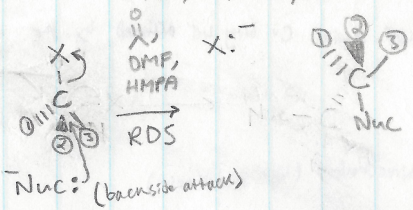
Reaction

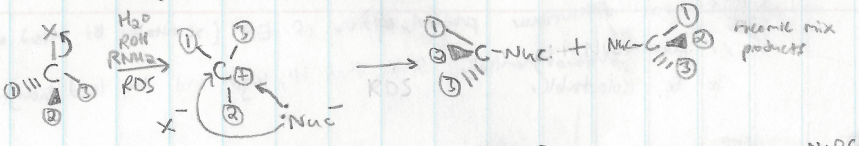
Substitution

S_N2

$I^\ominus, Br^\ominus, Cl^\ominus, NH_2^\ominus, CN^\ominus$ favor S_N2 over S_N1.

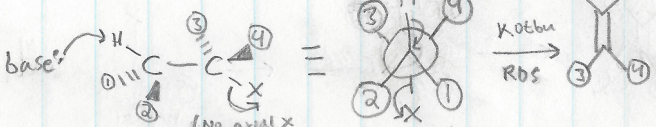


S_N1



Elimination

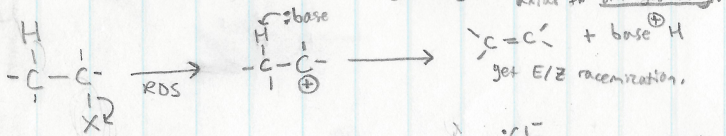
E2



Solvent = $\frac{NaOCH_3}{CH_3OH}$

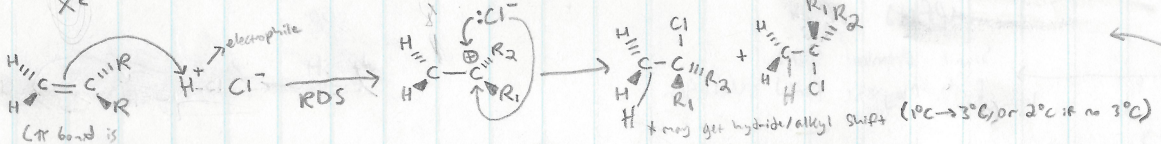
S_N2-E2, S_N1-E1 = compete

E1

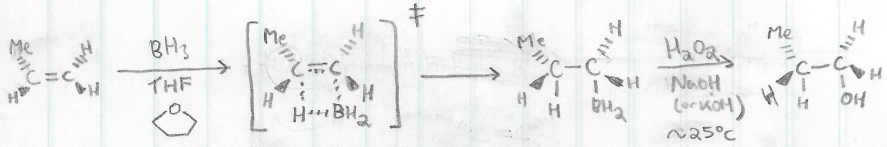


Addition

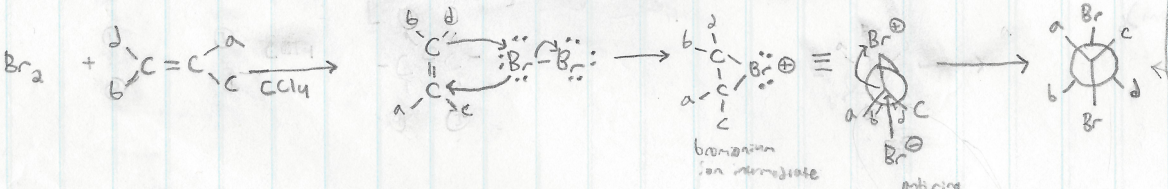
EA (Markovnikov addition)



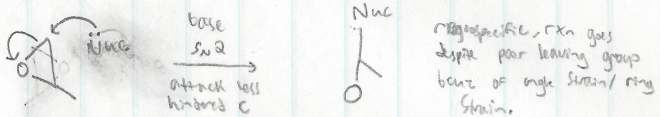
Hydroboration (anti-Markovnikov addition)



