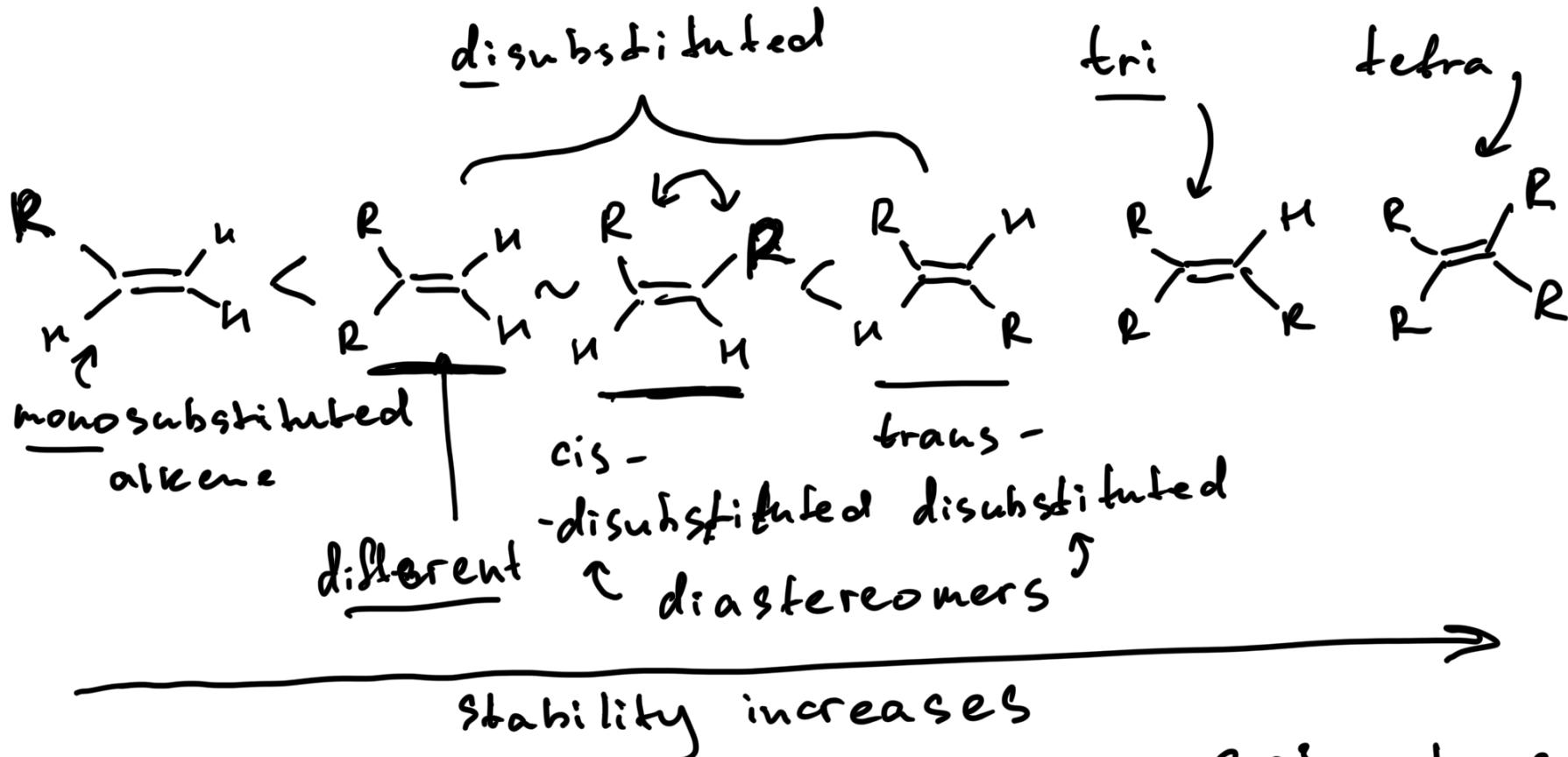


Elimination reactions: alkenes

Stereoisomerism and stability

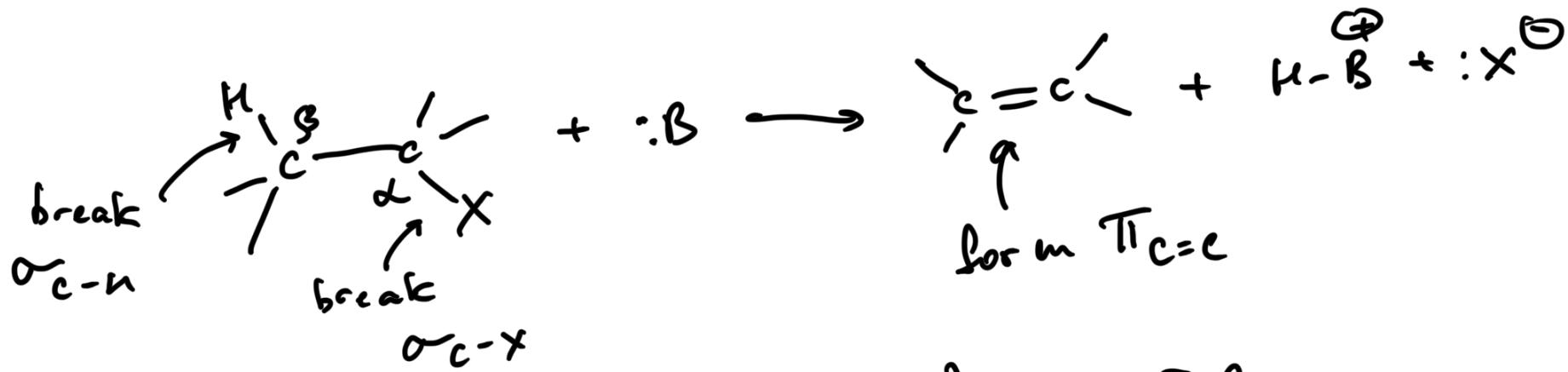


- sp^2 carbons MORE electronegative than sp^3 carbons
- trans-disubstituted MORE stable than cis \rightarrow sterics

