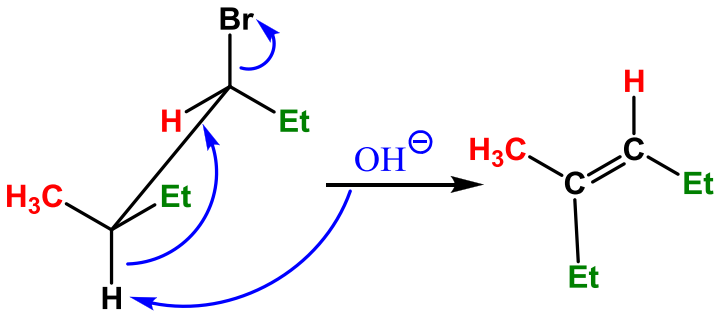
Overheads: - Outline

Quiz #2

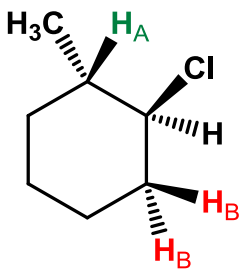
Recap Monday: Stereochemistry of E2



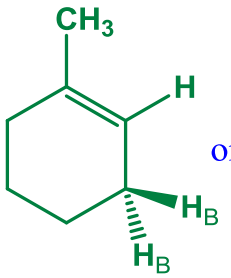
Can't always get Zaitsev product!

Cyclohexanes: H & LG must both be axial to be anti

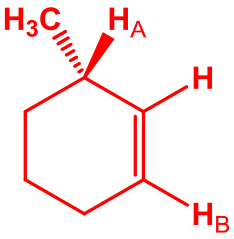
e.g.



base



or

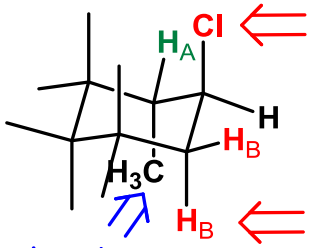


only this H is trans to Cl!

E1: major (Zaitsev) minor

E2: only product

chair:



put Cl axial

only this β-H is anti

CH_3 in anti pos'n ∴ E2 can't do Zaitsev

*** In an E2 reaction we can't always get Zaitsev!

Summary of 4 Reactions

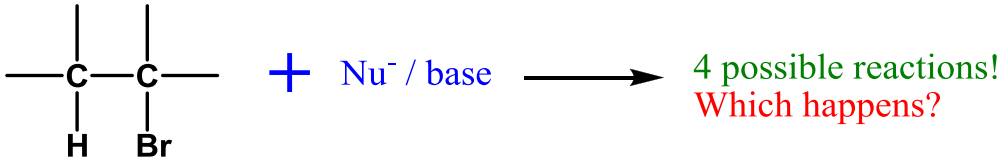
S_N1	S_N2	E1	E2
3° R-Br	1° R-Br	3° R-Br	ALL R-Br
2° R-Br / allylic	2° R-Br / allylic	2° R-Br / allylic	
weak Nu^- ok	strong Nu^- needed	weak base ok	strong base ($\geq OH^-$)
protic solvent	aprotic solvent	protic solvent	aprotic solvent

Elimination needs β-H
(E1 can rearrange first though)

Stereochemistry:

racemic	inversion	trans>cis	ANTI elimination

Competition Between the 4 Reactions:



Ask 2 Questions:

1) Is a C^+ likely formed?
   - 1° R-LG ⇨ NO
   - 3° ⇨ YES → unless strong base: E2 likely
   - 2° / allylic ⇨ MAYBE! → solvent: protic = C^+ aprotic = no C^+
     → base/Nu^-: weak = C^+ strong = no C^+

2) Substitution or Elimination? (Elim needs β-H)

   a) S_N1 *vs* E1 (if C^+)
   - both need weak base / Nu^- (same! ⇨ not in RDS!) *e.g.* Cl^-, H_2O
   - E1 helped by $NaHCO_3$, Na_2CO_3 (weak bases, not good Nu^-)
   ⇨ generally both compete ☹

   b) S_N2 *vs* E2 (if no C^+)
   - good Nu^- *vs* strong base (OH^- or better) (not always same thing!)
   (pKa ≥ 15)

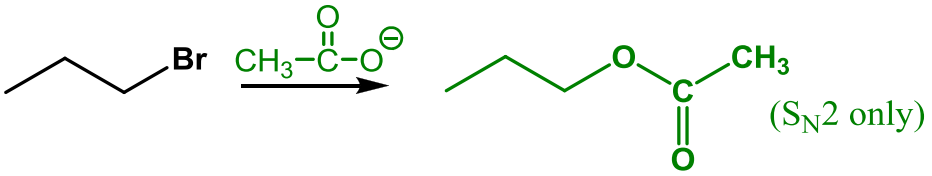
HA	pKa	A^- (base)
HCl	<0	Cl^-
H_3O^+	0	H_2O
CH_3COOH	~5	$CH_3CO_2^-$
RSH	~7	RS^- (or HS^-)
HCN	9	CN^-
NH_4^+	~10	$:NH_3$ (or R_2NH *etc*)
H_2O	~15	OH^-
ROH		RO^-
H_2	~30	H^-
NH_3	~35	NH_2^-
CH_4	~50	CH_3^-

weaker bases:
can do S_N2 but not E2

stronger bases:
can do E2 and S_N2

eg 

(S_N2) (E2)



(S_N2 only)