

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

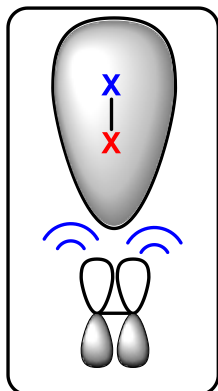
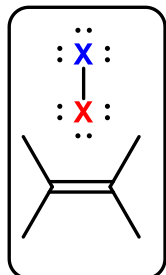
*Organic Chemistry 1 Primer 2019,*

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

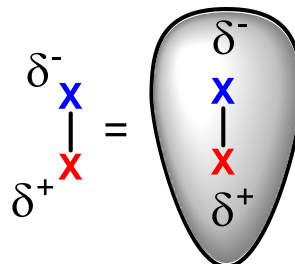
Lecture Topic III.6: Halogenation and Halohydrin Formation  
Formation of a Halonium Intermediate

When a halogen ( $\text{Cl}_2$  or  $\text{Br}_2$ ) comes in contact with an alkene, it sets off a series of events:

1. C=C pi electrons repel 'soft' electron cloud of halogen



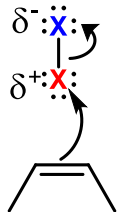
2. This causes an induced dipole in the halogen:



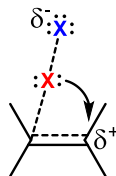
The partially positive end of the induced dipole now has an attraction for the nucleophilic alkene pi bond electrons ...

Notes

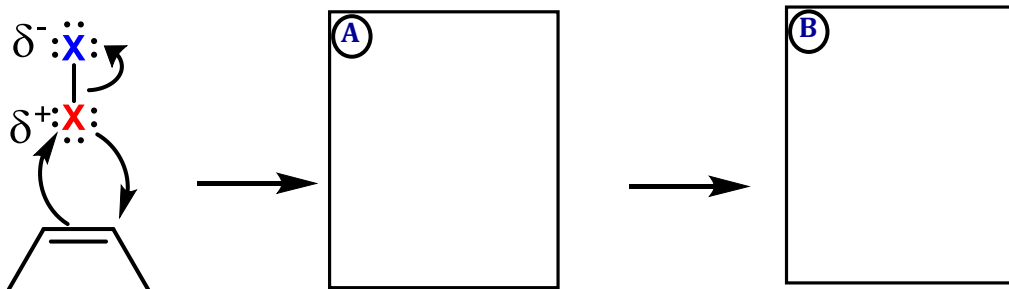
3. The polarized halogen begins an electrophilic addition to the alkene, losing  $X^-$ :



4. As the positive charge begins to form on the carbon, a halogen lone pair is naturally attracted to it:

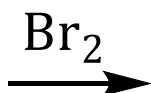
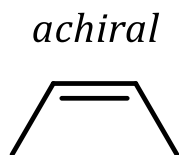


So that the final arrow pushing to give the resultant **halonium intermediate** and final  $S_N2$  reaction is:



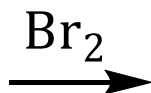
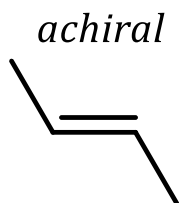
Notes

The formation of the halonium intermediate (chloronium if  $X = \text{Cl}$ , bromonium if  $X = \text{Br}$ ) is concerted, so the relative distribution of substituents in the alkene is maintained. Keep in mind the stereochemistry!



(A)

*Racemic*



(B)

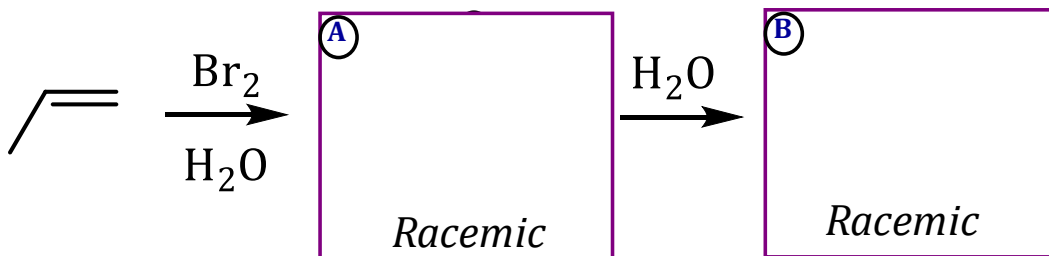
*Meso Compound*

Notes

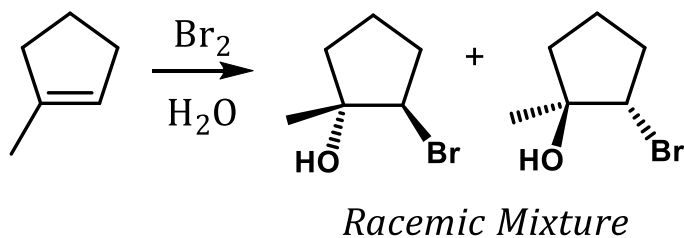
## Lecture Topic III.6: Halogenation and Halohydrin Formation

### Reactivity of a Halonium Intermediate

If an excess of water is present when the halonium intermediate forms, then the  $\text{H}_2\text{O}$  will serve as a nucleophile. A species in which an OH and Br units sit on adjacent carbon atoms is called a **Halohydrin**.



Note that since the water attacks the more substituted side, this is a **Markovnikov product**. The water attacks from the backside of the leaving group Br, so the OH and the Br end up **added anti-** to one another:



Notes