

Chapter 13:Highlights

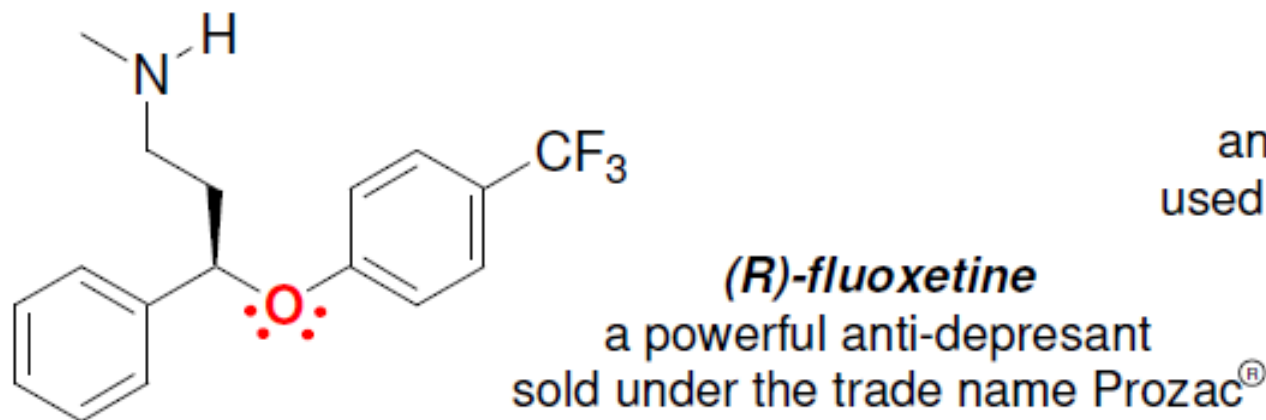
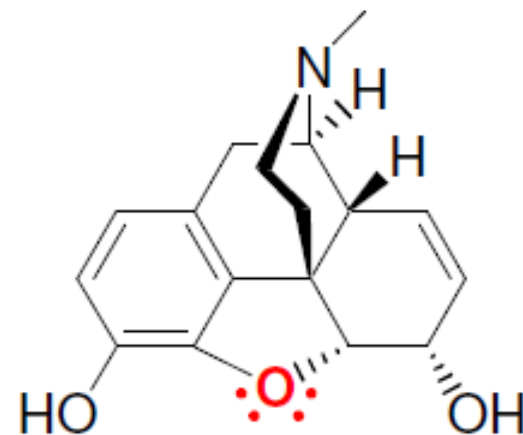
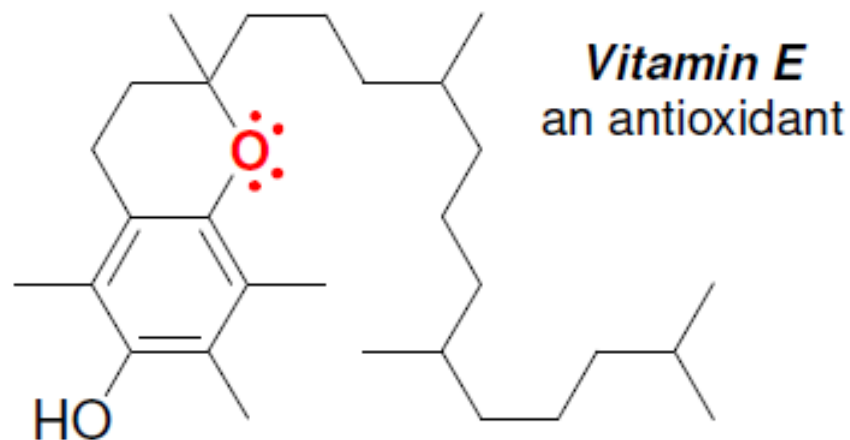
Today –(Ch. 13. 1- 13.6, 13.8)

Wednesday (Ch.13.9-13.12)

We will not cover nomenclature of epoxides.

