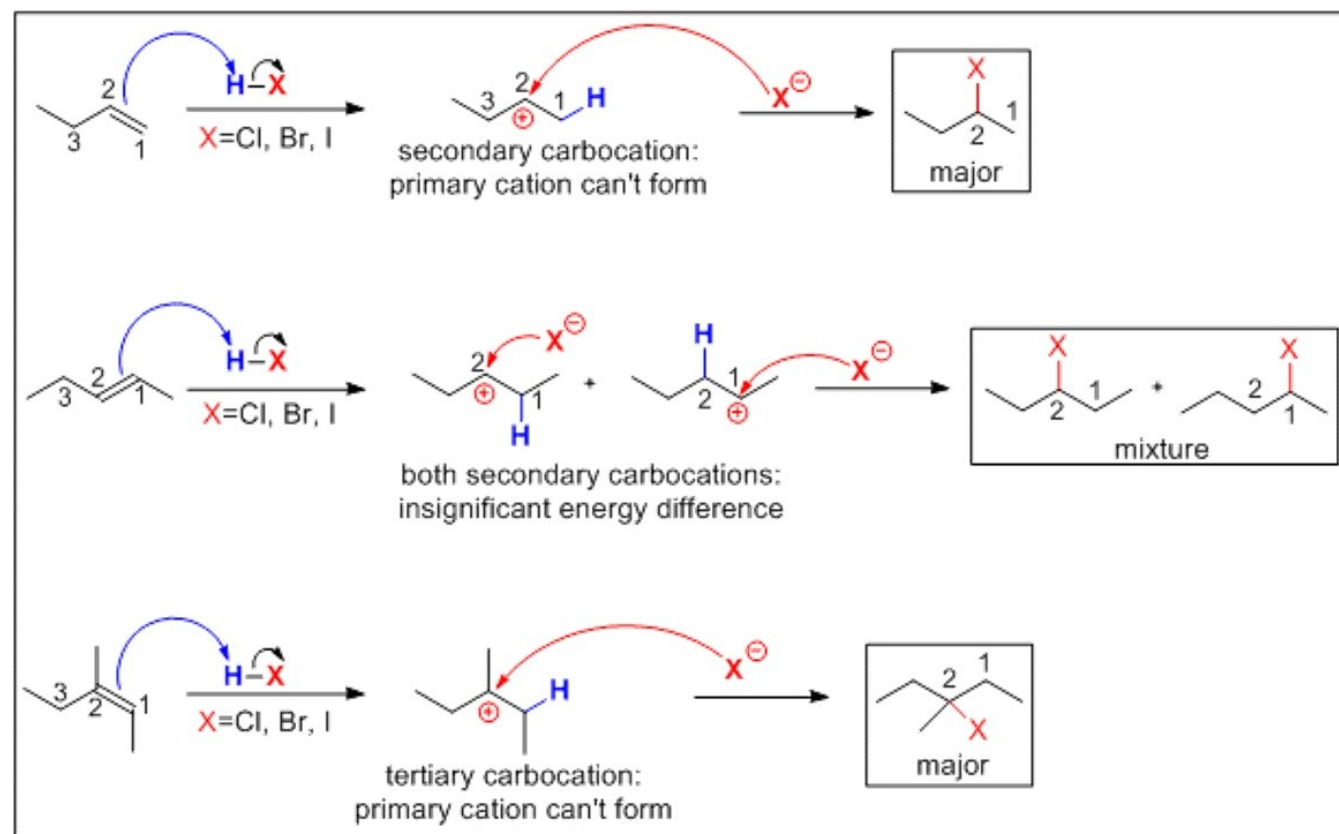


# Addition of Hydrogen Halides

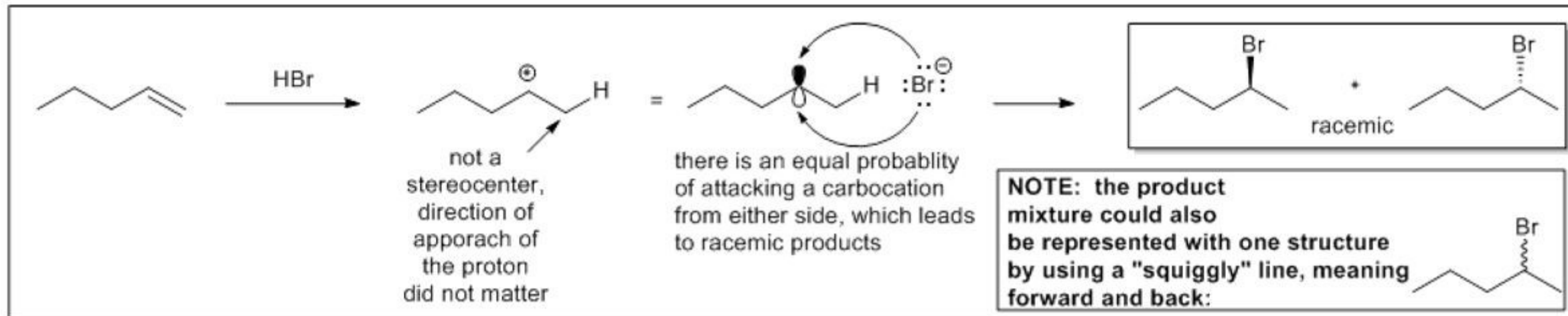
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# Addition of Hydrogen Halides