Elimination reactions: mechanisms

E1 and E2 mechanisms for elimination

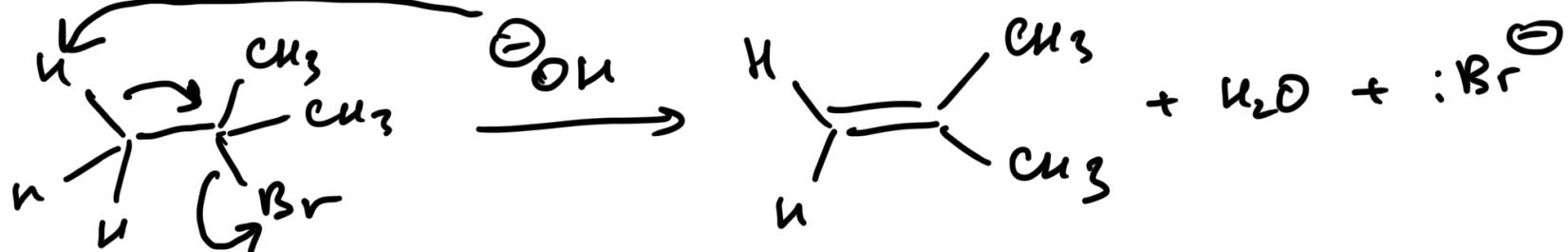
- sp^3 hybridized C with a leaving group
- H in β (beta) position



- 2-step mechanism (cf. S_N2) \rightarrow E2
- 2-step mechanism (cf. S_N2) \rightarrow E1