CHAPTER 13: Introduction to Ethers

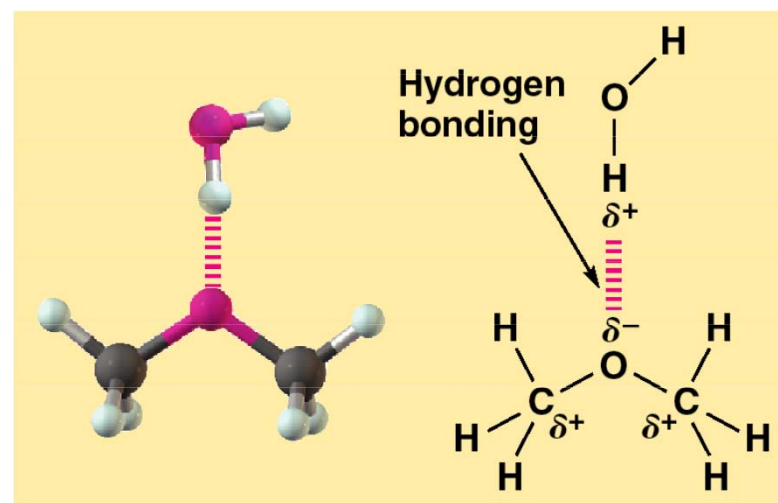
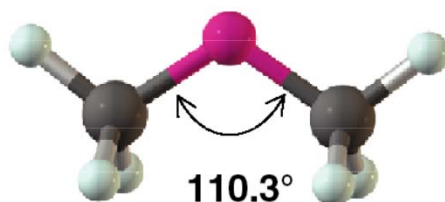
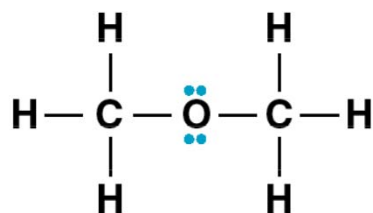
- Compounds containing ether groups are quite common.



Ethers: Structure and Nomenclature

- An **ether** has two organic groups bonded to the same oxygen atom, $R-O-R'$

dimethyl ether



- Tetrahedral bond angle
- Oxygen is sp^3 -hybridized
- Oxygen atom gives ethers a slight dipole moment

Naming Ethers

For symmetrical ethers, name the alkane on each side and then add "ether."

For unsymmetrical (or asymmetrical) ethers, name the alkane on each side, and then add "ether."



diethyl ether



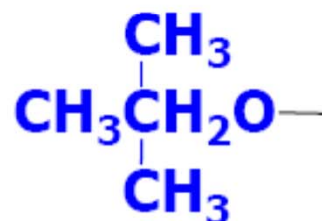
Cyclohexyl butyl ether
Butoxy-cyclohexane

Both are
Correct –
probably
see the
second
one more
often

As substituents, add "oxy" to the alkyl name:



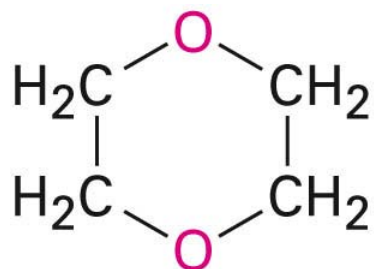
methoxy-



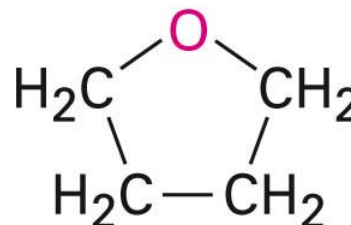
tert-butoxy-

If other functional groups are present, the ether part is considered an alkoxy substituent

Cyclic Ethers

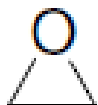


1,4-Dioxane

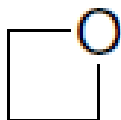


Tetrahydrofuran

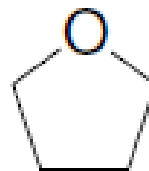
Cyclic ethers behave like acyclic ethers, except if it is 3-membered



