

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.8: Stereoelectronic Effects in the E2 Reaction  
Stereoelectronic Requirements

In order for the E2 reaction to work, the H and X to be eliminated must be **antiperiplanar**.

“Antiperiplanar” means the two groups are in the *anti*- conformation and in the same plane.

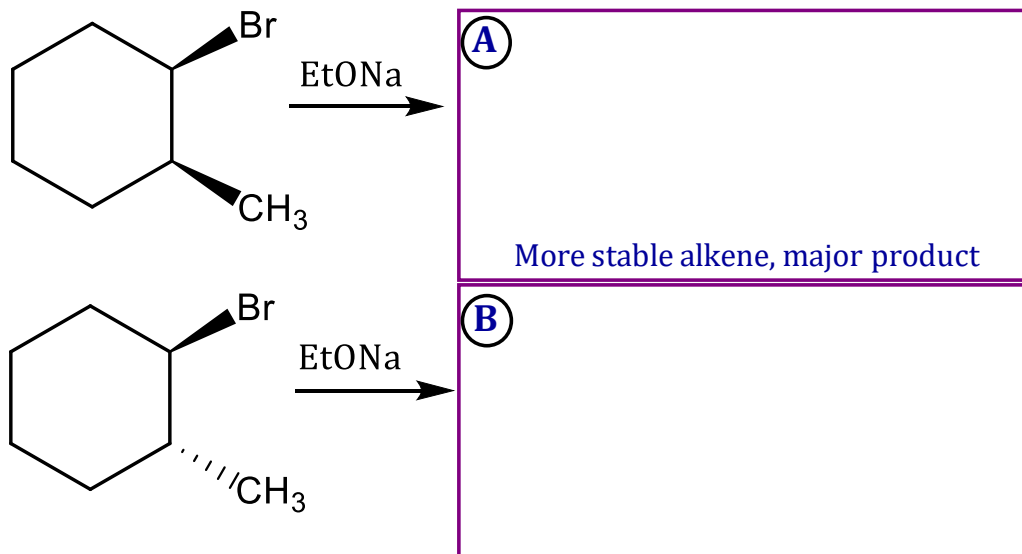
This is what is known as a **stereoelectronic** effect:

A

Notes

Lecture Topic II.8: Stereoelectronic Effects in the E2 Reaction  
Influence on Mechanistically-Accessible Products

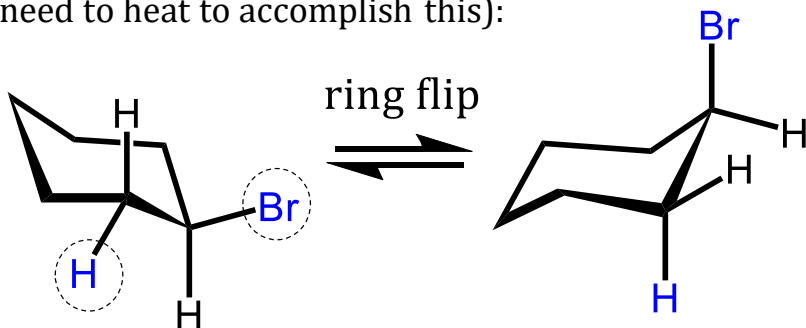
The stereoelectronic requirements of the E2 reaction must be considered when we attempt to predict products of a reaction.



Less stable alkene, but no antiperiplanar H available for elimination to form more stable alkene. Note that the configuration about the chiral C is preserved because it was not involved in the reaction.

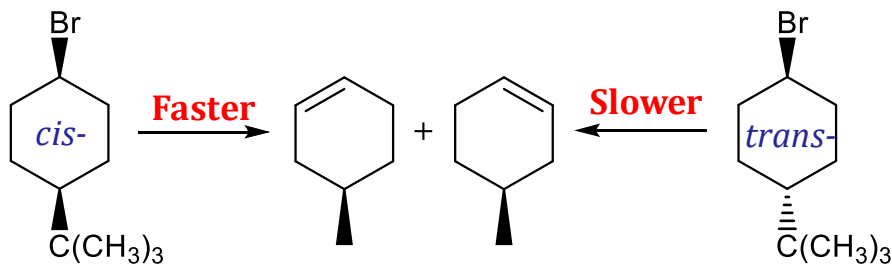
Notes

For reaction on a cyclohexane derivative, eliminated groups must be axial to be antiperiplanar. If the eliminated H and leaving group are not axial in the most stable conformation, a ring flip may be necessary (may need to heat to accomplish this):

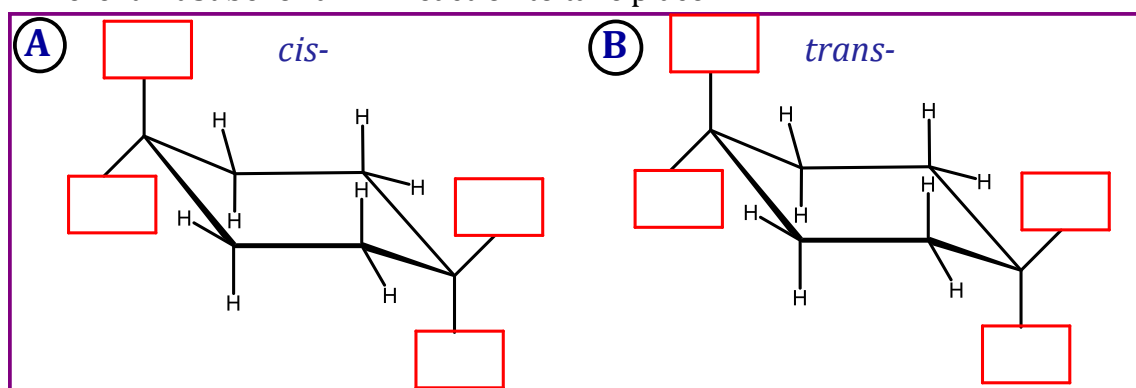
**A****B**Notes

Lecture Topic II.8: Stereoelectronic Effects in the E2 Reaction  
Conformational Analysis to Explain Reaction Rates

