**ORGANIC CHEMISTRY 1 LECTURE GUIDE 2019** 

BY RHETT C. SMITH

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## Organic Chemistry 1 Lecture Guide 2019

By Rhett C. Smith, Ph.D.

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**Companion Books from the Proton Guru:** 

Organic Chemistry 1 Reactions and Practice Problems 2019
by Rhett C. Smith

Organic Chemistry 1 Primer 2019,

by Rhett C. Smith, Andrew G. Tennyson, and Tania Houjeiry

### Lecture Topic II.15: Ring-Opening of Epoxides

Ring Strain Makes Epoxides More Reactive than other Ethers

An epoxides is a specific type of ether consisting of a 3-membered ring having an oxygen atom in the ring:



Epoxides are much more reactive than most other ethers because:



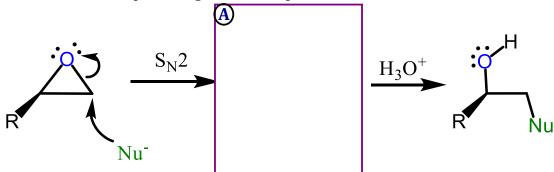
Nucleophiles can thus attack one of the electrophilic carbon atoms, alleviating the ring strain:



### Lecture Topic II.15: Ring-Opening of Epoxides

### Even a Poor Nucleophile will Attack a Cationic Species

Under basic (or simply non-acidic) conditions a typical  $S_N2$  reaction occurs, which requires a good nucleophile:



f B Like other  $S_N 2$  reactions on neutral substrates, the nucleophile preferentially attacks:

Note that after ring-opening, the oxygen:

## **Notes**

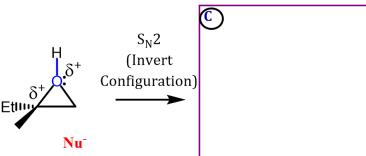
### Lecture Topic II.15: Ring-Opening of Epoxides

### A Good Nucleophile is Needed to Attack a Neutral Species

Under acidic conditions, the epoxide oxygen is protonated just as in acid cleavage of other ethers:



The less substituted side is attacked unless there is a tertiary site. A tertiary C next to an O with formal charge of +1 has a lot of positive charge, and will be attacked preferentially:

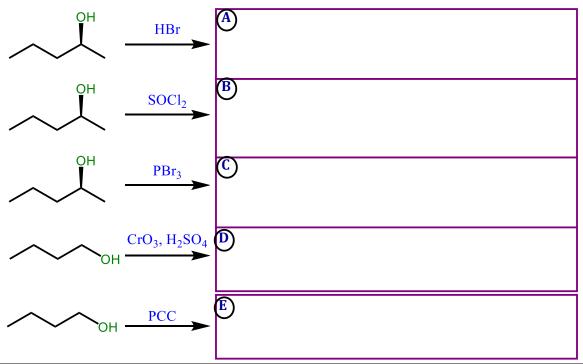


Under acidic conditions, the nucleophile will attack the tertiary C if there is one. Otherwise, the less-hindered side is attacked, just as under basic conditions.

<u>Notes</u>			

# Lecture Topics II.11-15: Recap of Alcohol and Ether Reactivity Substitution, Elimination and Oxidation

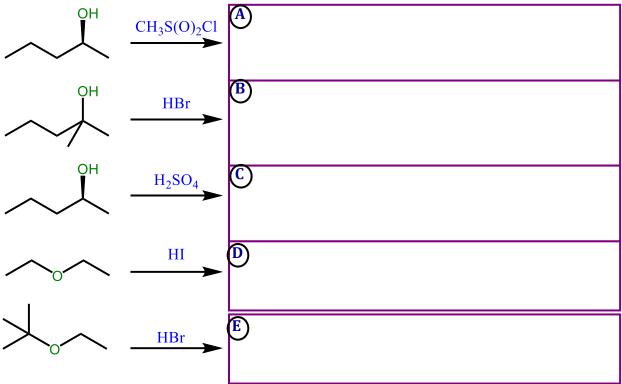
**Example.** Predict the major product of each reaction, showing stereochemistry where applicable.



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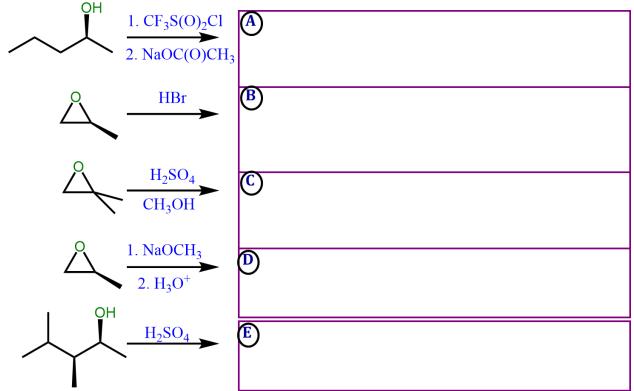
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<u>Notes</u>		
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