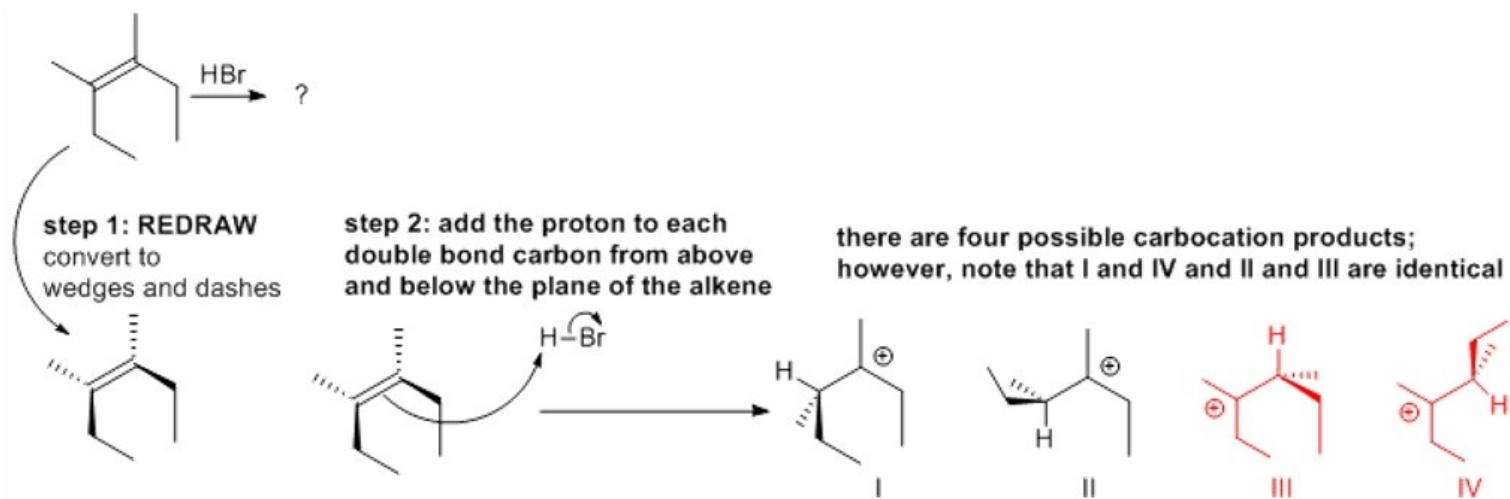
# Addition of Hydrogen Halides





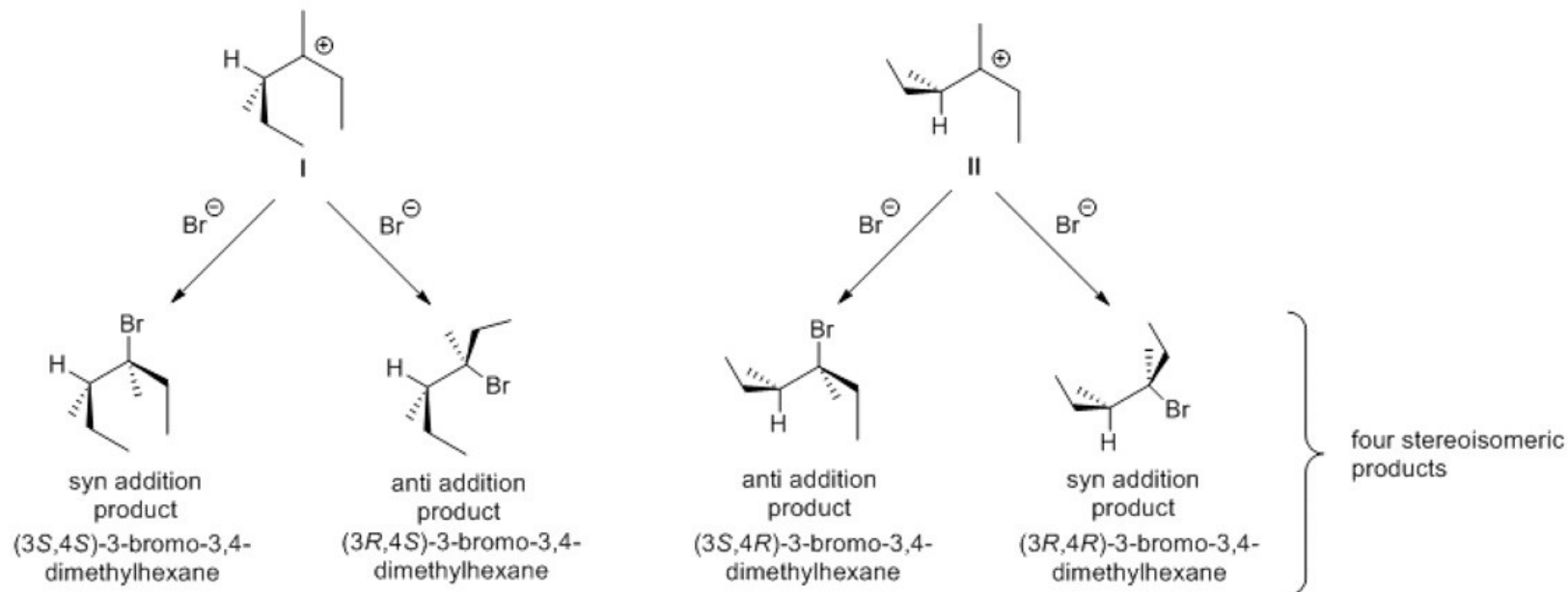
# Addition of Hydrogen Halides-Mechanism

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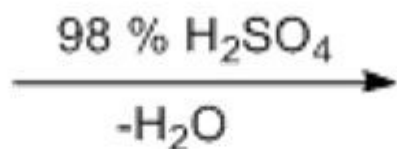
# Addition of Hydrogen Halides-Mechanism

step 3: add the  $\text{Br}^-$  nucleophile to the carbocation of I and II, and add it both syn and anti to the hydrogen:

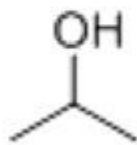
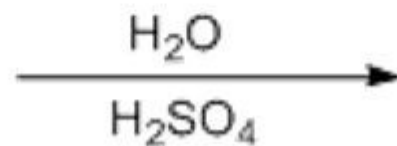


# Addition of Alcohols and Water to Alkenes

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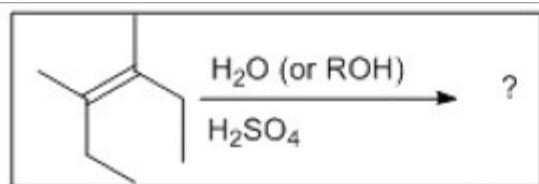


*elimination (Chapter 13):* loss of  $\text{H}_2\text{O}$ ,  
conc  $\text{H}_2\text{SO}_4$  protonates ROH

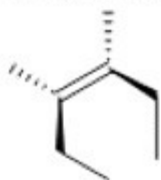


*addition:* addition of  $\text{H}_2\text{O}$ , more water  
is needed for the reaction,  $\text{H}_3\text{O}^+$  protonates the alkene

