

S_N1 vs. S_N2 vs. E1 vs. E2

Factors to examine:

1. Steric environment of the substrate leaving group (1° vs. 2° vs. 3° vs. near 4°)
2. Nature of the leaving group (I⁻ vs. Br⁻ vs. H₂O vs. TsO⁻ = ⁻OSO₂C₆H₄CH₃)
3. Nature of the nucleophile/base (i.e. a strong=highly polarized/negatively charged)
4. Steric environment of the nucleophile/base
5. Temperature (higher temps generally favor elimination reactions)
6. Concentration of the nucleophile/base
7. Solvent which might promote carbocation formation (least important item)

Halide on	S _N 1	S _N 2	E2**	E1**
1°	No	Yes	Yes*	No
2°	Yes	Yes	Yes*	Yes*
3°	Yes	No	Yes*	Yes*
Allylic C	Yes	Yes	Possible*	Yes
Benzylic C	Yes	Yes	Possible*	Yes
Sp ²	No	No	Depends	No

*All Elimination reactions require a beta hydrogen, which is typically on an sp³ carbon.

**Must have a beta hydrogen

S_N1 vs S_N2

	Substitution on SM	Good nuc.*	Polar solvent	Good leaving group
S _N 1	Accelerates	No effect	Accelerates	Greatly accelerates
S _N 2	Slows	Accelerates	Use aprotic/polar	Accelerates

* A good nucleophile is defined as a small highly polarized (i.e. negatively charged) species.

E2 vs. S_N2**

	Sub. on SM	Small nucleophile/base	Bulky nucleophile/base	Higher temp
S _N 2	Slows	Favored		
E2	Favored		Favored	Favored

**Both E2 and S_N2 generally require a high concentration of base/nucleophile

E1 vs. S_N1*

	Higher temp.	Large base/nucleophile	Good nucleophile
S _N 1			Favored
E1	Favored	Favored	

*Both require neutral or acidic conditions—e.g. not in NaOH or NaOEt soln.

Strong nucleophile weak base	Strong BASE Good nucleophile (1°)	Strong BASE poor nucleophile	weak nucleophile weak base
I ⁻ N ₃ ⁻ R'S ⁻	HO ⁻	H ⁻	H ₂ O
Br ⁻ ⁻ CN	MeO ⁻	RR'N ⁻	ROH
Cl ⁻ R-C(=O)O ⁻	RO ⁻	^t BuO ⁻	RSH
	R' ₂ N ⁻	DBU	
<i>predominant mechanism</i>	S _N 2	S _N 2 or E2	E2
			S _N 1 or E1

Rough categorization of common reagents and their favored reaction pathway

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