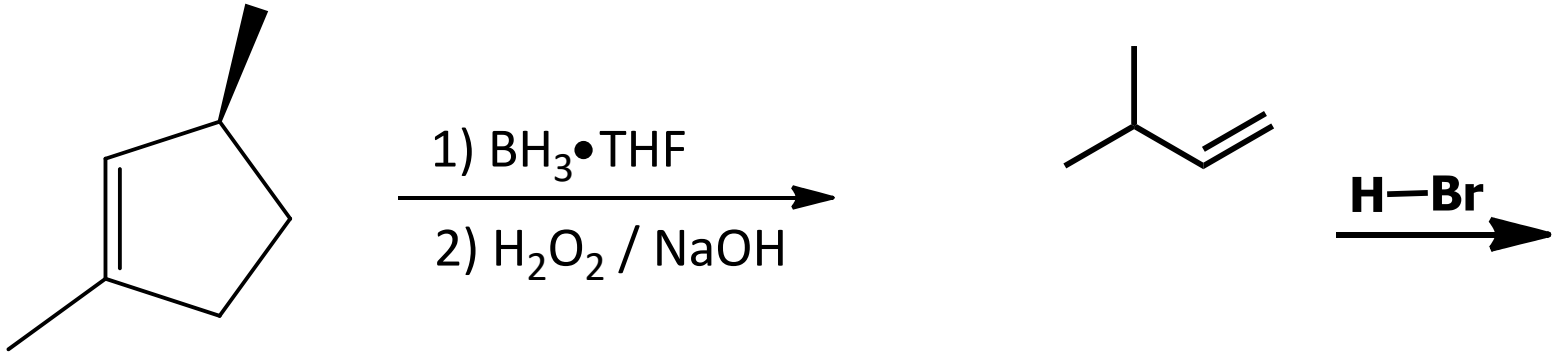
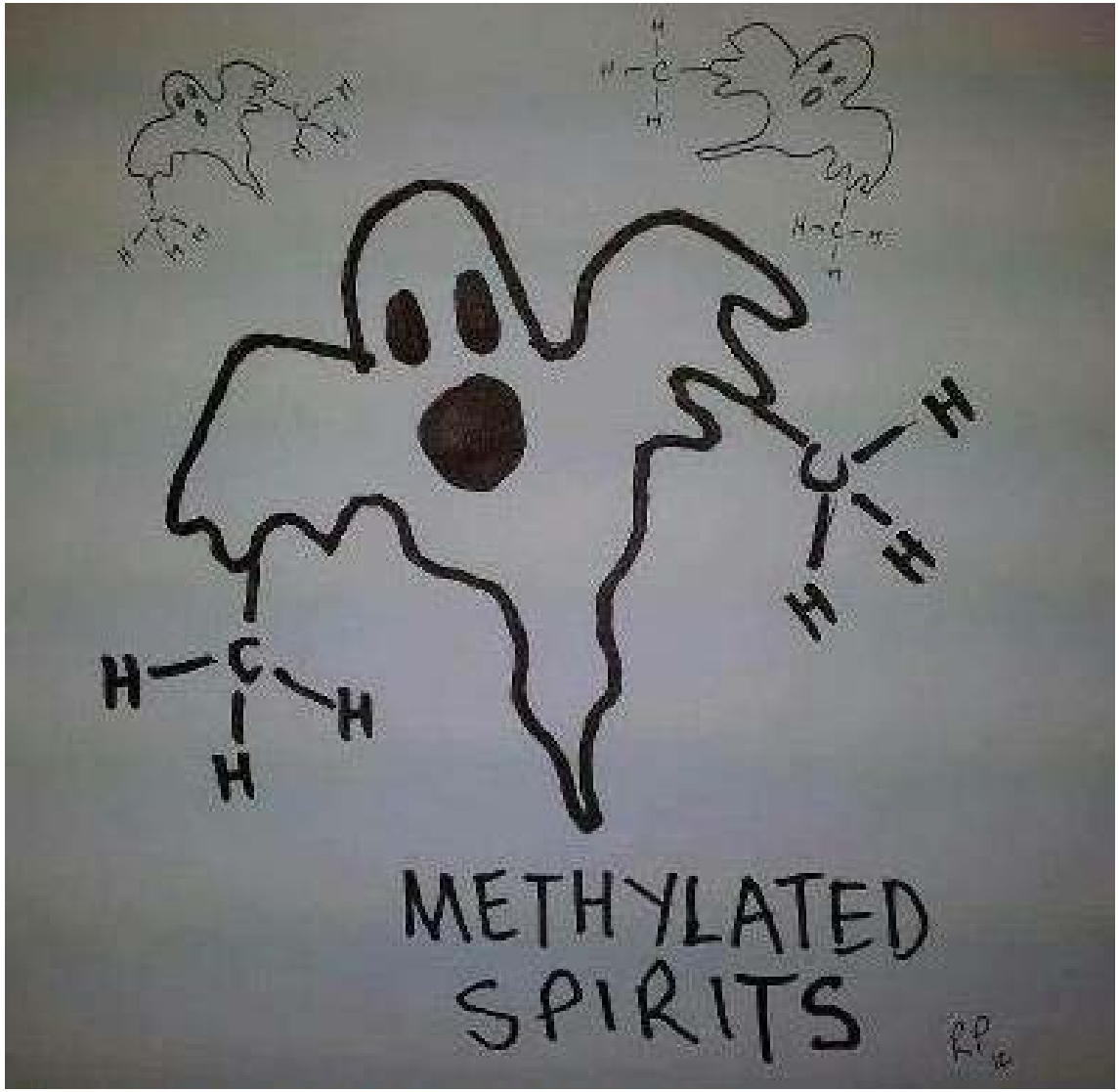
Chapter 8 part 4:

