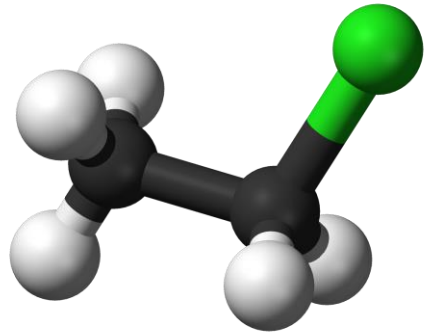
2302263 – Organic Chemistry I – Part III

Lecture 1-5

Alkyl Halides – S_N1 vs. S_N2 vs. E1 vs. E2



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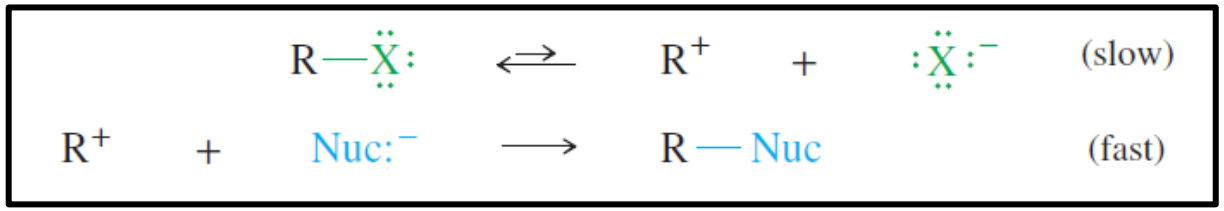
Recommended Textbook:

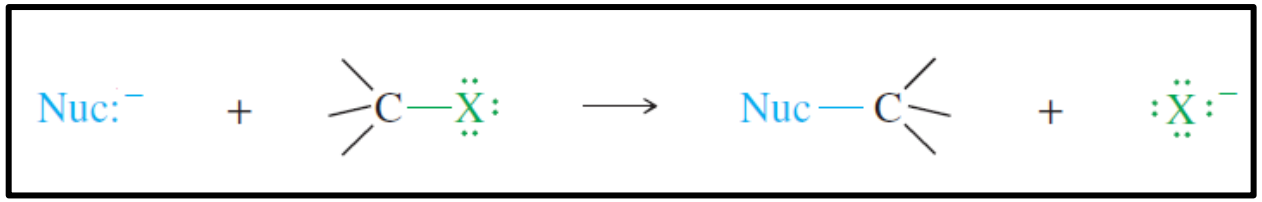
Chapter 6 in *Organic Chemistry*, 8th Edition, L. G. Wade, Jr., **2010**, Prentice Hall (Pearson Education)