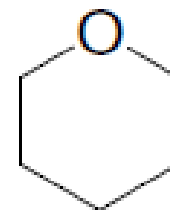
oxirane
ring system



oxetane
ring system



furan
ring system

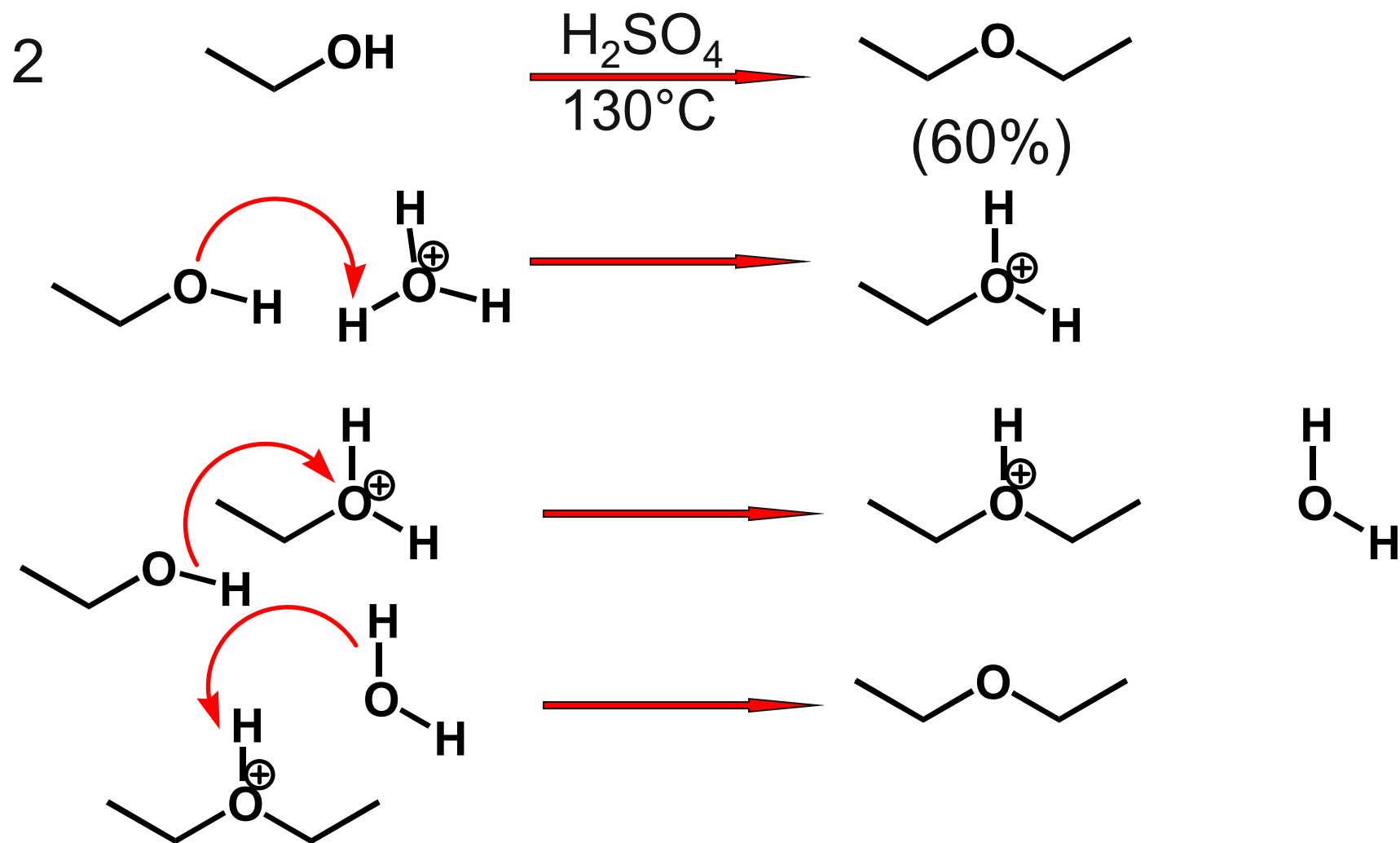


pyran
ring system

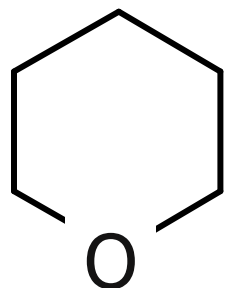
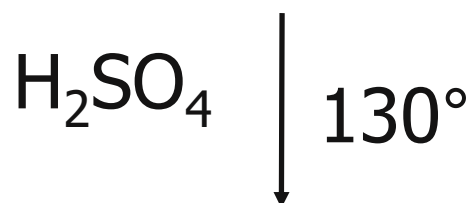
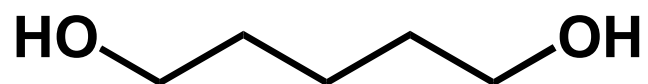
A three membered ring ether is called an oxirane or **an EPOXIDE.**

Synthesis of Ethers