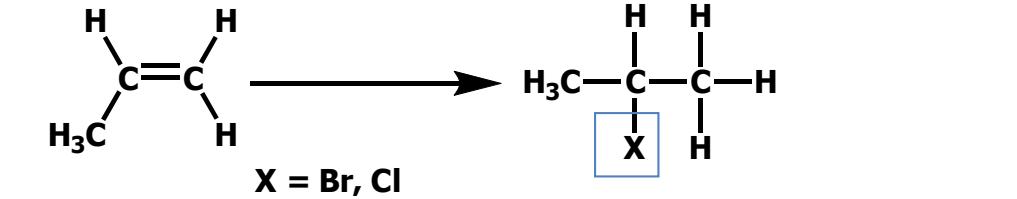
Halogenation/Halohydrins formation

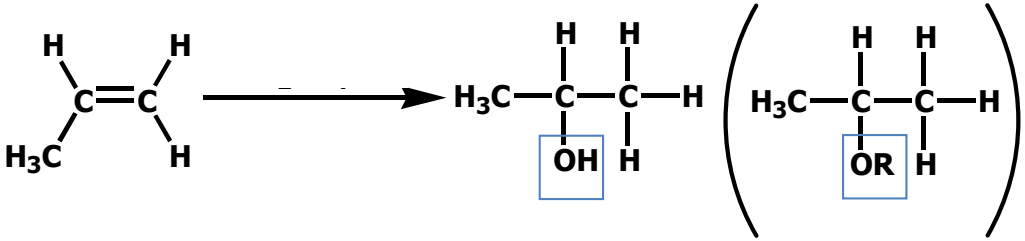
- Today Hydrogenation Halogenation/Halohydrin formation

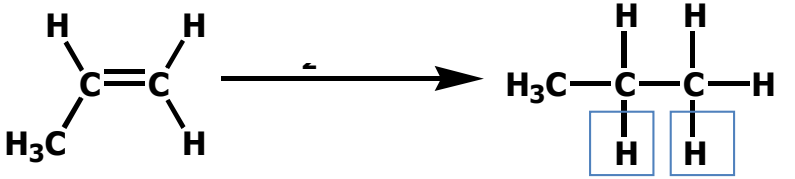


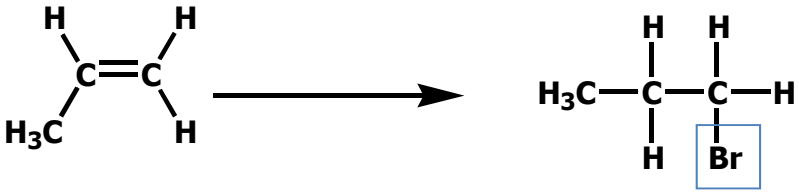

METHYLATED
SPIRITS

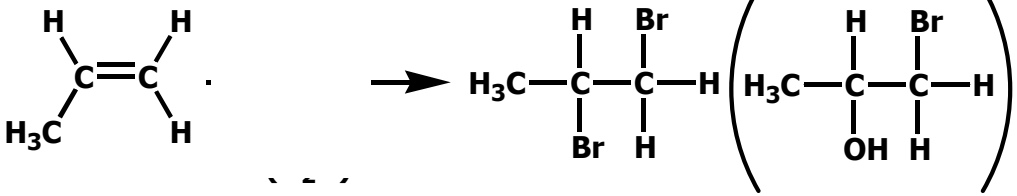
Addition Reactions:





