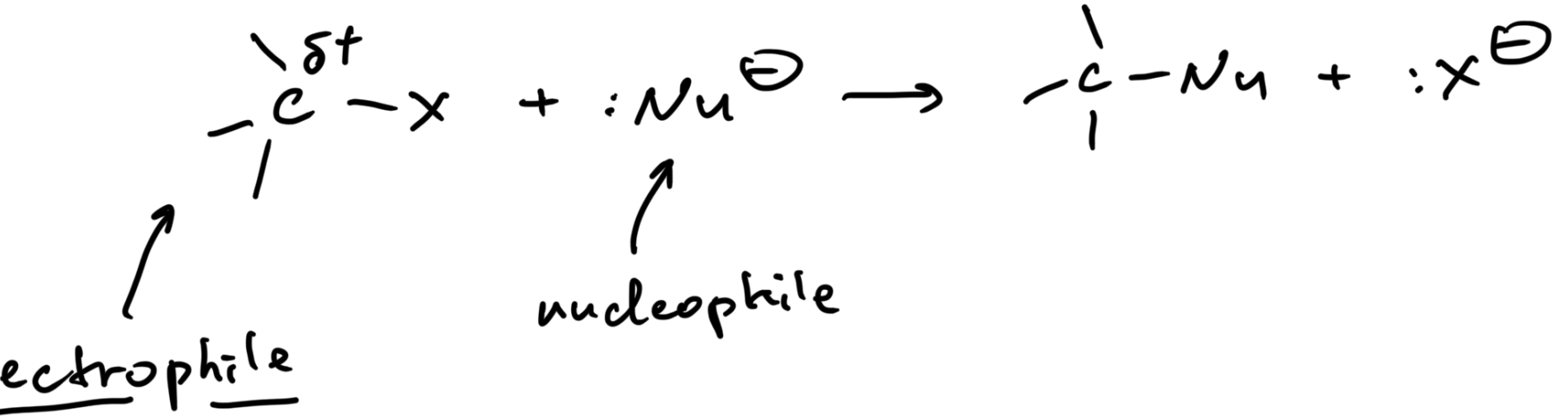
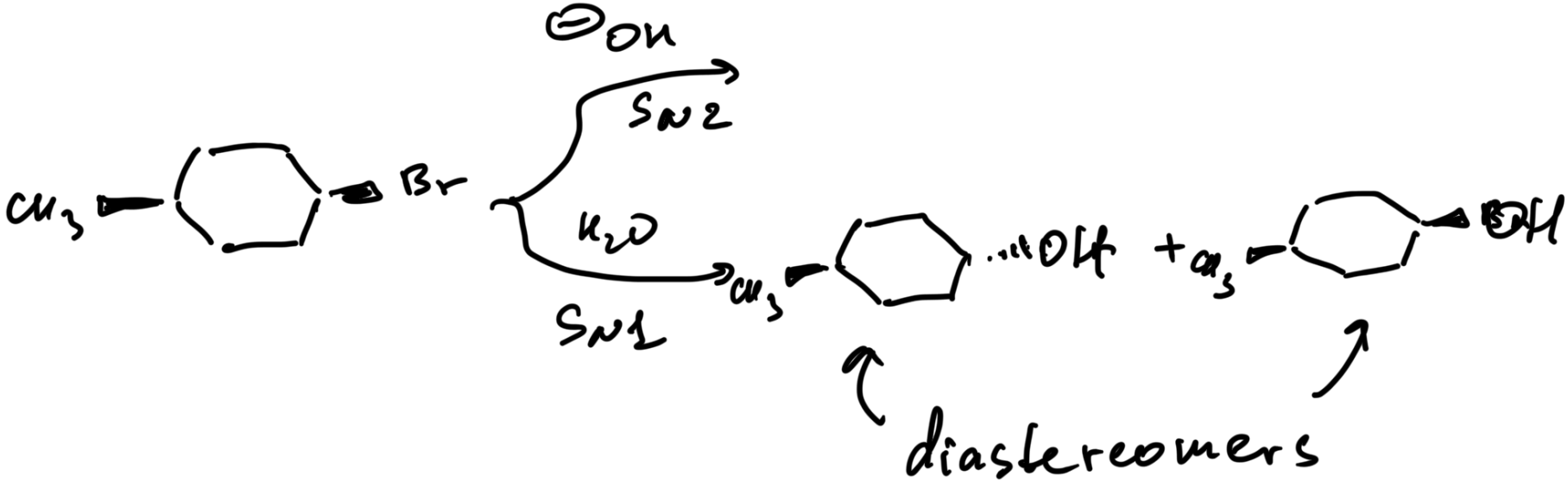
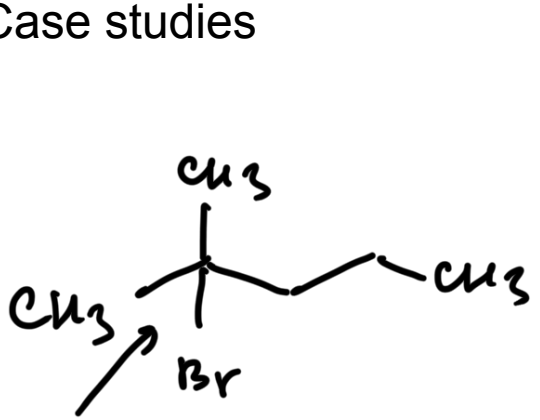