Ethers are prepared industrially by acid-catalyzed dehydration of primary alcohols

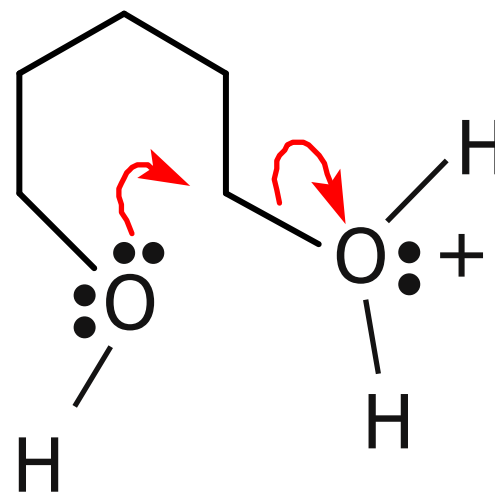


Intramolecular Analog



(76%)

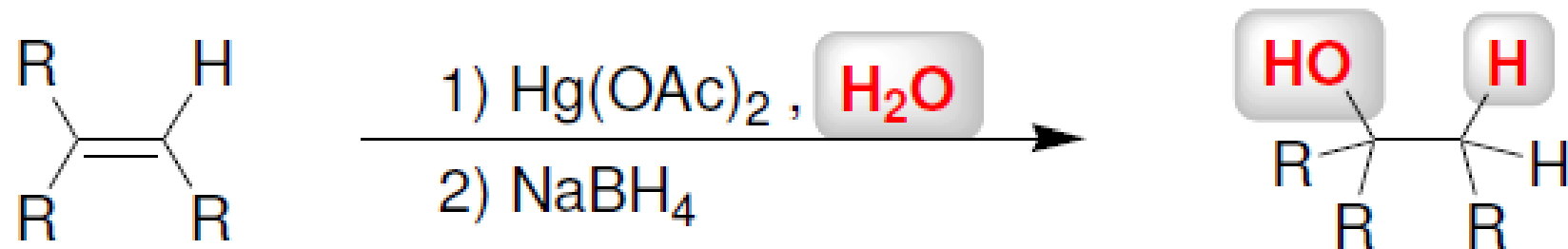
via:



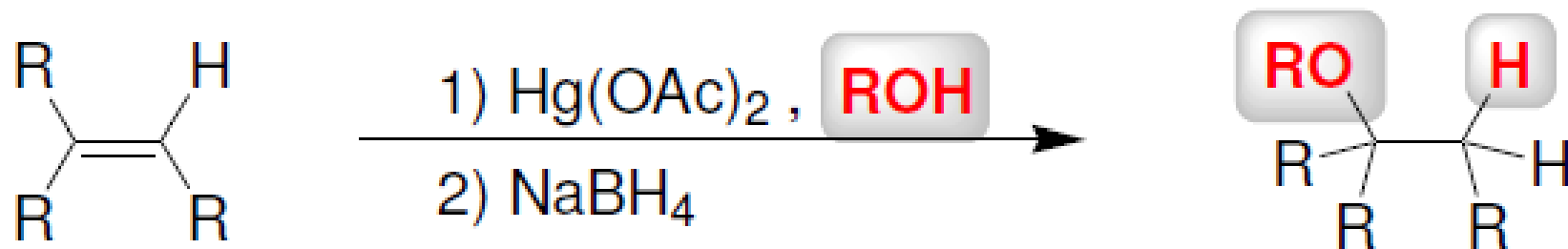
reaction normally works well only for
5- and 6-membered rings

Preparation of Ethers

- Recall from Section 9.5 that oxymercuration-demercuration can be used to synthesize alcohols.