Typical Reactions of Alkyl Halides

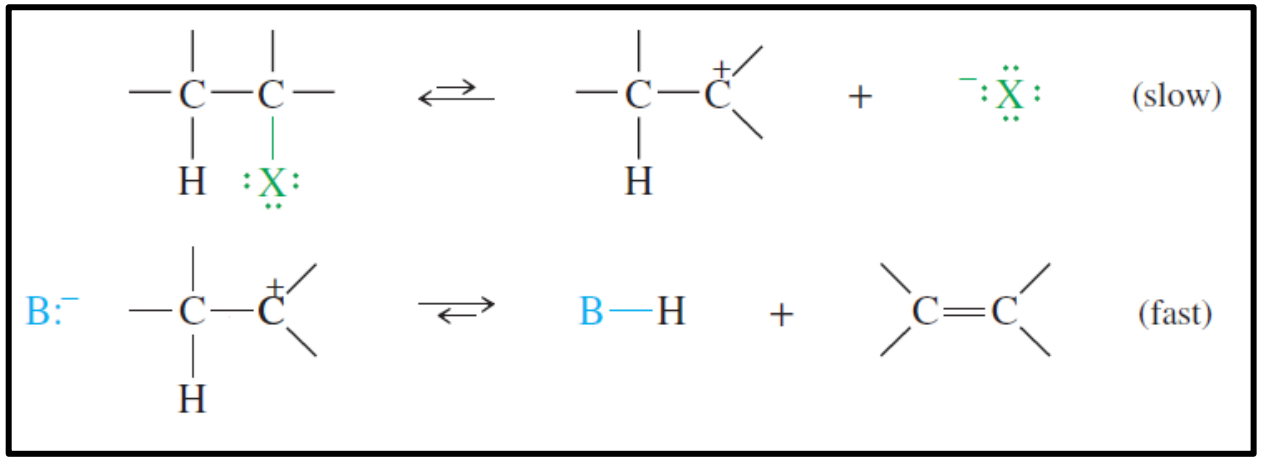
S_N1



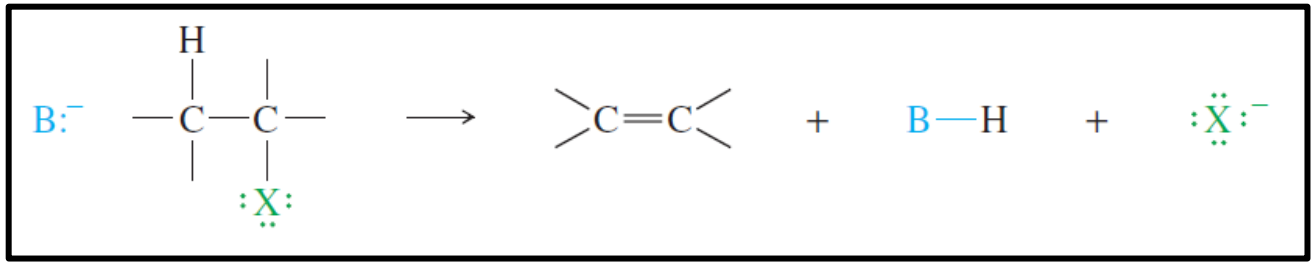
S_N2



E1



E2



S_N1 vs. S_N2 vs. E1 vs. E2

How can we predict what products will result and which mechanisms will be involved?

alkyl halide substrate —**reagent (s)**, **solvent, temperature**→ **product(s)?**

Guideline #1 The **strength of the base or nucleophile** determines the order of the reaction.

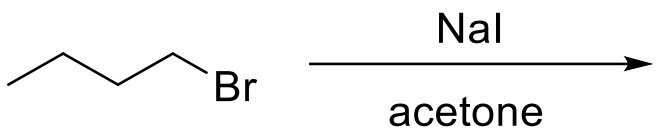
Strong nucleophile / base = S_N2 or E2 (or no reaction)

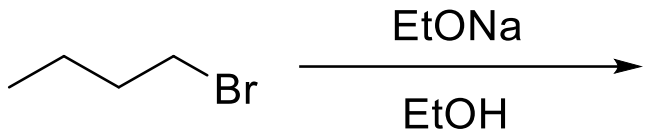
Weak nucleophile / base = S_N1 or E1 (or no reaction)

S_N1 vs. S_N2 vs. E1 vs. E2

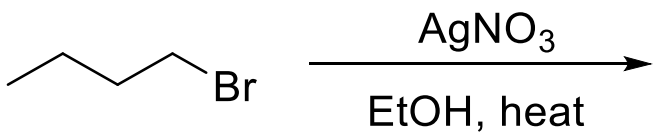
Guideline #2 **Primary halides** usually undergo the **S_N2** reaction, occasionally the **E2** reaction.

Unless they are resonance-stabilized, primary halides rarely undergo first-order reactions, because primary carbocations are relatively unstable. With **good nucleophiles**, **S_N2** is usually observed. With a **strong base**, **E2 may** also be observed.





Sometimes **silver salts** or **high temperatures** are used to force a primary halide to ionize, usually with **rearrangement** to give a more stable carbocation. In such a case, the **rearranged S_N1** and **E1** products may be observed.