δ+
C
X
+ :Nu⊖
electrophile
nucleophile


⊖OH
SN2
Br
H2O
SN1
OH
diastereomers

Nucleophilic substitution: S_N2 or S_N1 mechanism?

Case studies



3° alkyl halide

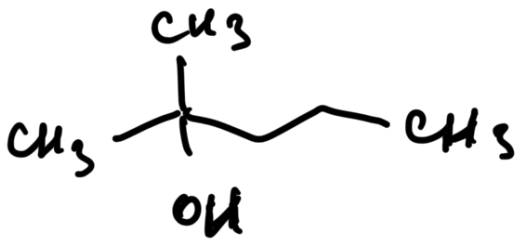
↓

S_N1 only

weak nucleophile

↓

good for S_N1

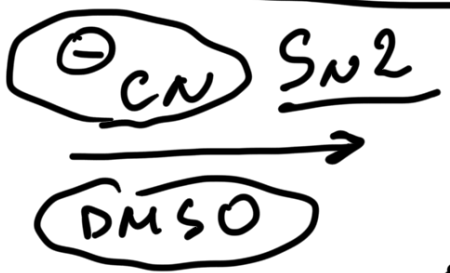


(also polar protic solvent)

↓

good for S_N1

2° alkyl halide → both S_N1 and S_N2