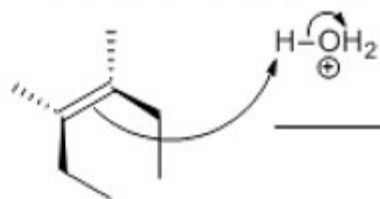
# Addition of Alcohols and Water to Alkenes



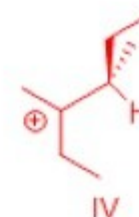
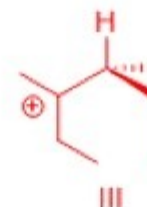
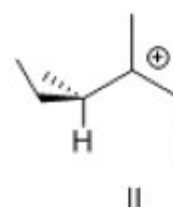
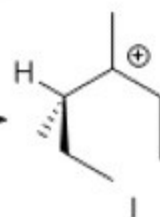
**step 1: REDRAW**  
convert to  
wedges and dashes



**step 2: add the proton to each  
double bond carbon from above  
and below the plane of the alkene**

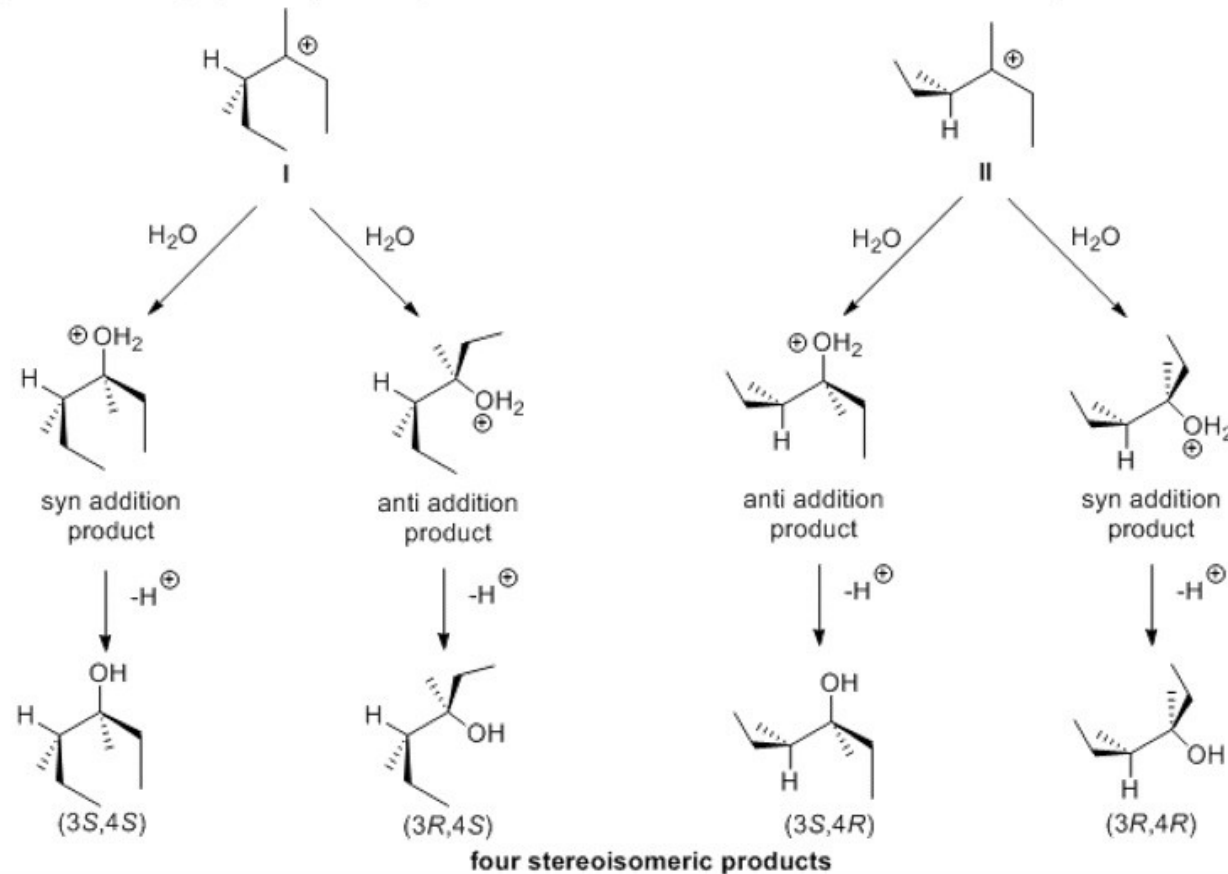


there are four possible carbocation products;  
however, note that I and IV and II and III are identical



