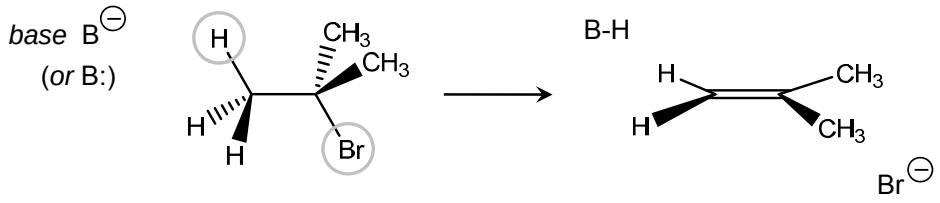
Elimination Reactions

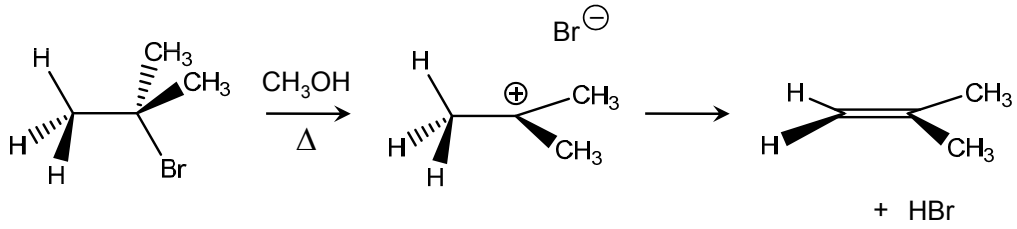
- Elimination reactions generate alkenes via the loss of a leaving group and a proton.
- The proton must be one carbon away from (α to) the leaving group.
- The new double bond stretches between the two carbons that used to bear the H and the leaving group.



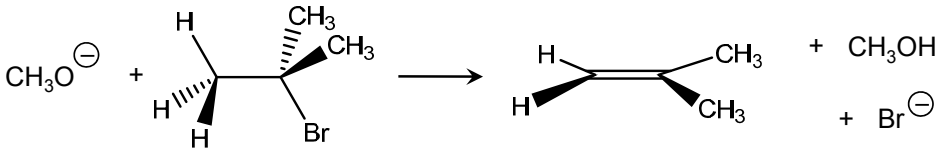
Elimination Reaction Mechanisms

- As with substitution, there are two elimination mechanisms that yield the same products.

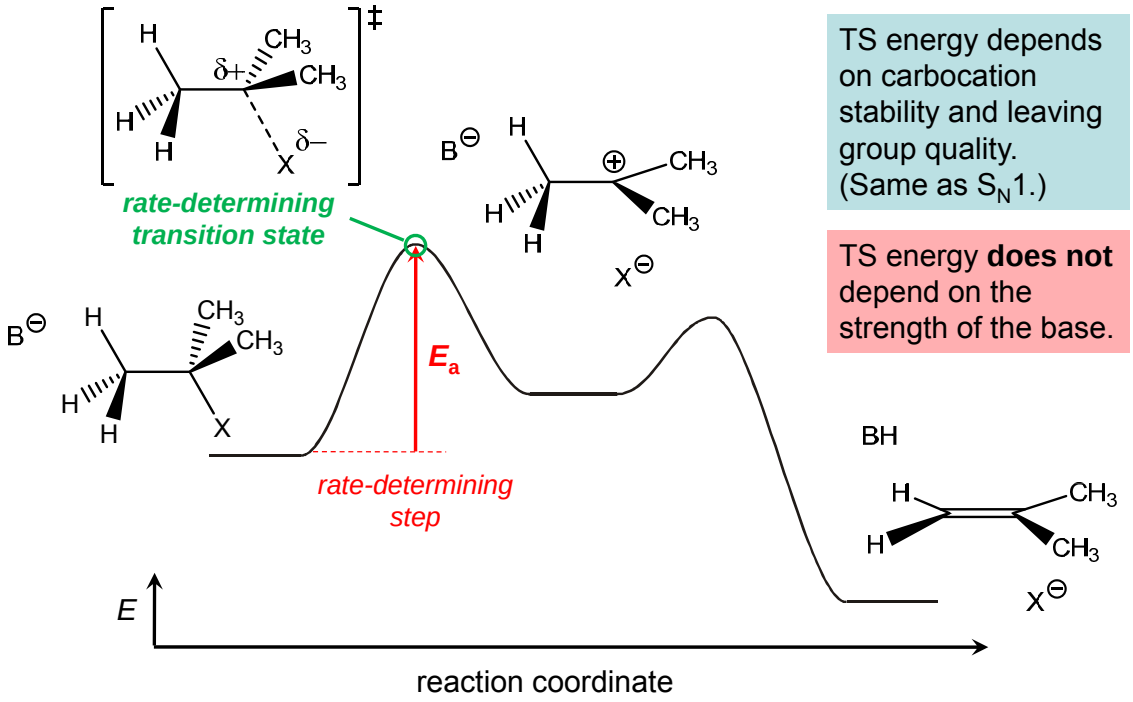
1st Order Elimination (E1) :