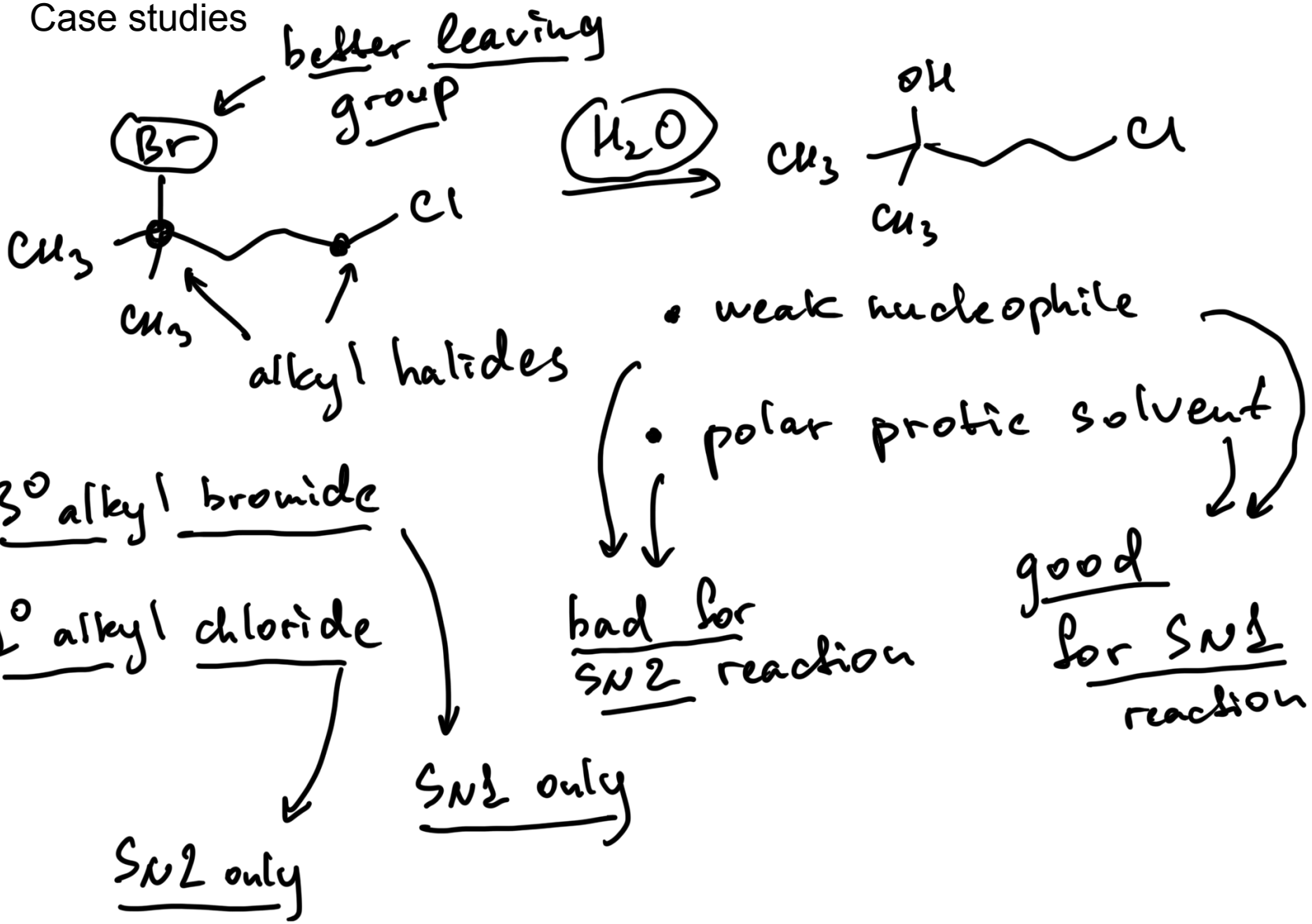


- strong nucleophile → S_N2
- $CH_3-\overset{\overset{O}{\|}}{S}-CH_3$ polar aprotic solvent

↓ good for S_N2

Nucleophilic substitution: S_N2 or S_N1 mechanism?

Case studies



Organic synthesis

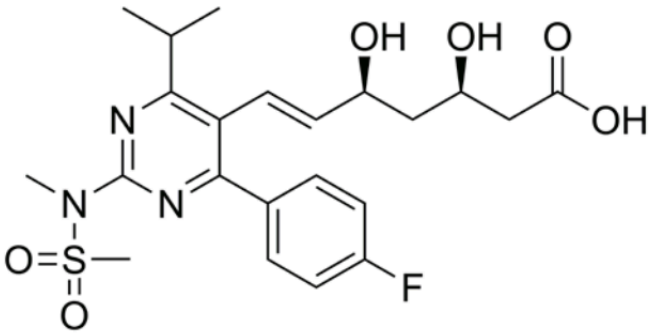
Organic synthesis

↓

systematic evaluation of ways to prepare desired compounds

20 **Crestor**

(Rosuvastatin)