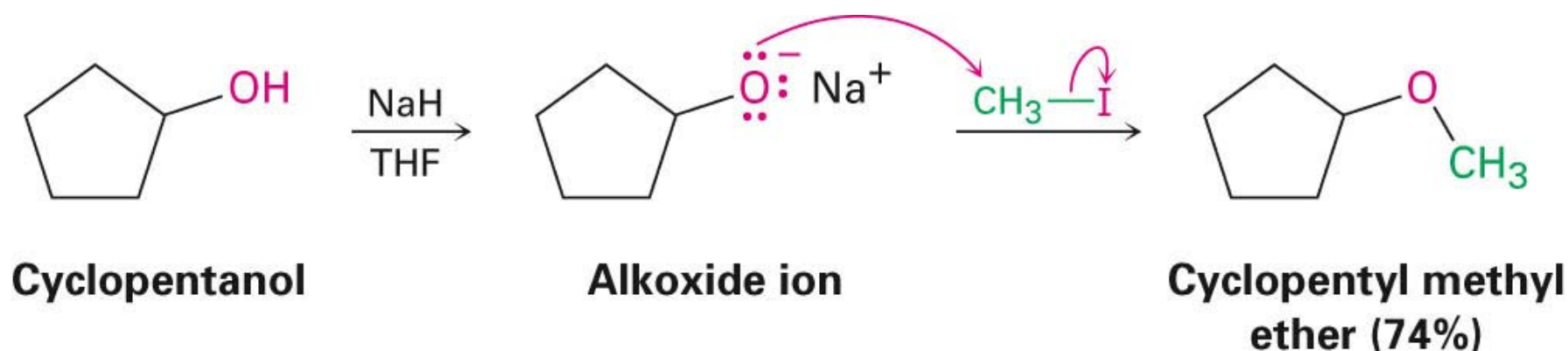


- Similarly, alkoxymercuration-demercuration can be used to synthesize ethers.



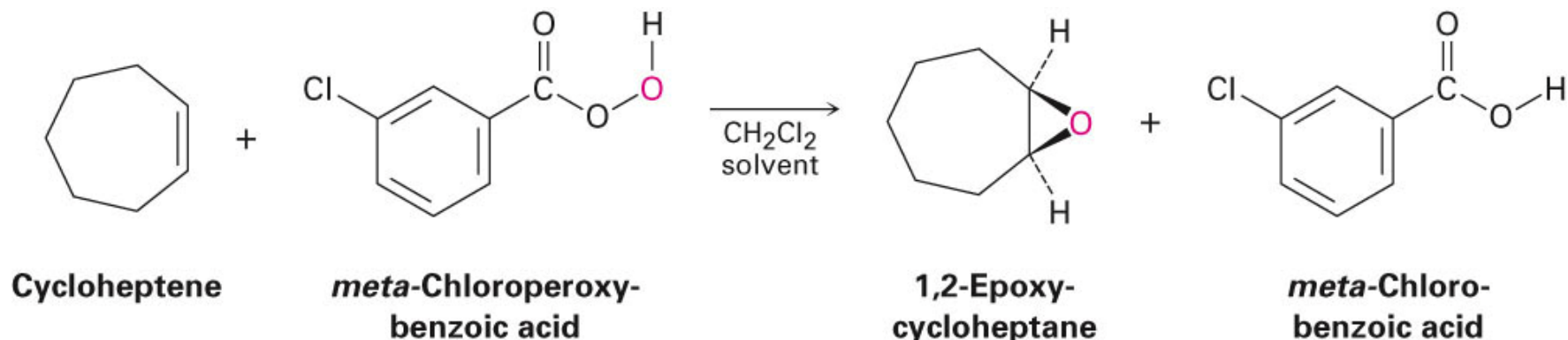
The Williamson Ether Synthesis

- Reaction of metal alkoxides and primary alkyl halides and tosylates
- Best method for the preparation of ethers
- Alkoxides are prepared by reaction of an alcohol with a strong base Ex: NaH or NaNH₂