**Example.** The *cis*- isomer of 1-bromo-4-*t*-butylcyclohexane reacts by E2 reaction 500 times faster than does the *trans*- isomer. Why?

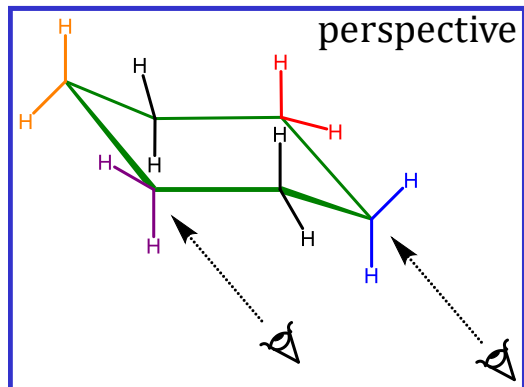


Start by drawing each reagent with Br (leaving group) in an axial position, where it must be for an E2 reaction to take place:

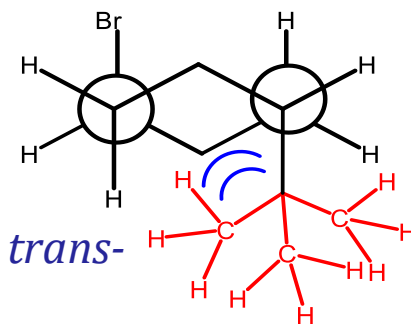
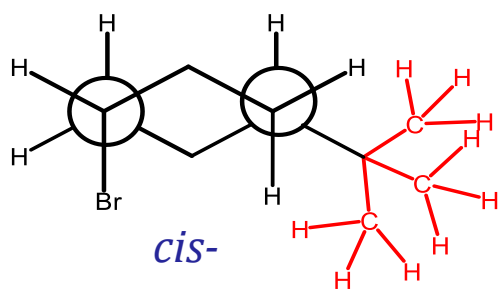


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Lecture Topic II.8: Stereoelectronic Effects in the E2 Reaction  
Conformational Analysis to Explain Reaction Rates



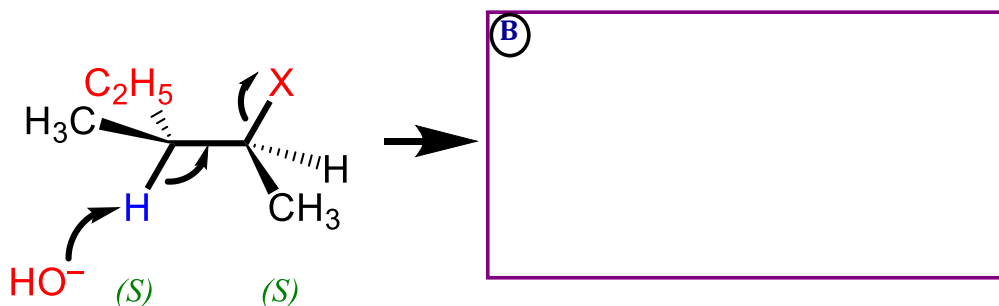
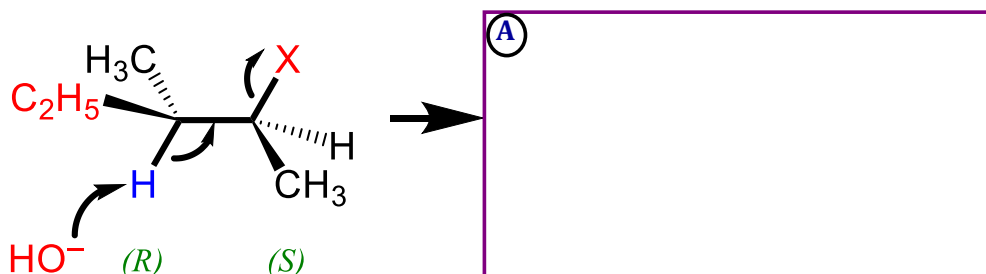
In the *cis*- conformation, when the leaving group is axial, the sterically encumbered *t*-butyl is equatorial. In the *trans*- conformation, both *t*-butyl and bromide can be equatorial. As a result, the *trans*- isomer reacts much more slowly (needs an energetically unfavorable ring flip to get Br axial to react!)



Notes

Lecture Topic II.8: Stereoelectronic Effects in the E2 Reaction  
Substrate Configuration Influences Accessible Products

There are instances when only one H is present for elimination to form the most-substituted alkene. In these cases the antiperiplanar requirement may enforce formation of one alkene stereoisomer:



Notes