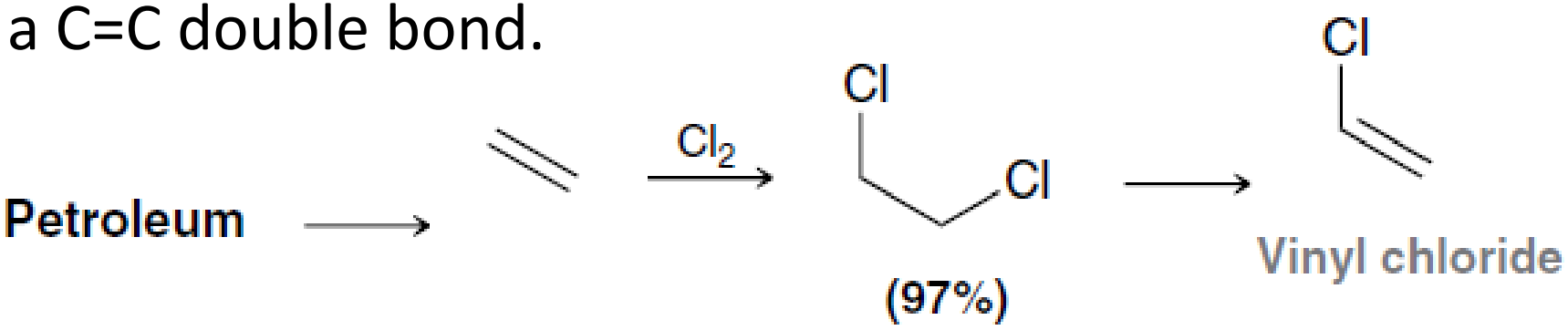




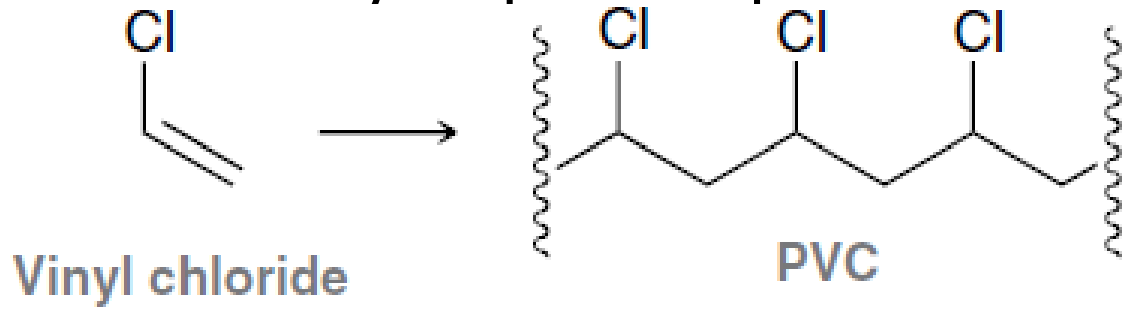


Halogenation

- Halogenation involves adding two halogen atoms across a C=C double bond.



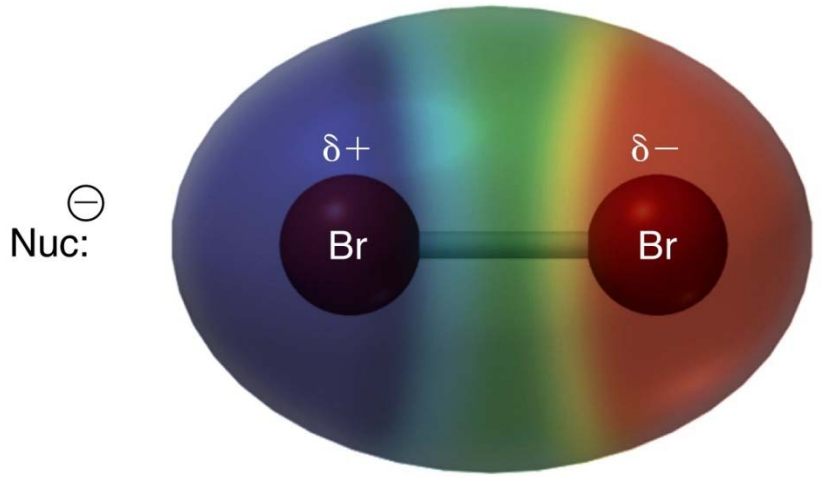
- Halogenation is a key step in the production of PVC.

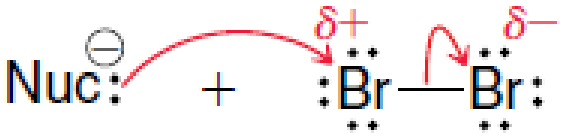


- Halogenation with Cl_2 and Br_2 is generally effective, but halogenation with I_2 is too slow, and halogenation with F_2 is too violent.

Halogenation

- Let's look at the reactivity of Br_2. Cl_2's reactivity is similar.
- It is nonpolar, but it is polarizable. WHY?
- Does the Br_2 molecule have a good leaving group attached to it?