AstraZeneca

$3,401 Million

Cardiovascular Diseases

Organic synthesis

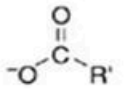
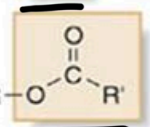
Organic synthesis and nucleophilic subsitution

S_N2

↓

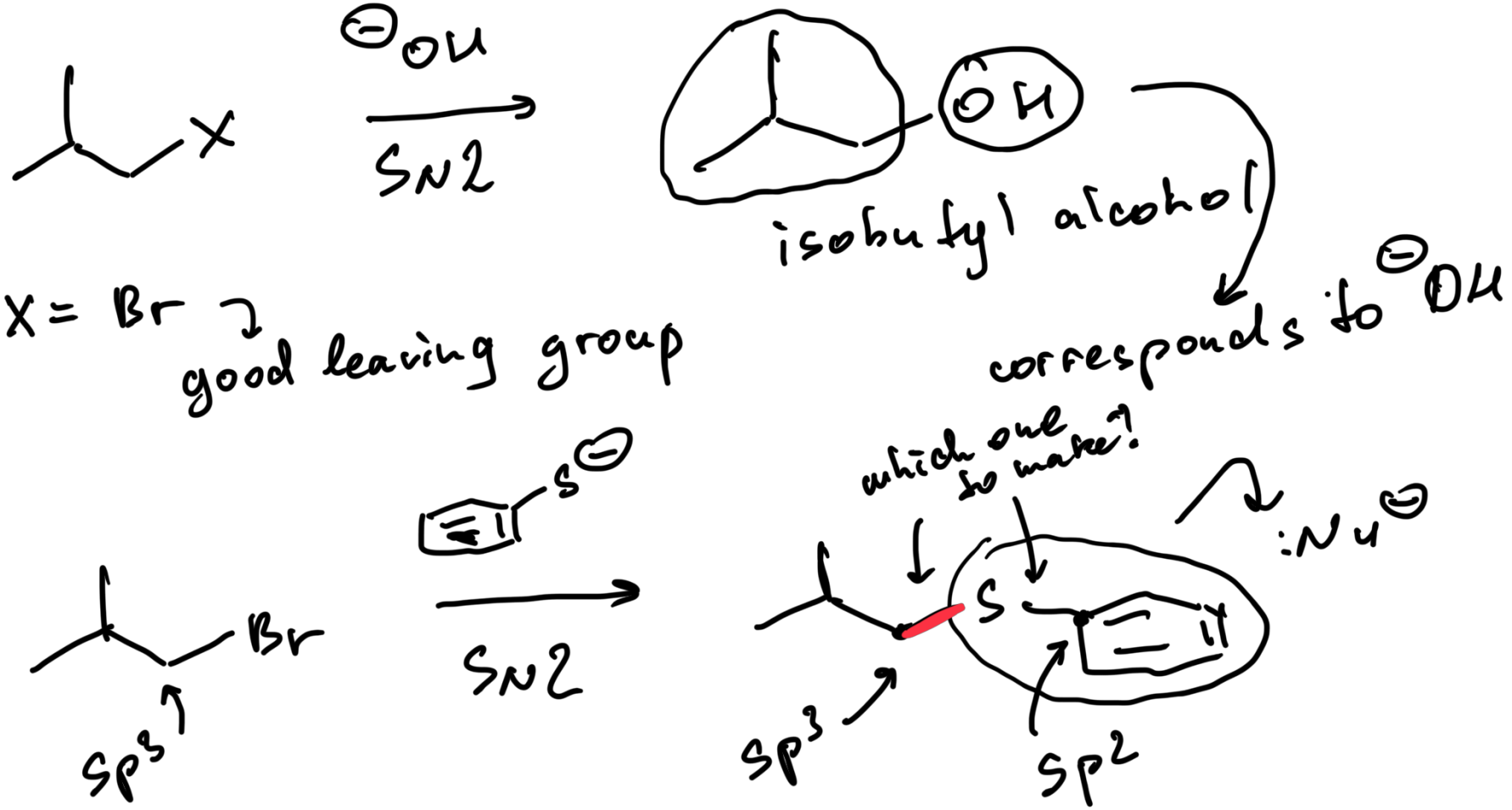
particularly popular in organic synthesis