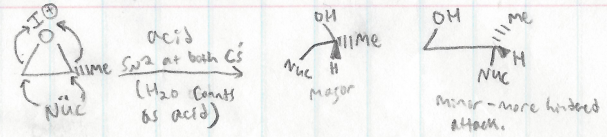
Bromination



Base catalyzed epoxide ring opening



Acid catalyzed epoxide ring opening



Order	Solvent
2nd	- aprotic - polar - aprotic - basic, e⁻ rich - substrate: 1°>2°>3° - good leaving group, or tosylate - Exergonic, concerted, 1 step.
1st	- very polar - protic - substrate 3°>2°>1° - good leaving groups, or tosylate ΔG<0, 2 step w/ intermediate.
2nd	- anti - polar - aprotic - good base, poor nucleophile - eliminate preferentially to get more substituted alkene. (Zaitzevs rule) (same for E1) - If rate change is >2x from kinetic isotope effect then E2 and not E1.
1st	- very polar - protic
1st	- generates most stable C⊕ - lose stereochem at C⊕, potential racemization at this point. - low ΔG (π higher energy than σ bonds) - markovnikov rule - protonation to form more stable C⊕ - polar protic solvent (like SN1), 2 steps
2nd	- regiospecific / stereospecific ↳ prefers either C1 or C2 ↳ Adds either syn or anti ↓ attacks from same face. ↓ attacks from opposite face. - syn
2nd	- anti addition - SN2 like - 2 step, not concerted - trans/anti product always - inversion of stereochem to specific stereochem. - solvent not nucleophilic so doesn't compete.
2nd	- look like SN2 energy diagrams, one step. - Cyclohexane must have transdiaxial products, not trans equatorial products.

Hilbray

Radical mechanism

initiation: $RO\!-\!OR \xrightarrow[\text{or heat}]{h\nu} 2\,RO\cdot$; $RO\cdot + HX \longrightarrow ROH + X\cdot$

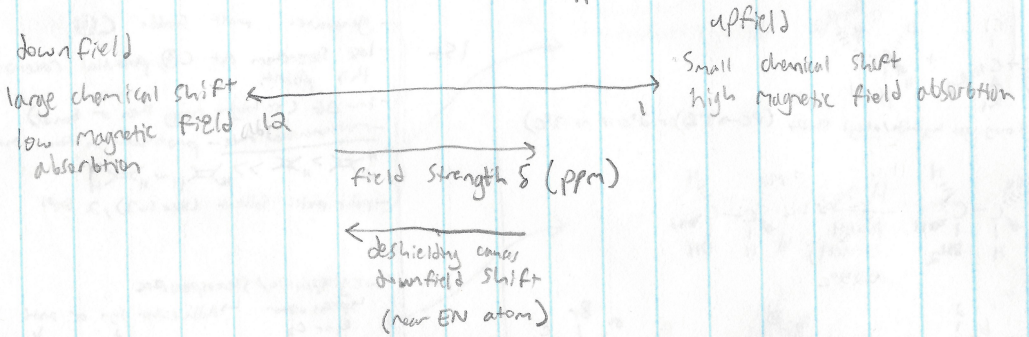
propagation: $X\cdot + C{=}C \longrightarrow X\!-\!C\!-\!C\cdot$; $X\!-\!C\!-\!C\cdot + HX \longrightarrow X\!-\!C\!-\!C\!-\!H + X\cdot$