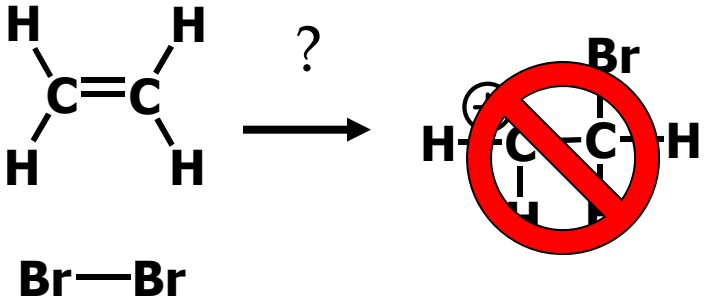


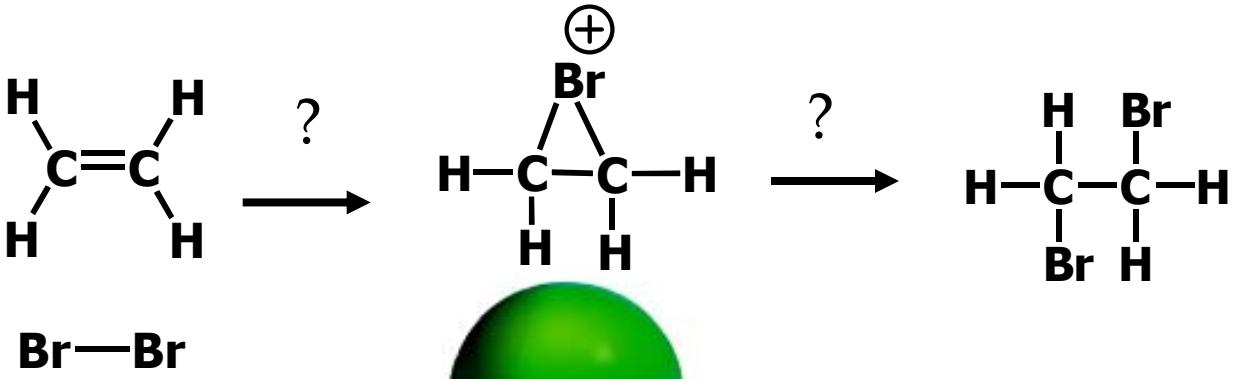


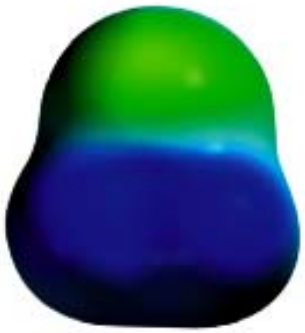
Addition of Halogens to Alkene

Imagine an alkene attacking Br_2.

Imagine an alkene attacking Br_2. You might imagine the formation of a carbocation.