2nd Order Elimination (E2):



Potential Energy Diagram for E1

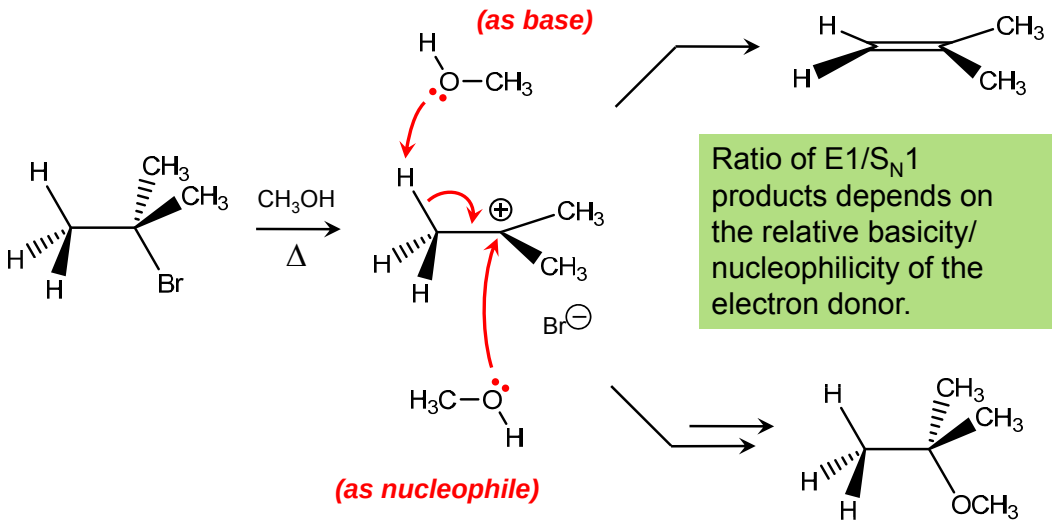


TS energy depends on carbocation stability and leaving group quality. (Same as S_N1.)

TS energy **does not** depend on the strength of the base.

E1 and S_N1 Frequently Occur Together

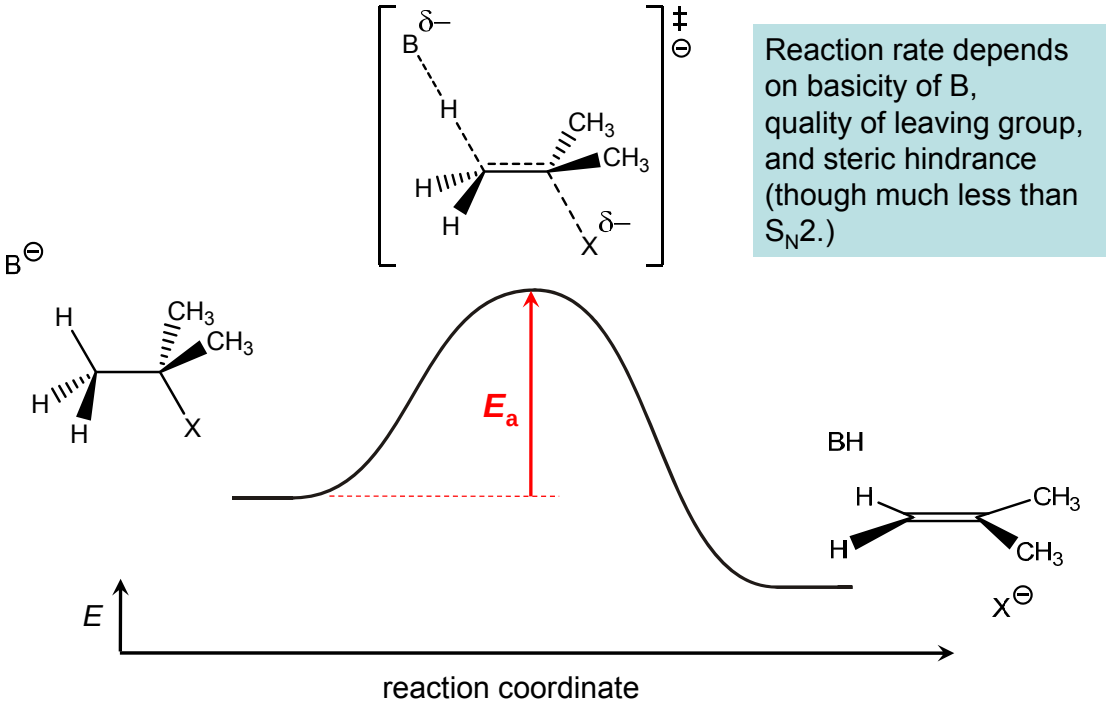
(because they pass through a common intermediate)