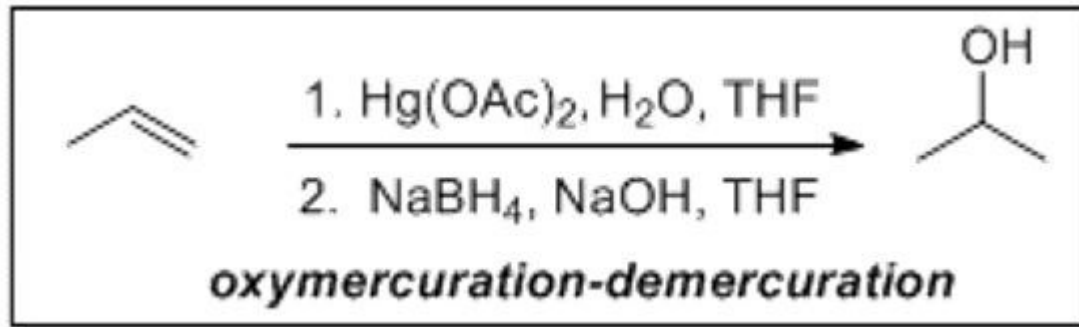
# Addition of Alcohols and Water to Alkenes

step 3: add the  $\text{H}_2\text{O}$  (or ROH) nucleophile to the carbocation of I and II, and add it both syn and anti to the hydrogen:

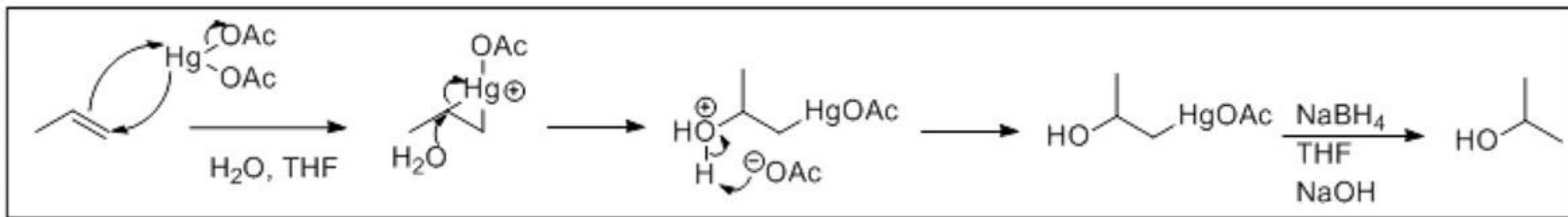


# Oxymercuration-Demercuration

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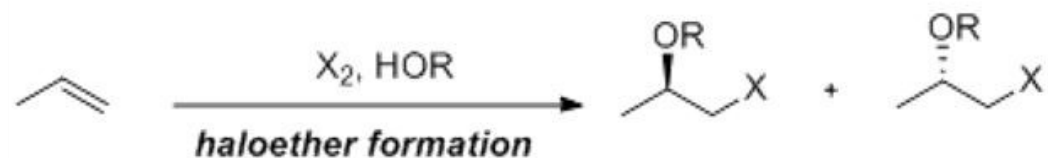
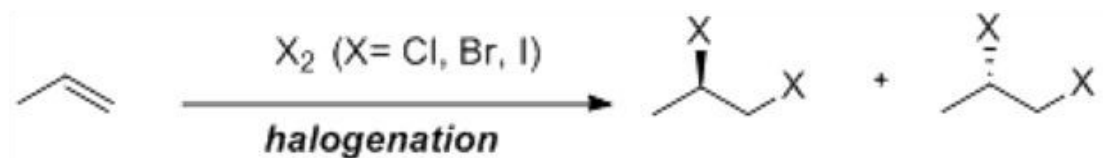