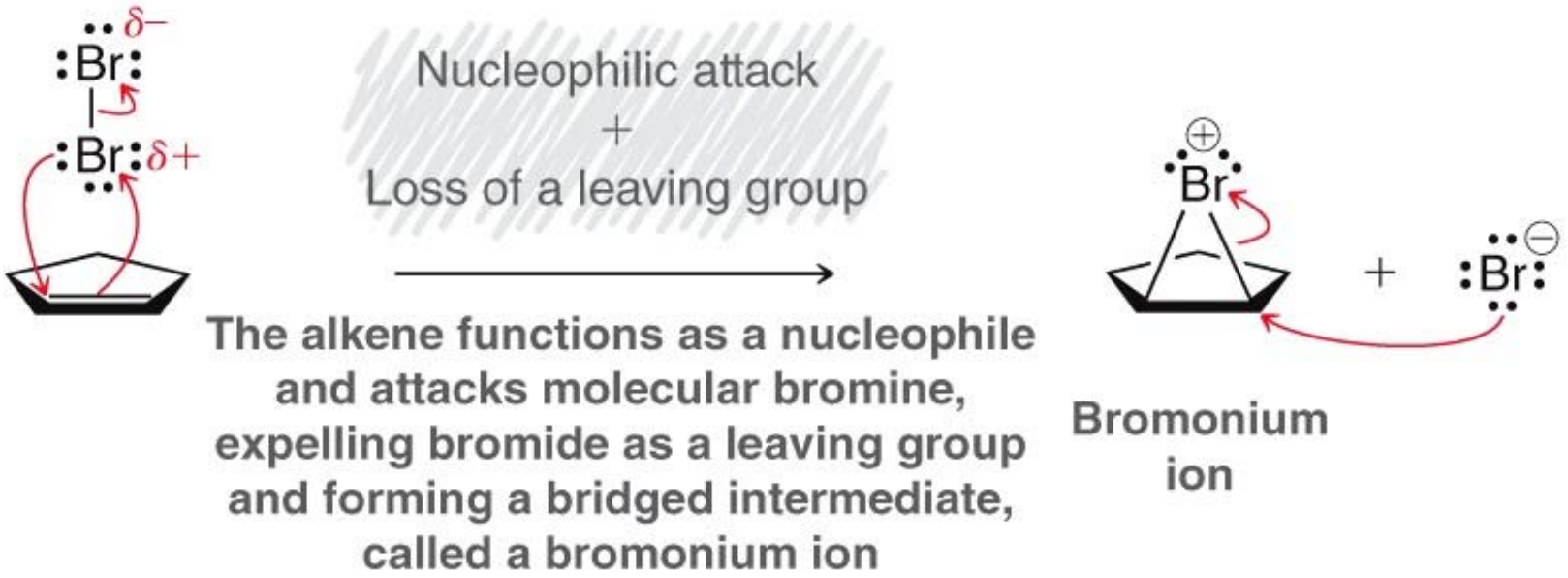




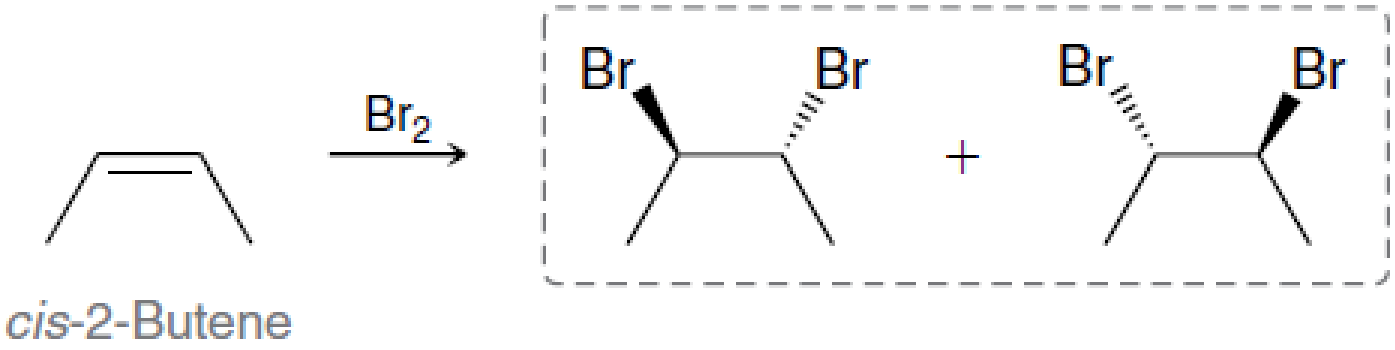


Bromonium Ion

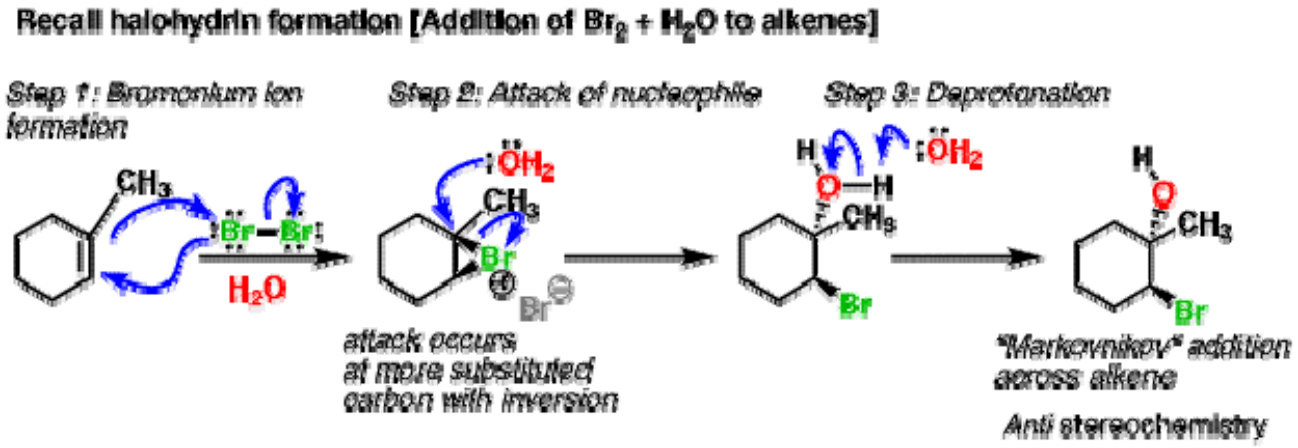
Halogenation

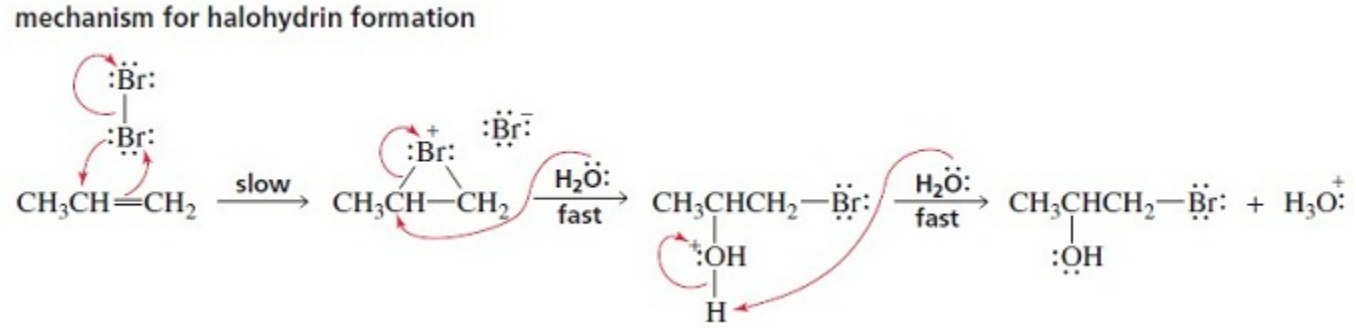


- Only ANTI addition is observed. WHY?



Addition of Halogens in or with Water



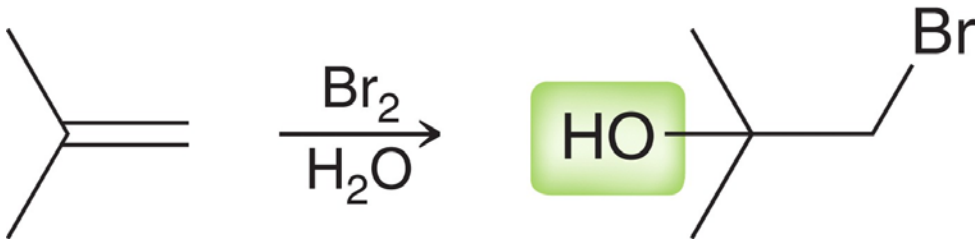


