

Substitution and Elimination
Learning Objectives

Here are the skills you should have for most chapters on Substitution & Elimination:

1) Substitution and Elimination Reactions (S_N2, E2, S_N1, E1)
   A. Know the name, features, requirements, and limitations of each reaction
   B. Understand the information that kinetics (i.e. rate law) can provide about each reaction
   C. Be able to provide a mechanism for each reaction, including variations on each theme (e.g. intramolecular rxns)
   D. Understand the "players" involved in each reaction, what factors influence the effectiveness of each, and how each player affects the type of reaction that occurs:
      i. leaving group
      ii. substrate (methyl, 1°, 2°, 3° and other structural influences like β-branching)
      iii. reagent (nucleophilicity and basicity)
      iv. solvent
   E. Be able to determine which reaction will occur. You might use the following table as a guide for deciding which reaction will occur...

	Leaving Group?	Solvent?	Nucleophile or Base?	Substrate 1°, 2°, or 3° carbon?
S_N2	All require **good leaving groups**. If the lvg grp is OH, OR, SH, SR, NH_2, NHR, or NR_2 (all bad lvg grps), you can make them good by protonating them with a strong acid. Also, if the leaving group is OH, you can make it good w/ TsCl (we'll cover TsCl in ch 9).	Favored in **polar aprotic** solvents (acetone, DMF, DMSO, HMPT) but possible in **all** solvents.	Requires a **good nucleophile** (preferably one w/ neg. charge)	**1°** or **2°** only. Never with 3° or cmpd w/ β branching.
E2			Needs a **strong base**.	**2°** or **3°**. With 2° carbons, E2 competes w/ S_N2 but can be made favorable w/ **Δ**.
S_N1		Require **polar protic** solvents.	Occurs w/ poor **and** good nucleophiles.	**3°** or stabilized carbocations. **2°** is sometimes possible. Favored at lower temps.
E1			Favored w/ weak bases.	**3°** or stabilized carbocations. **2°** is sometimes possible. Favored at higher temps.

   F. Be able to predict the stereochemical (R/S, E/Z, number of stereoisomers formed) outcomes of each reaction.
2) Be able to propose reaction conditions that turn a hydroxyl group (a poor leaving group) into a good leaving group.
3) Be able to use elimination reactions in tandem to synthesize alkynes
4) Be able to use substitution & elimination reactions, along with reactions from previous chapters, in synthesis problems.