- proceed with inversion of configuration

	Nucleophile ($:Nu^-$)	Product	Name
Oxygen compounds	^-OH	R—OH	alcohol
	$^-OR'$	R—OR'	ether
			ester
Carbon compounds	^-CN	R—CN	nitrile
	$:C\equiv C-H$	R—C≡C—H	alkyne
Nitrogen compounds	N_3^-	$R-N_3$	azide
	$:NH_3$	$R-NH_2$	amine
Sulfur compounds	^-SH	R—SH	thiol
	$^-SR'$	R—SR'	sulfide

Organic synthesis

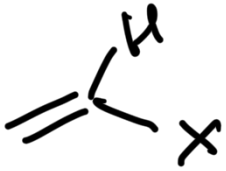
Organic synthesis and nucleophilic subsitution



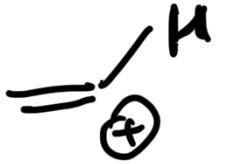
Organic synthesis

Can we use vinyl and aryl halides in nucleophilic substitution reactions?

no!



- sp^2 hybridized carbon → stronger σ_{C-X} bond
- S_N2 reaction requires backside attack
- S_N1 reaction proceeds via carbocation



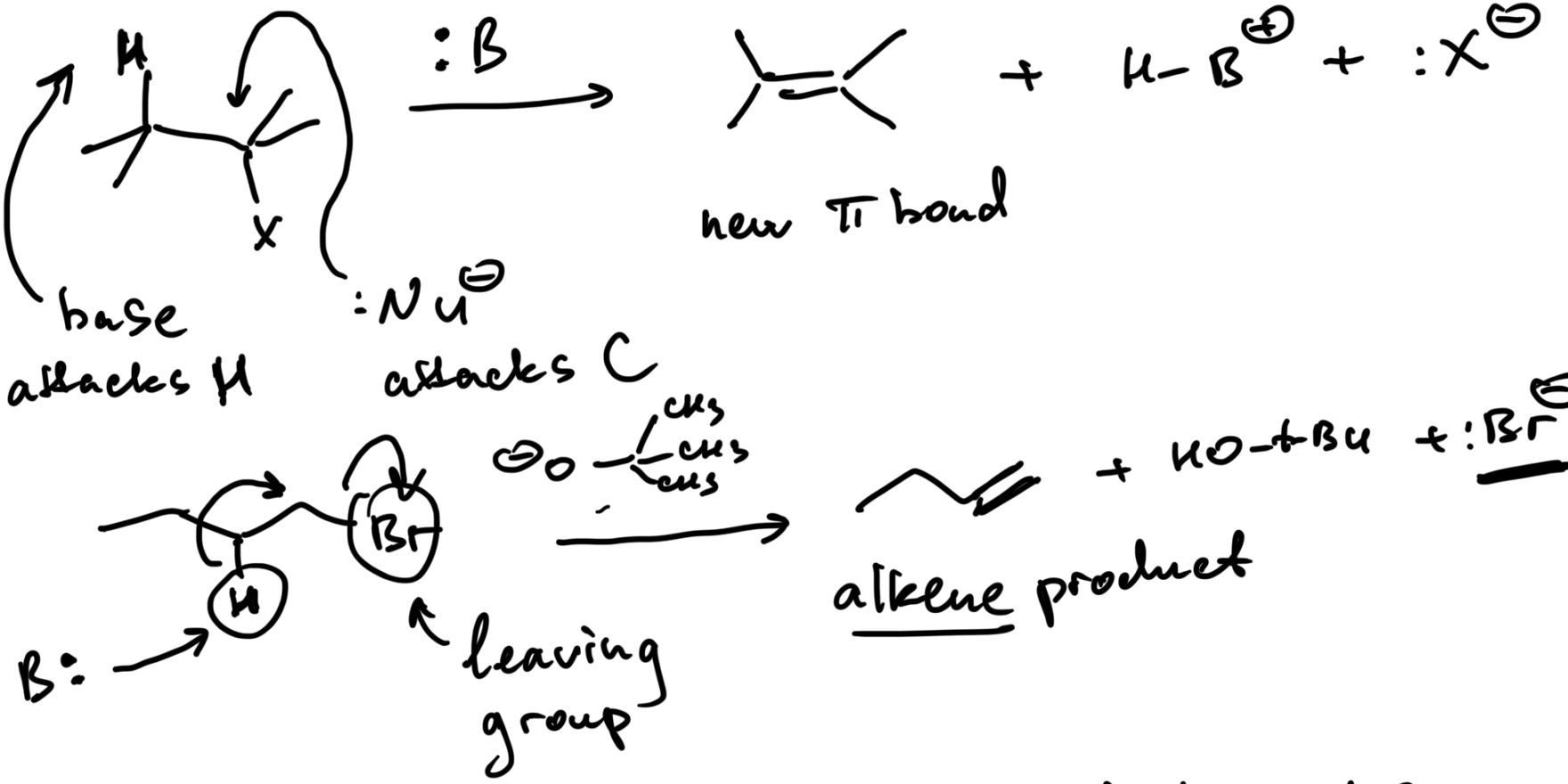
→ carbocation sp hybridized

↓

very unstable

Elimination reactions

General features of elimination



- dehydrohalogenation → used to make alkenes from alkyl halides

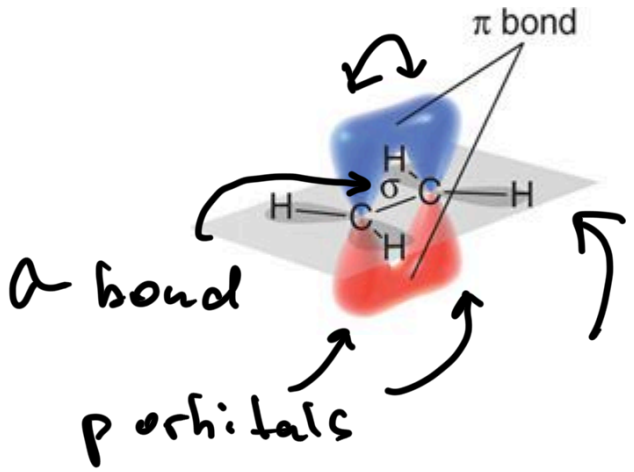
Elimination reactions: alkenes

Structure and bonding

2 bonds between Cs

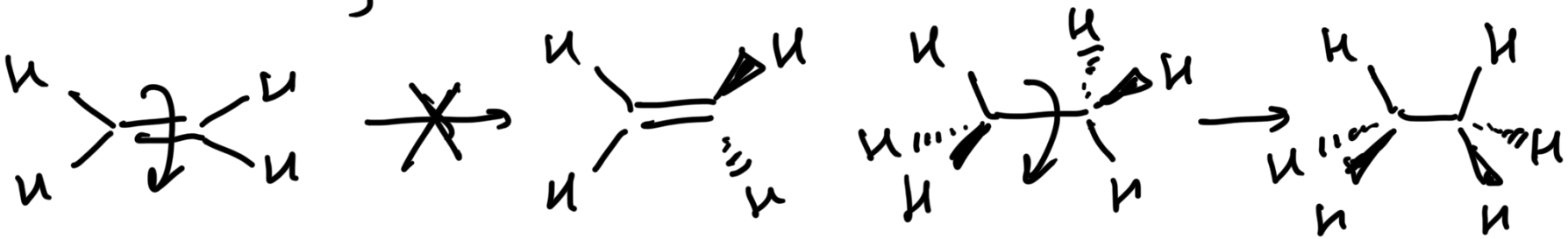
σ_{C-C} and π_{C-C}