Halohydrins are formed when halogens (Cl_2 or Br_2) are added to an alkene with WATER as the solvent.

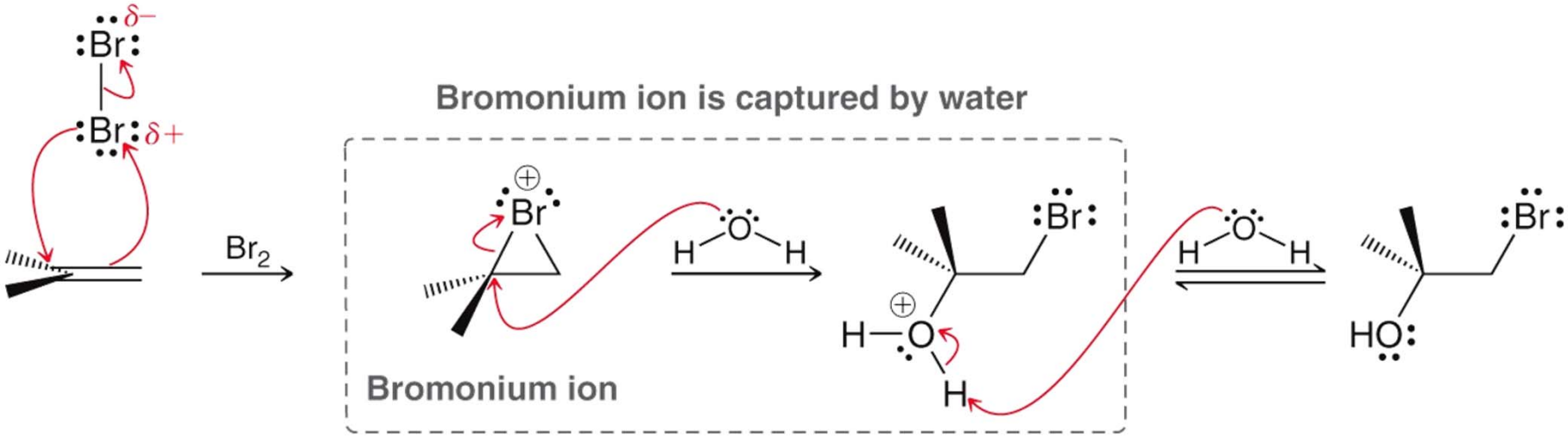
The bromonium ion forms from Br_2 + alkene, and then it is attacked by water.

Halohydrin Regioselectivity

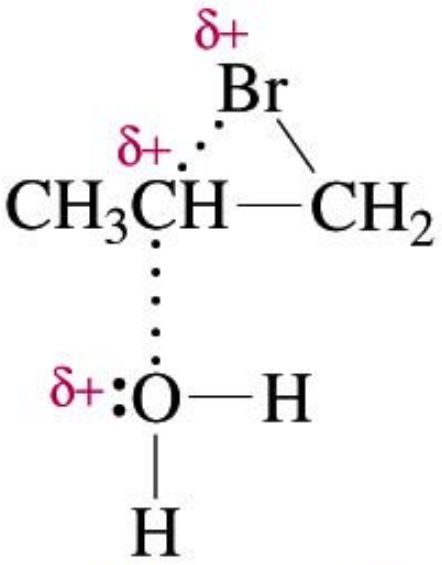
- The –OH group ALWAYS adds to the more substituted carbon



