Substitution and Elimination Reactions
3- Review

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S_N2 and S_N1 Characteristics

	S_N2	S_N1
Substrate	Primary or methyl	Tertiary
Nucleophile	Strong nucleophile	Weak nucleophile (may also be solvent)
Solvent	Polar aprotic solvent	Polar protic solvent, silver salts
Kinetics	[substrate][Nu]	[substrate]
Stereochemistry	Inversion	Racemic mixture
Rearrangement	No	Yes

E1 and E2 Characteristics

Condition	E1	E2
Mechanism	1^{st} order	2^{nd} order
Kinetics	[substrate]	[substrate] [base]
Substrate	3^{o} - should form a stable carbocation	1^{o} for better results
Bases	Does not need a strong base	Needs a strong base to cause elimination
Solvent	Polar	Nonpolar
Competes	With S_N1	With S_N2
Stereochemistry	Regiospecific (gives Zaitsev's product as major product)	Stereospecific (needs the H and leaving groups to be anti-periplanar)

Substitution or Elimination?

	Substitution	Elimination
Nucleophile strength	Strong Nu but weak base – S_N2	Strong Nu – E2
Nucleophile size	Small	Bulky
Substrate	Primary – S_N2	Tertiary - S_N1, E1 or E2
Temperature		Higher temp for more E

<u>E2 vs S_N2</u>
3º halide and bulky base promote E2

<u>E1 vs S_N1</u>
High heat promotes E1

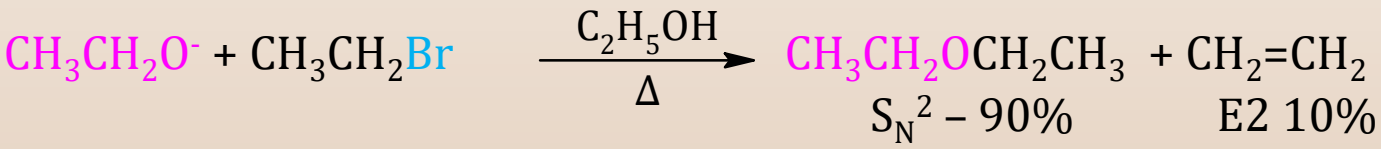
<u>Types of Alkyl Halides</u>

1º – will almost always give S_N2
2º – primarily S_N2 except when using a bulky base
3º – S_N1, E1 or E2. Strong base and high temperature promotes E

Substitution or Elimination?

Look at the conditions and then decide.

- Primary substrate
  - If the base is small, S_N2 competes strongly because approach at carbon is unhindered.



- Secondary substrate
  - Approach to carbon is sterically hindered and E2 elimination is favored.