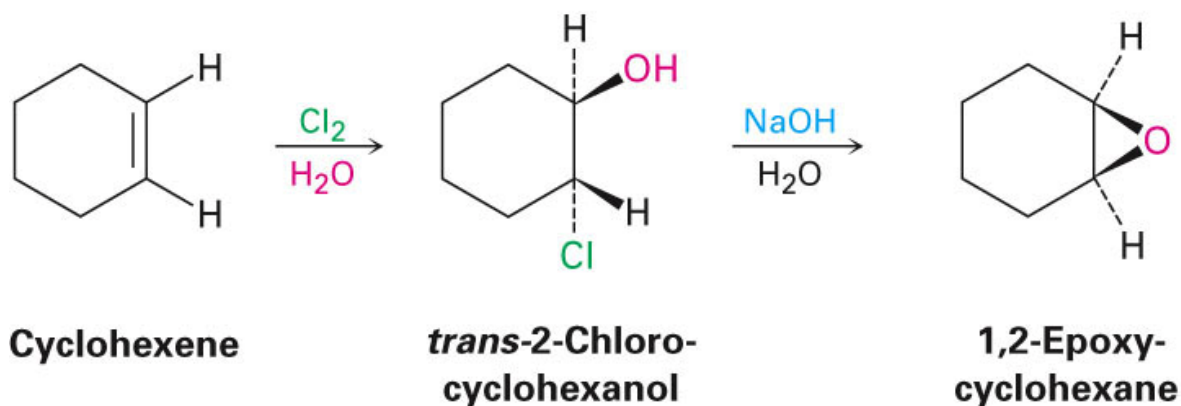


Preparation of Epoxides:

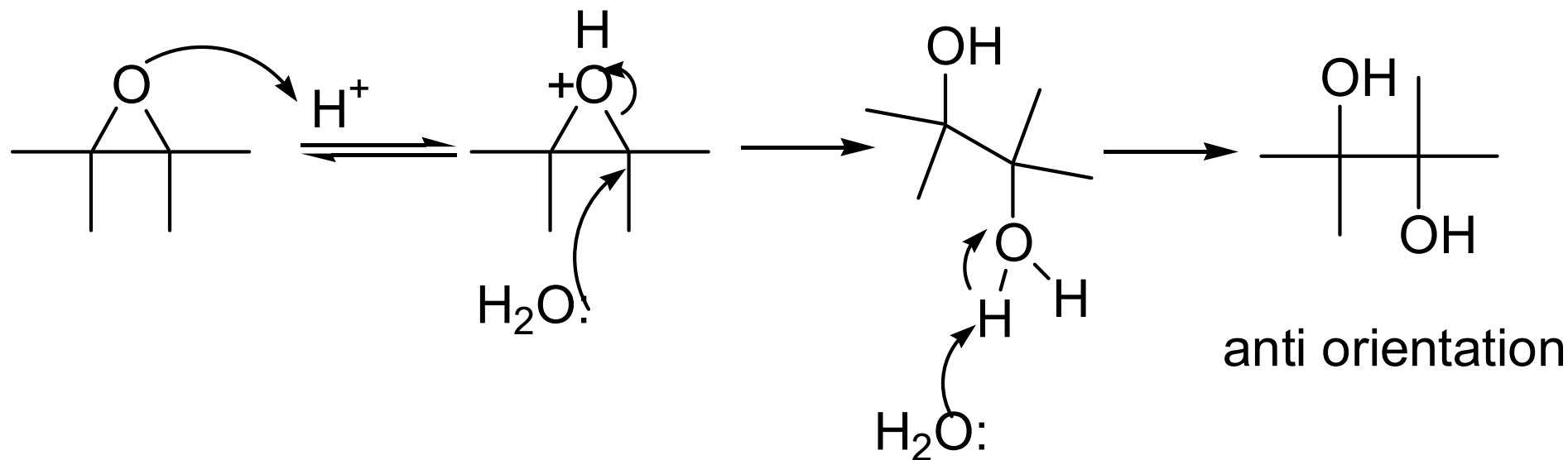
- Treatment of an alkene with a peroxyacid