weaker



- cannot rotate

along C-C double bond



Elimination reactions: alkenes

Stereoisomerism and stability

Elimination reactions: mechanisms

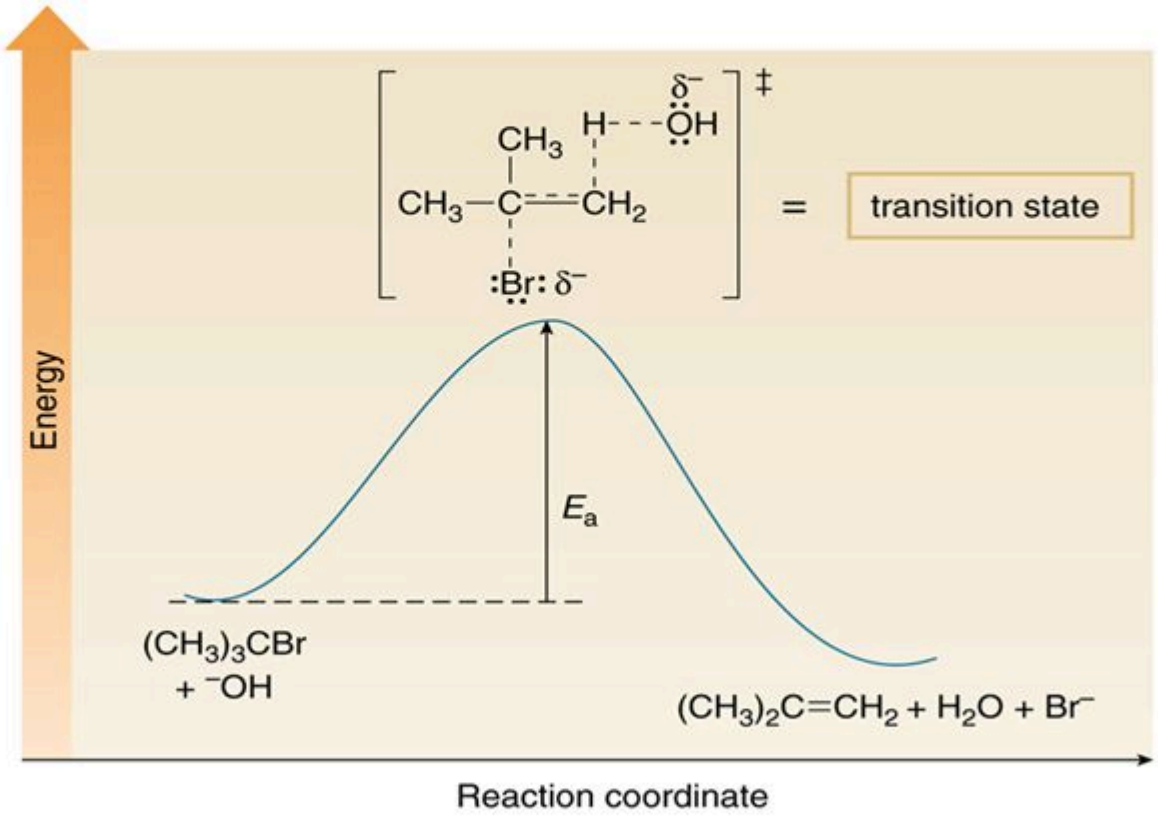
E1 and E2 mechanisms for elimination

Elimination reactions: the E2 mechanism

Elimination bimolecular, kinetics and mechanism

Elimination reactions: the E2 mechanism

Energy diagram



Elimination reactions: the E2 mechanism

Effect of the base, the leaving group, and the solvent

Elimination reactions: the E2 mechanism

Effect of the structure of the alkyl halide