Elimination reactions: the E2 mechanism

Elimination bimolecular, kinetics and mechanism

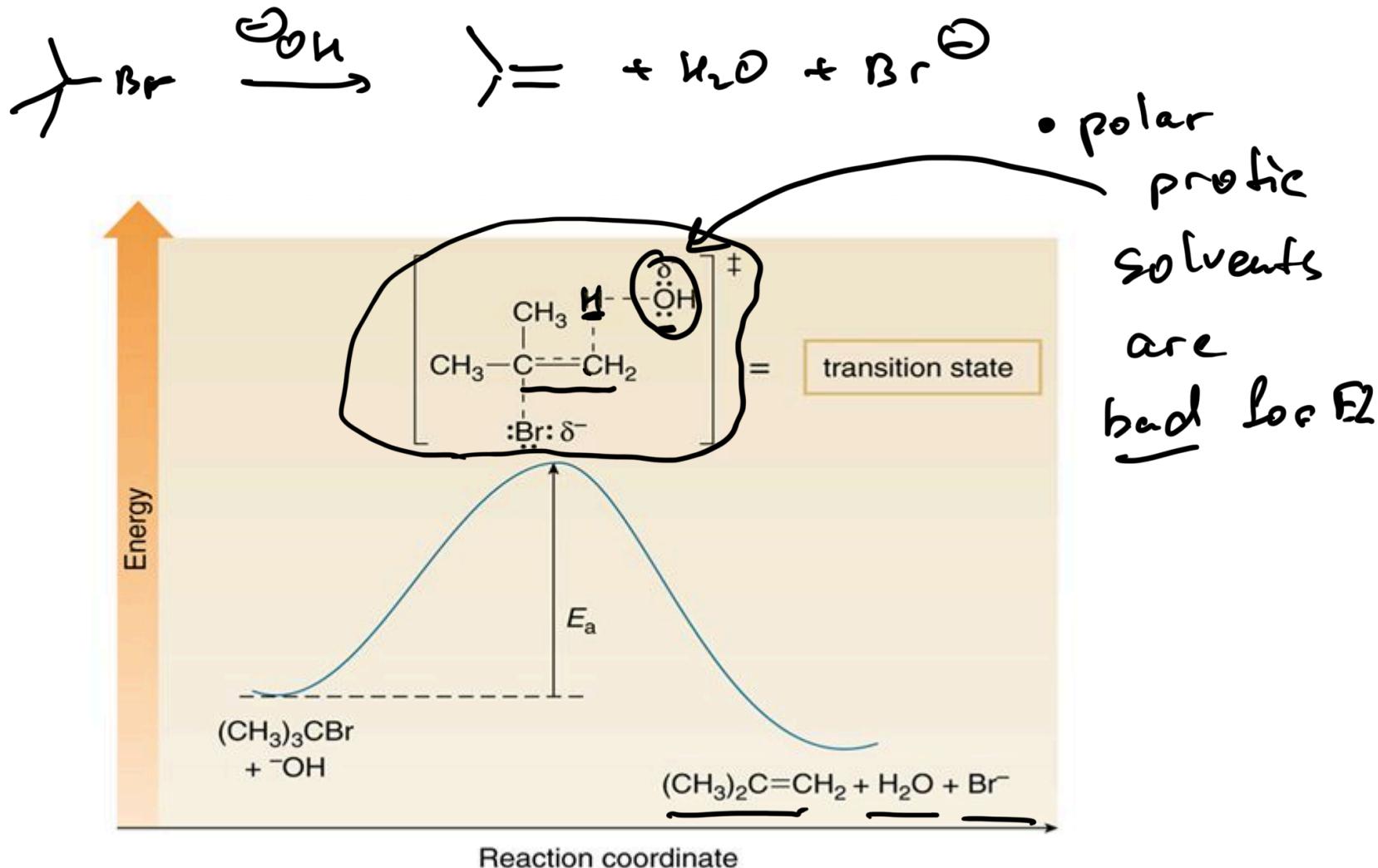


$$\text{rate} = K \underline{[\text{R}-\text{Br}]} \underline{[\text{OH}^-]}$$

second order reaction
↑
similar to $\text{S}_{\text{N}}2$

Elimination reactions: the E2 mechanism

Energy diagram



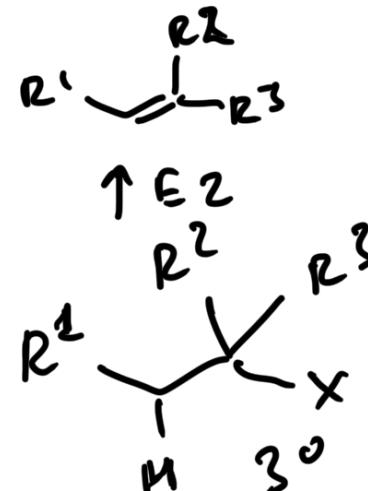
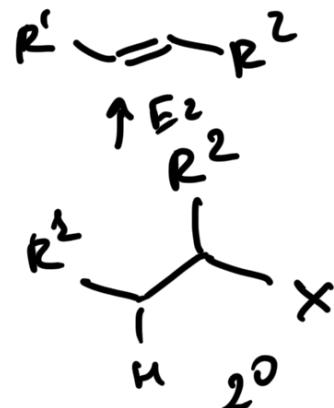
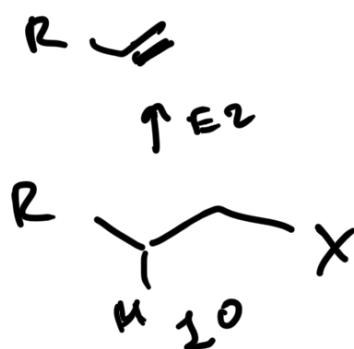
Elimination reactions: the E2 mechanism