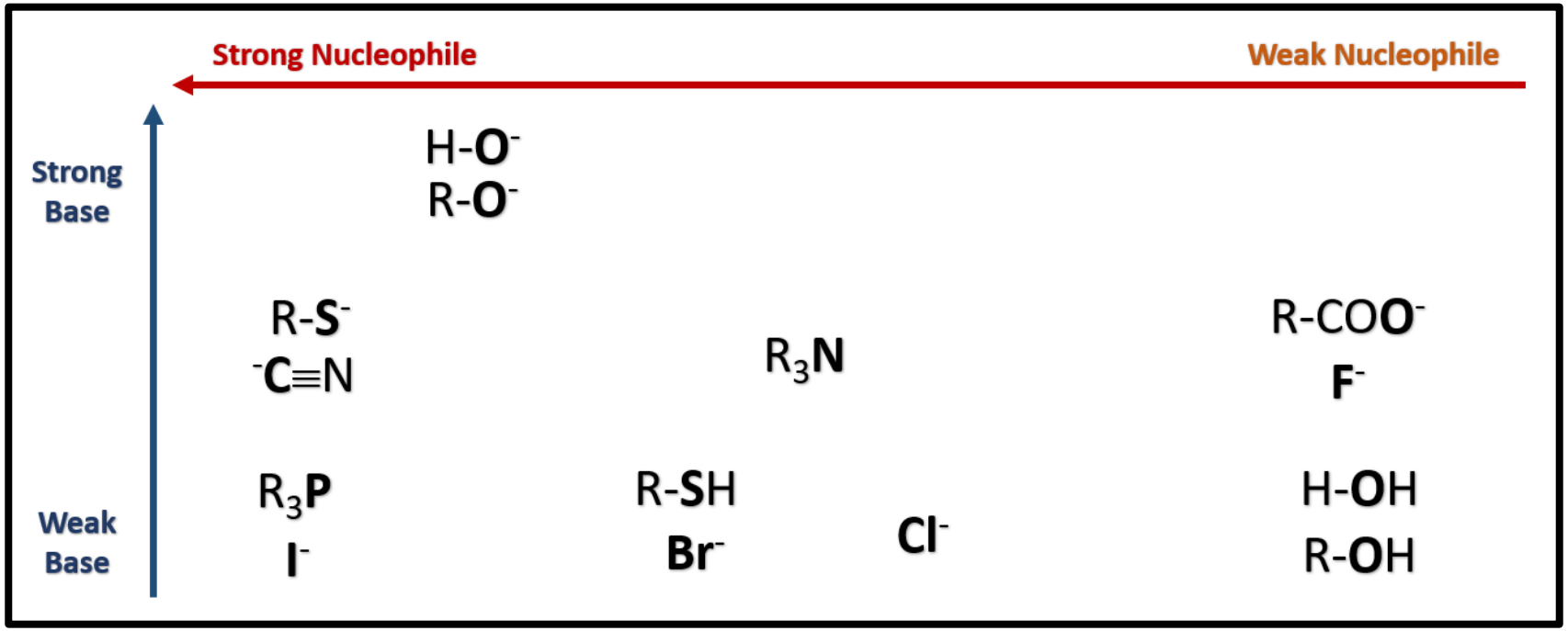
S_N1 vs. S_N2 vs. E1 vs. E2

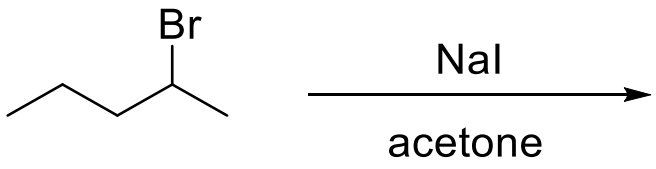
Guideline #3 **Tertiary halides usually undergo the E2 reaction (strong base) or a mixture of S_N1 and E1 (weak base).**

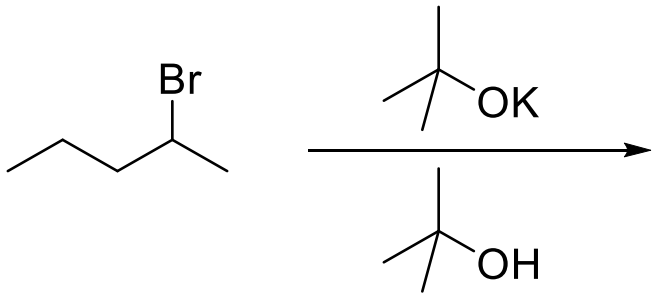
Guideline #4 **The reactions of secondary halides are the most difficult to predict.**

S_N1 vs. S_N2 vs. E1 vs. E2

Guideline #5 Some nucleophiles and bases favor substitution or elimination.



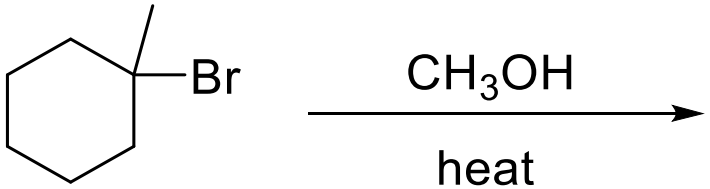




S_N1 vs. S_N2 vs. E1 vs. E2

Example 1 Predict the mechanisms and products of the following reactions.

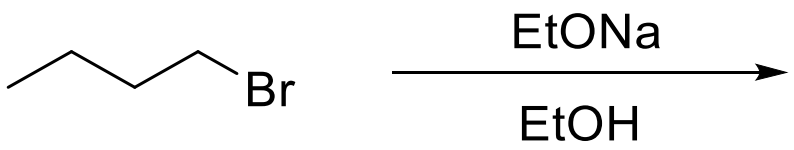
(a)



S_N1 vs. S_N2 vs. E1 vs. E2

Example 1 Predict the mechanisms and products of the following reactions.