- Treatment of a halohydrin with base gives an epoxide



Acid catalyzed Ring Opening of Epoxides

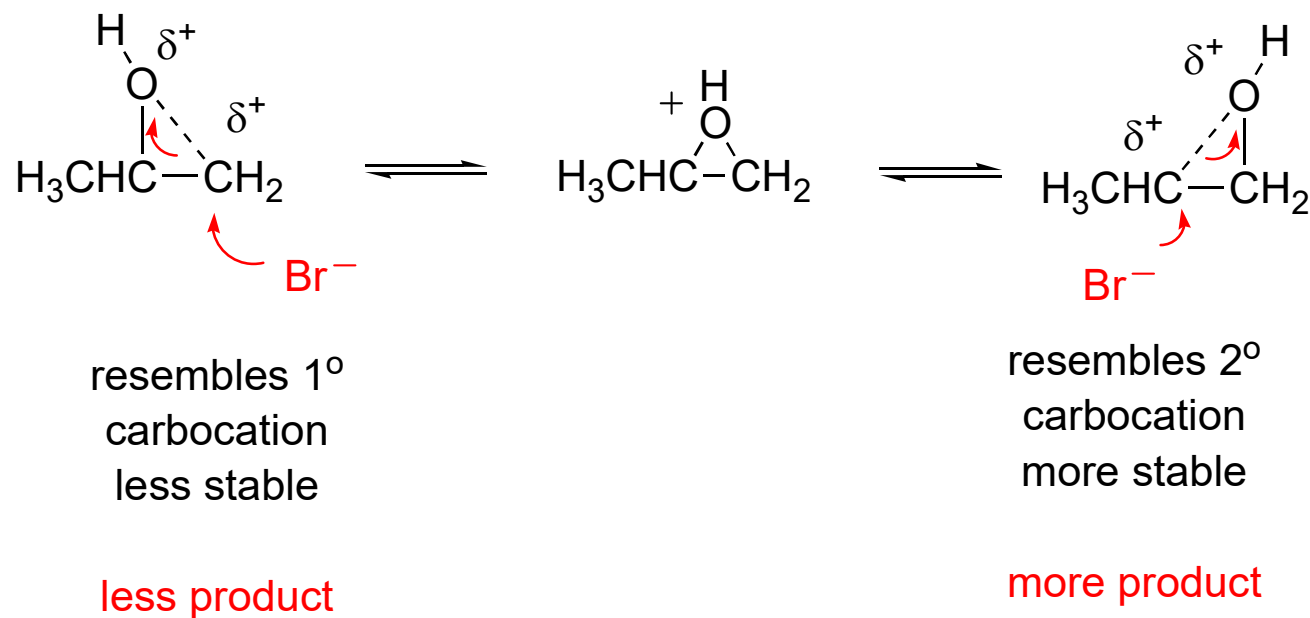


Nucleophile attacks more substituted carbon of protonated epoxide

Inversion of configuration at site of nucleophilic attack

Mild acid reacts with epoxides in water to generate anti 1,2-diols

Regioselectivity under acidic conditions explained if we consider that protonated epoxide has slight carbocation character.



REMEMBER: When a nucleophile attacks an unprotonated epoxide (under basic conditions) the reaction is a pure $\text{S}_{\text{N}}2$ reaction

For Next Time....

Suggested Homework Problems

Chapter 13 #1, 5, 10, *18, 26, 29, 37, 38, 44, ***51**