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

- stronger base
higher concentration
good E2
- better leaving group
accelerates E2
- polar aprotic
solvents are best
for E2

Elimination reactions: the E2 mechanism

Effect of the structure of the alkyl halide

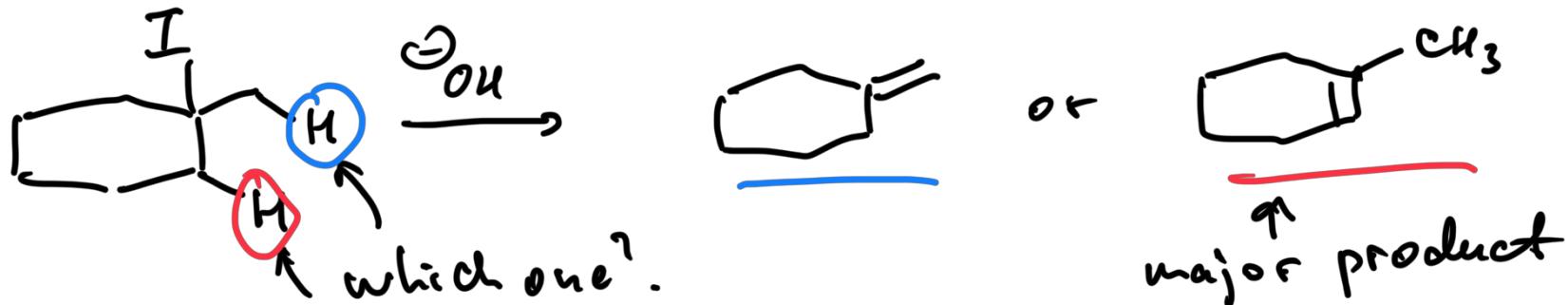


increases rate of E2

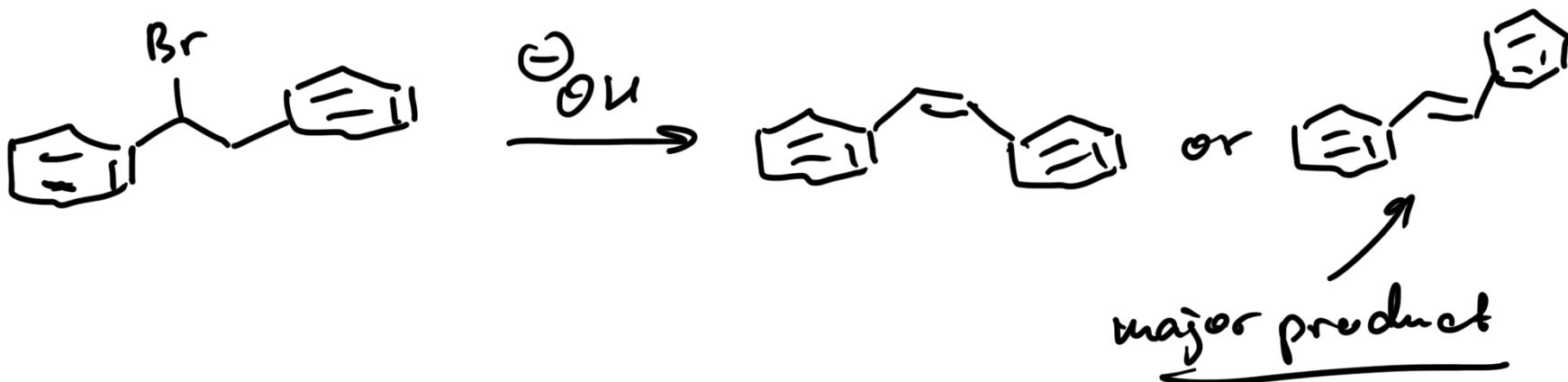
- consider stability of alkenes
- substituents stabilize TS^\ddagger of E2
(much like they stabilize the alkene product)
- trend opposite to S_N2 ↓
faster reaction