# Oxymercuration-Demercuration



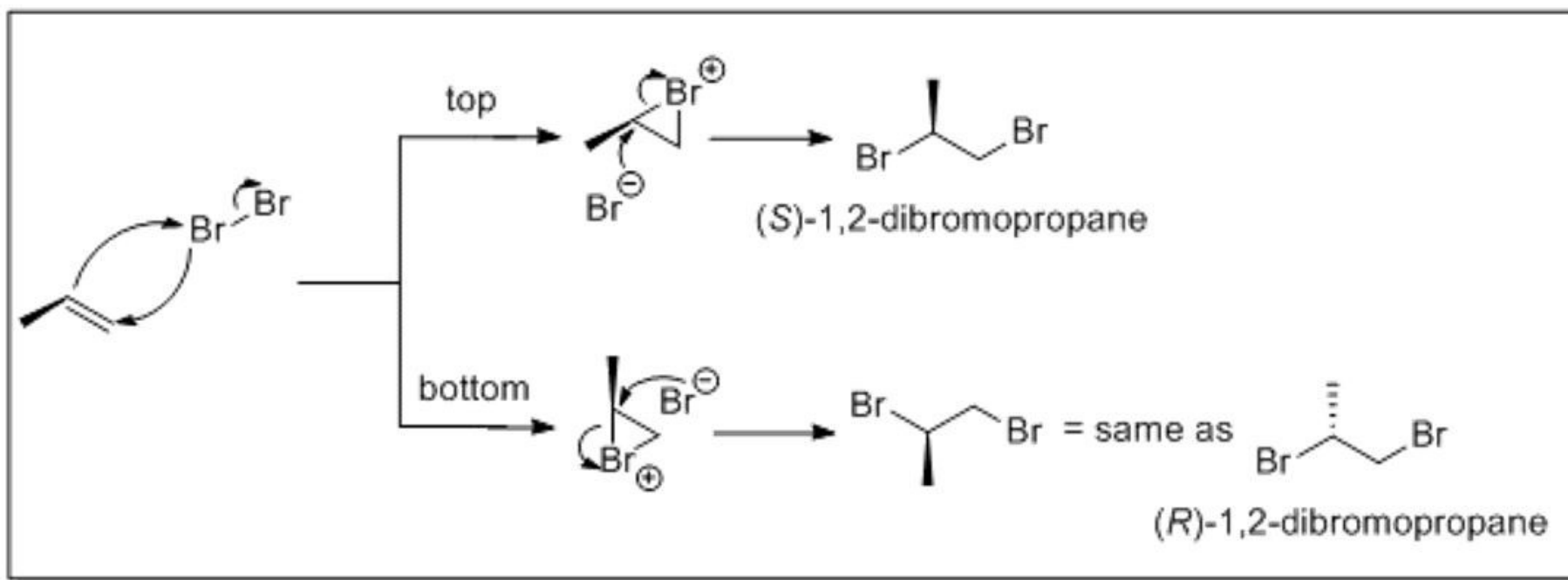
# Halogenation, Halohydrin and Haloether Formation

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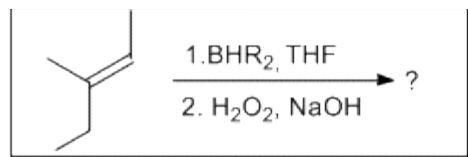




# Halogenation, Halohydrin and Haloether Formation



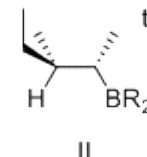
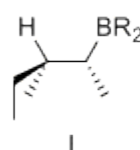
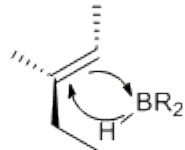
# Hydroboration-Oxidation



**step 1: REDRAW**  
convert to  
wedges and dashes



**step 2: add the boron to the less substituted carbon, the hydrogen to the more substituted carbon and add from above and below (R= alkyl as in 9-BBN, so add to just one alkene)**



I and II  
are the main regioisomers:  
they are enantiomers

$\xrightarrow{\text{H}_2\text{O}_2, \text{NaOH}}$

**step 3: in the second reaction step the basic peroxide replaces  $\text{BR}_2$  with  $-\text{OH}$  (there is ALWAYS RETENTION of stereochemistry in this step)**