Ratio of E1/S_N1 products depends on the relative basicity/ nucleophilicity of the electron donor.

Nucleophilicity and basicity are often correlated. So, difficult to control.

Potential Energy Diagram for E2



Reaction rate depends on basicity of B, quality of leaving group, and steric hindrance (though much less than S_N2.)

Predicting Reaction Patterns

S_N2

- Unhindered 1° halides as substrates (2° ok)
- Better nucleophiles than bases: I^-, Br^-, $CH_3CO_2^-$, RS^-, HS^-, CN^-, N_3^-

E2

- 2° or 3° halide as substrate
- Better bases than nucleophiles: HO^-, RO^-, (esp. *t*BuO^-), $RC{\equiv}C^-$, R_3N, H_3N

S_N1

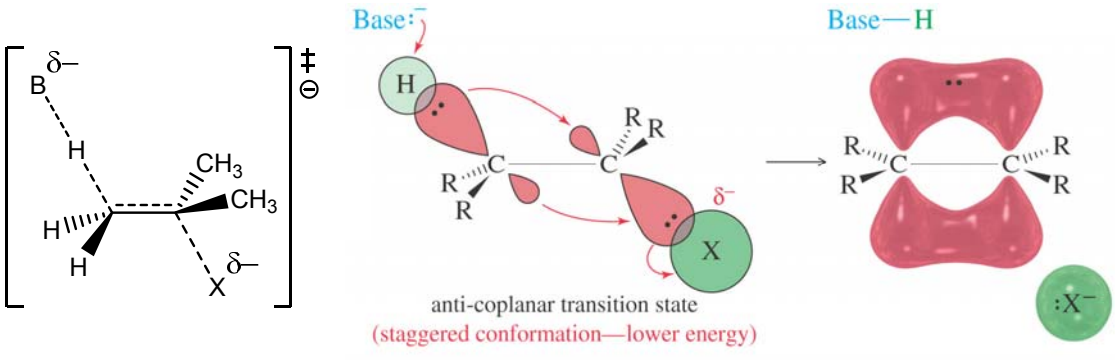
- 2° or 3° halide as substrate
- Neutral or acidic conditions
- Better nucleophiles than bases: RSH, H_2S, CH_3COOH

E1

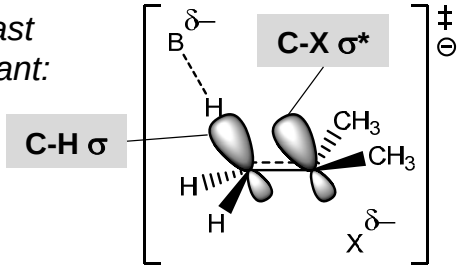
- 2° or 3° halide as substrate
- Neutral or acidic conditions
- Better bases than nucleophiles: H_2O, ROH

In E2, Base Approach and Leaving Group are Anti-Periplanar

Your textbook shows:



But, at least as important:



Either way, B---H---C and C---X must be across from each other.

Nomenclature of Alkenes

To use the Cahn-Ingold-Prelog System for naming alkenes,

1. Assign priority numbers (1 and 2) to each group attached to each sp^2 carbon.

2. If #1 priority groups are on the same side of alkene, then configuration is (*Z*); if #1 groups are on opposite sides, then configuration is (*E*).

Example: How would you name the alkene product from the In-Class Exercise we just did?