Elimination reactions: the E2 mechanism

The Zaitsev rule and selectivity of the E2 reaction

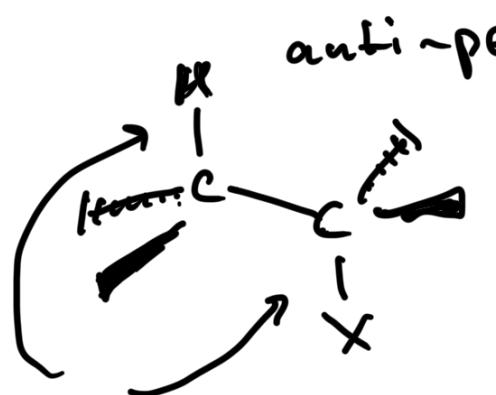


- Zaitsev rule: the more stable alkene is the major product

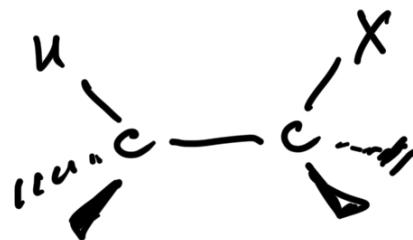


Elimination reactions: the E2 mechanism

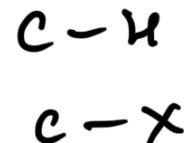
Stereochemistry of the E2 reaction



anti-periplanar

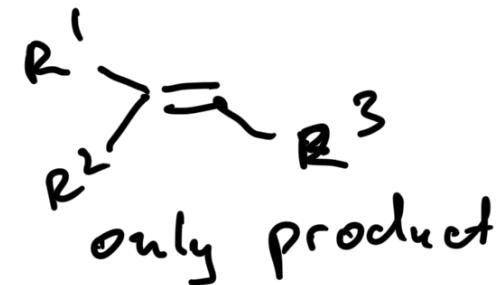
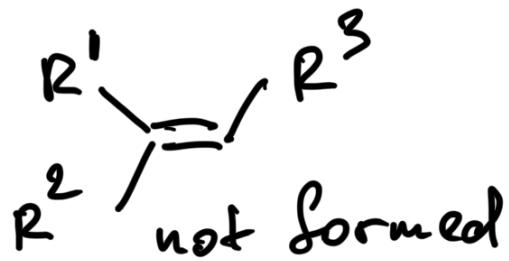
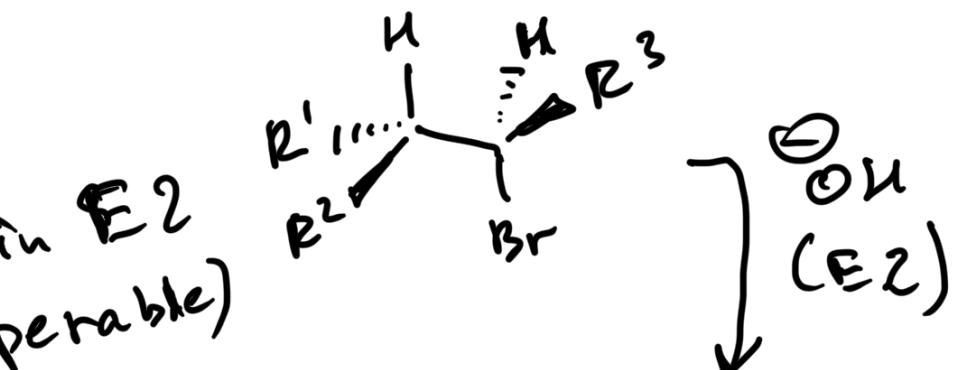