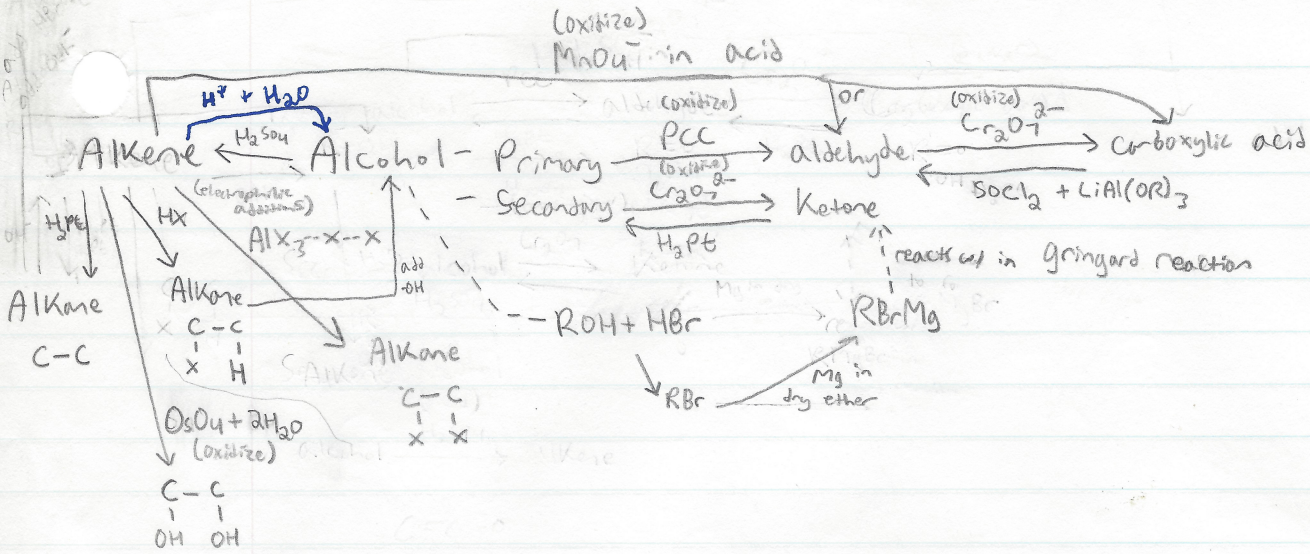
termination: $2X\cdot \longrightarrow Br_2$

* generate most stable radical, despite C· being less affected by the inductive effect as C⊕.
  $3^\circ C\cdot > 1^\circ C\cdot$
* diffusion controlled reaction, no directionality (like acid/base)
* gives anti-markovnikov product, opposite of EA (X attacks 1st instead of H)
* X· more thermodynamically stable than H·, larger and long lived enough to be isolatable.

NMR spectroscopy
- # of unequivalent Hs = # of peaks
- Close to EN atom = more downfield (more EN atom near = even more downfield)
- # of Hs represented by absorption = height of peak.
- If equivalent Hs are adjacent to n nonequivalent Hs, then peak is split into n+1 subpeaks,

[3 bonds or fewer $\left(\begin{array}{c} H \\ | \\ C\!-\!C \\ | \\ H \end{array}\right)$



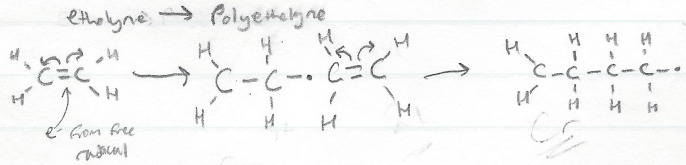


homopolymer - contain 1 type of monomer

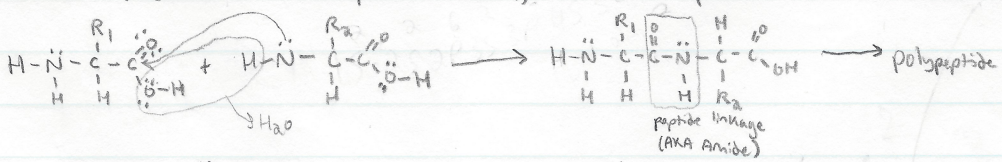
Copolymer - contain 2 types of monomer

- addition polymerization - monomers add together, form polymer (↳ alkene)
  - initiated by free radical ($HO\cdot$) attacks monomer making it free radical, elongates the C-chain
  - terminated when 2 radicals collide w/ eachother, share bond.

ethylene → Polyethylene



- Condensation Polymerization - nucleophilic substitution, small molecule produced for each extension of polymer chain



primary - order of amino acids (covalent bonds)
Secondary - arrangement of protein chain, ex helix or β pleated sheets (H-bonds)
tertiary - folding of helix into globular (ionic, covalent, H-bonds, dipole and induced dipole)
quaternary - # of globules are held together, by R groups sticking out of globules.