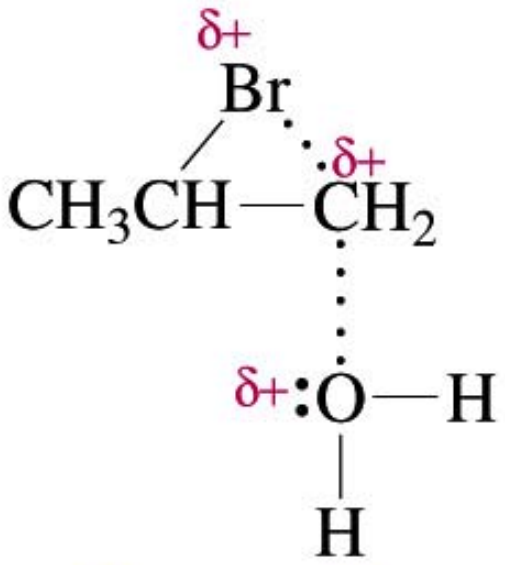
- The key step that determines regioselectivity is the attack of water on the bromonium ion



Consider the transition states …



more stable transition state

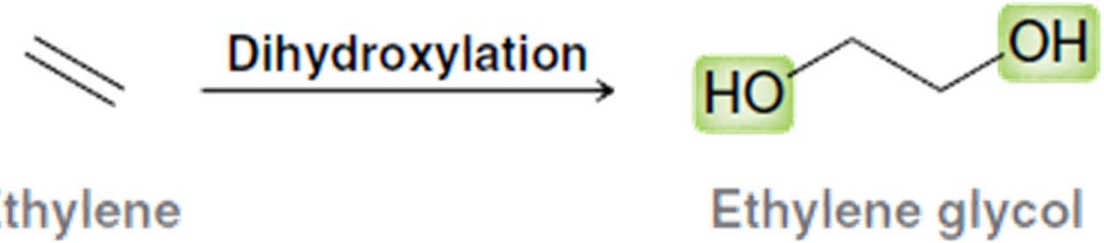


less stable transition state

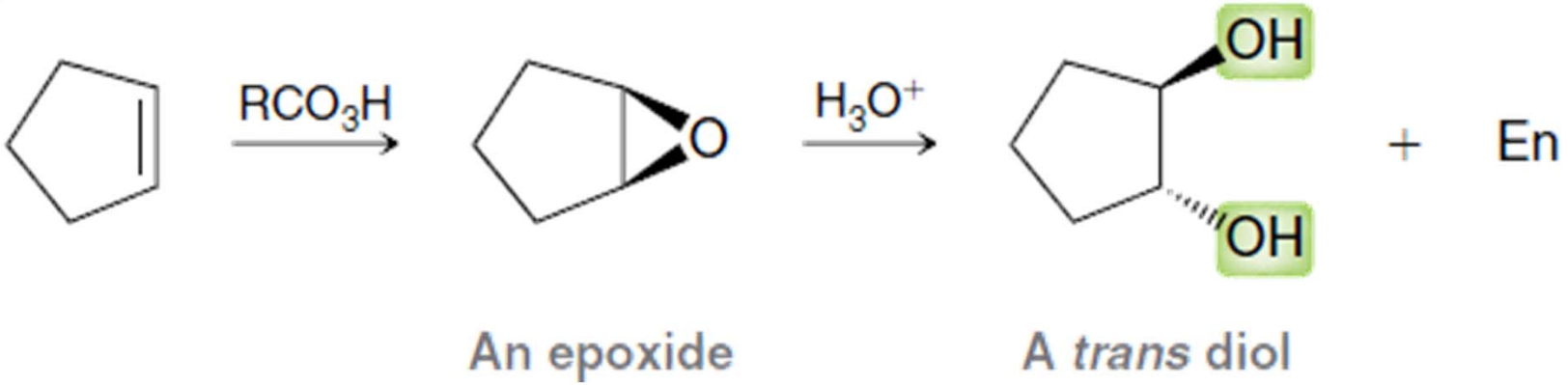
When water attacks the bromonium ion, it will attack the side that goes through the lower energy transition state.

Anti Dihydroxylation

- Dihydroxylation occurs when two –OH groups are added across a C=C double bond.