syn-periplanar



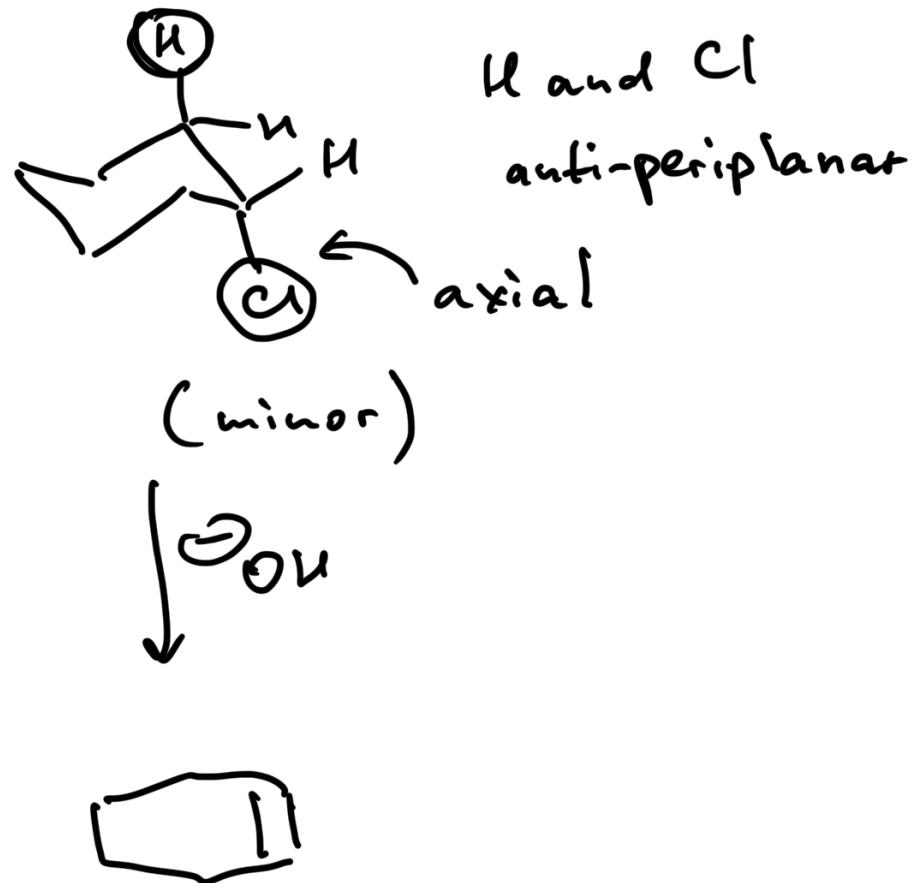
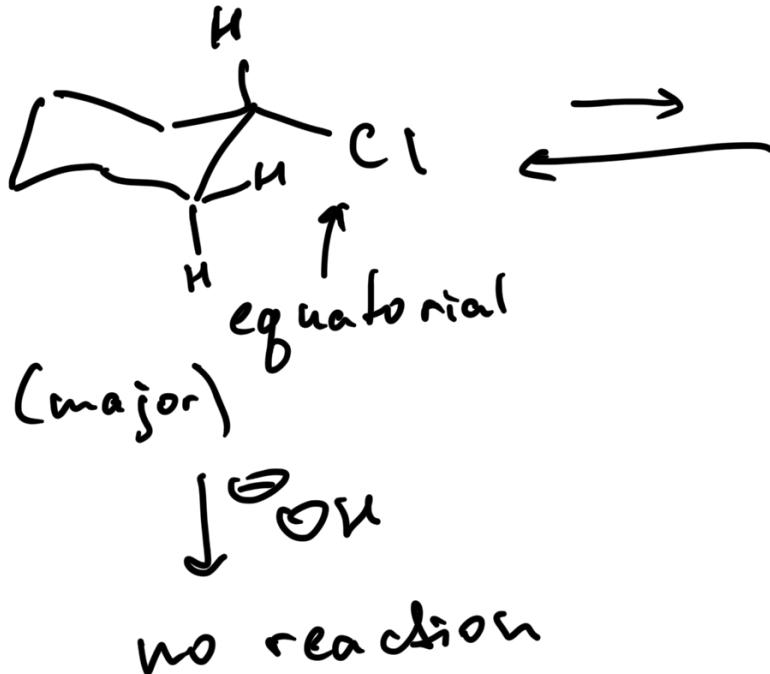
need to be aligned

preferred alignment in E2
(only one operable)