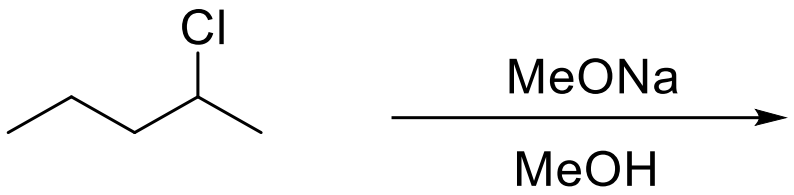
(b)



S_N1 vs. S_N2 vs. E1 vs. E2

Example 1 Predict the mechanisms and products of the following reactions.

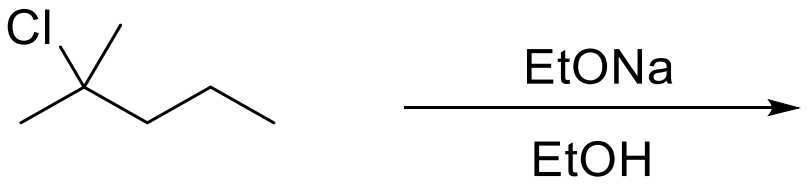
(c)



S_N1 vs. S_N2 vs. E1 vs. E2

Example 1 Predict the mechanisms and products of the following reactions.

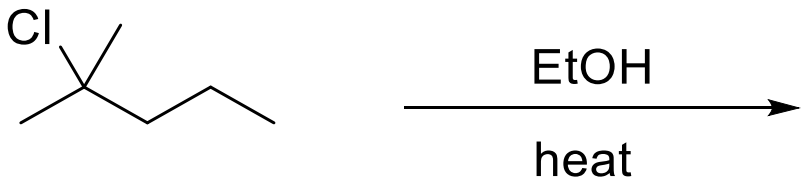
(c)



S_N1 vs. S_N2 vs. E1 vs. E2

Example 1 Predict the mechanisms and products of the following reactions.

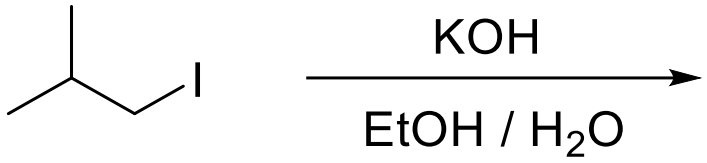
(d)



S_N1 vs. S_N2 vs. E1 vs. E2

Example 1 Predict the mechanisms and products of the following reactions.

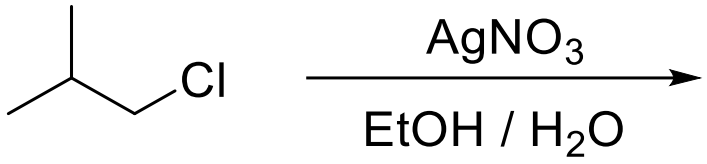
(e)



S_N1 vs. S_N2 vs. E1 vs. E2

Example 1 Predict the mechanisms and products of the following reactions.

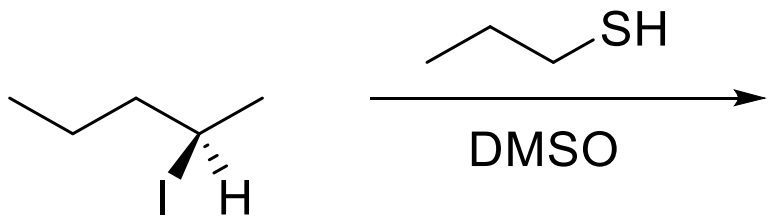
(f)



S_N1 vs. S_N2 vs. E1 vs. E2

Example 1 Predict the mechanisms and products of the following reactions.

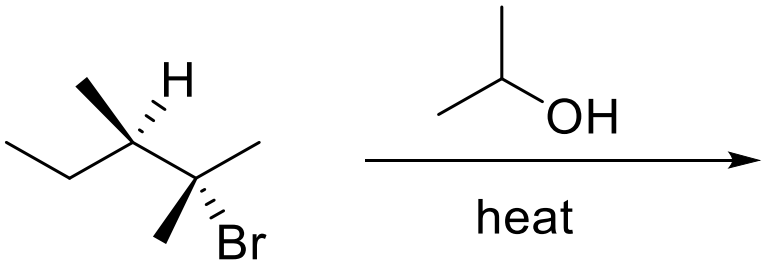
(g)



S_N1 vs. S_N2 vs. E1 vs. E2

Example 1 Predict the mechanisms and products of the following reactions.

(h)



S_N1 vs. S_N2 vs. E1 vs. E2

Example 1 Predict the mechanisms and products of the following reactions.

(i)