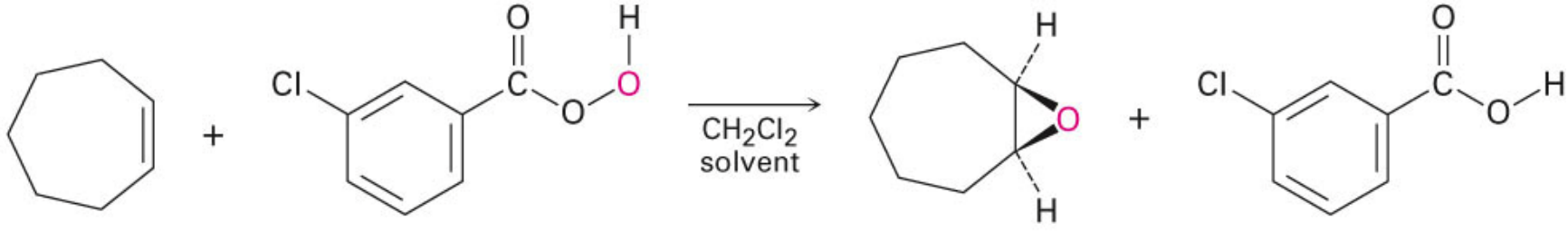


- ANTI dihydroxylation is achieved through a multi-step process.



Preparation of Epoxides:

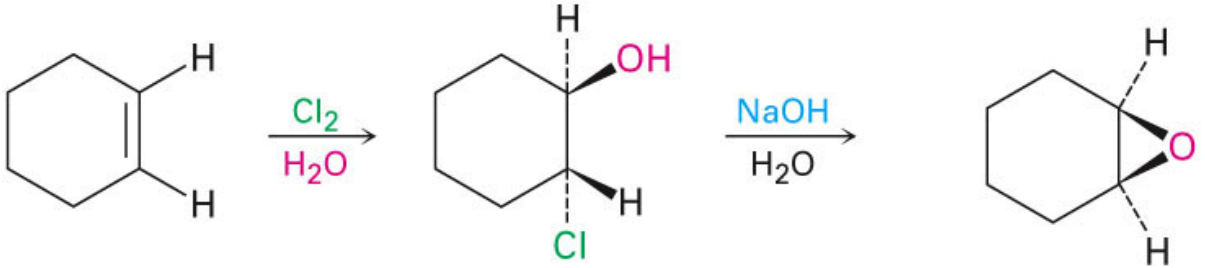
- Treatment of an alkene with a peroxyacid gives an epoxide



Cycloheptene | ***meta*-Chloroperoxy-benzoic acid** | **1,2-Epoxy-cycloheptane** | ***meta*-Chloro-benzoic acid**

mCPBA

- Treatment of a halohydrin with base gives an epoxide

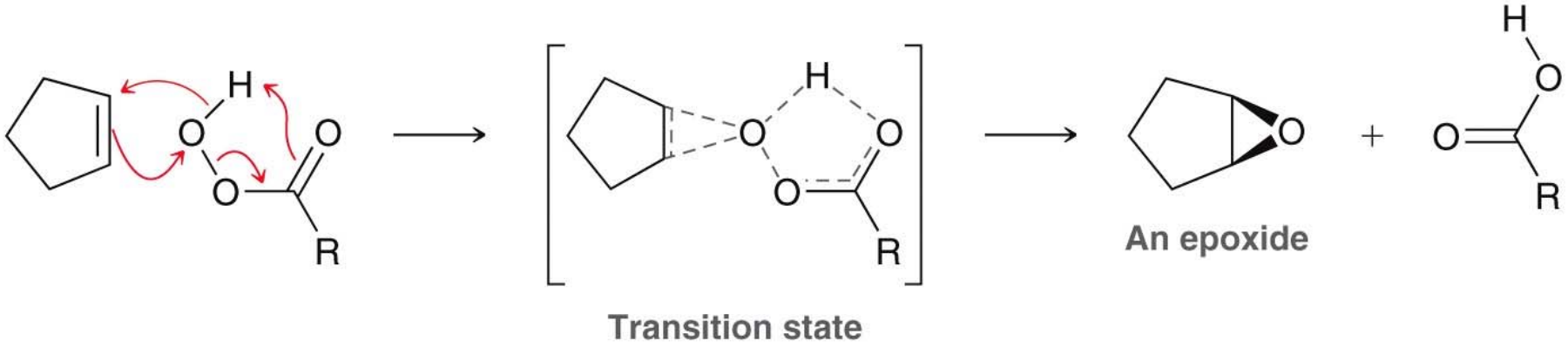


Cyclohexene | ***trans*-2-Chloro-cyclohexanol** | **1,2-Epoxy-cyclohexane**

A three membered ring ether is called an **Epoxide** or an oxirane

Anti Dihydroxylation

- First, an epoxide is formed



- Replacing the relatively unstable O-O single bond is the thermodynamic driving force for this process
- Is there anything unstable about an epoxide?
- Will an epoxide likely to react as a nucleophile (Lewis base) or as an electrophile (Lewis acid)?

For Next Time….

End Chapter 8 on Friday

Exam #2 Wednesday!

Next week Chapter 9

Suggested Homework Problems Chapter 8

1, 2, 5, 9, 12,13, 18, 24, 27, 31, 42-46, 52, 57,62,63

Suggested Homework Problems Chapter 9

1,7,9,13,18,20,32-37, 41,44,52,57