Elimination reactions: the E2 mechanism

Stereochemistry of the E2 reaction



Elimination reactions: the E2 mechanism

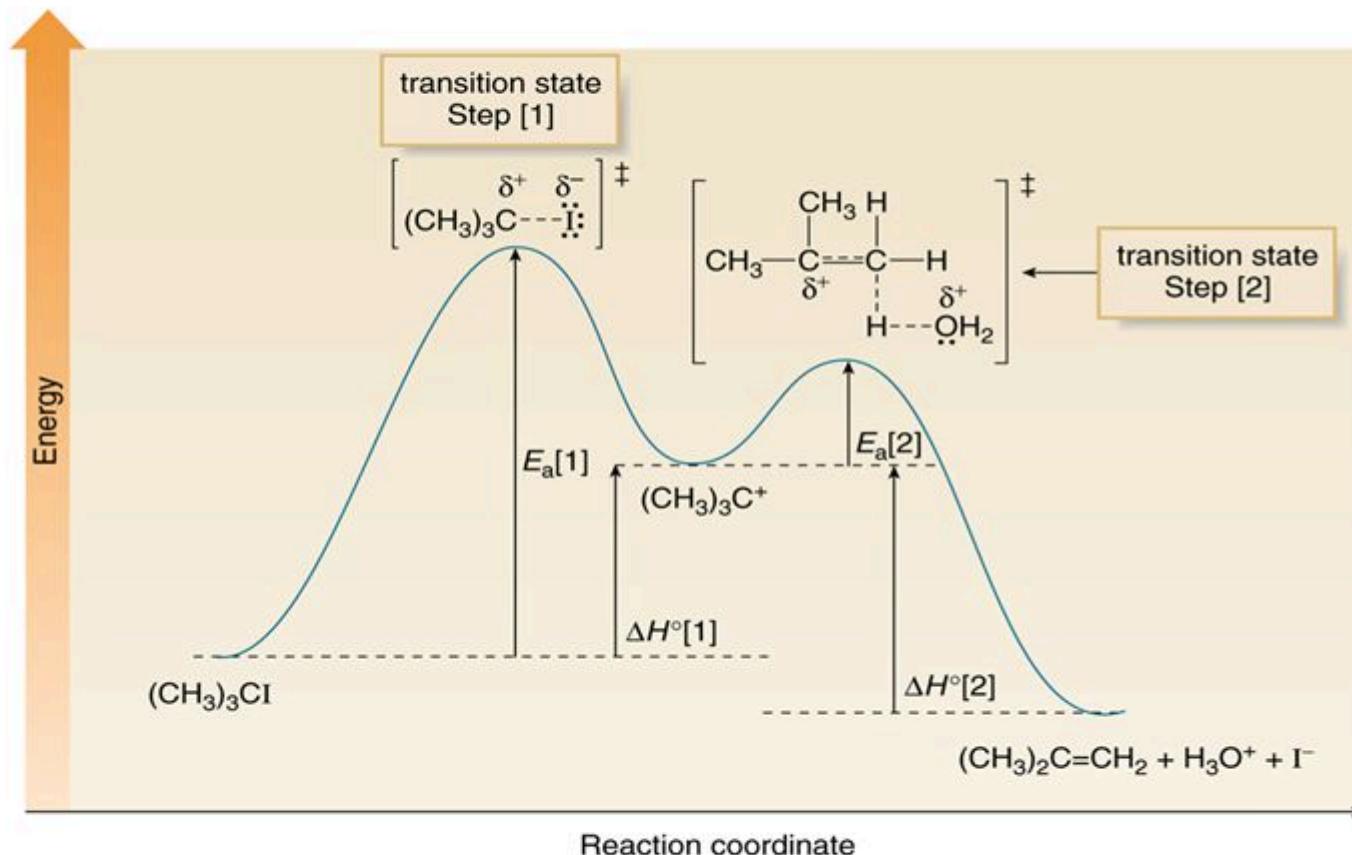
Stereochemistry of the E2 reaction

Elimination reactions: the E1 mechanism

Elimination unimolecular, kinetics and mechanism

Elimination reactions: the E1 mechanism

Energy diagram



Elimination reactions: the E1 mechanism

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

Elimination reactions: the E1 mechanism

Effect of the structure of the alkyl halide