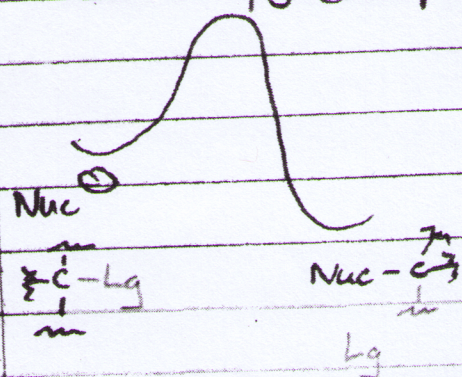
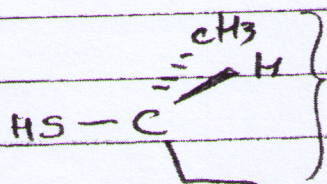


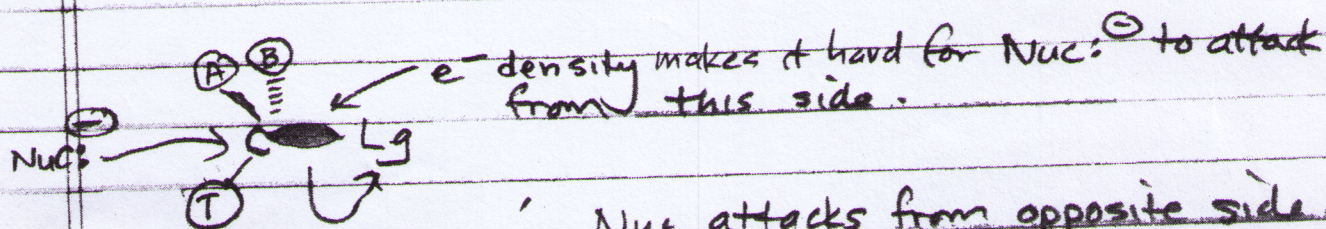
Ch9-2 TS (see previous page)



SN2 (one-step reaction)

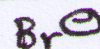
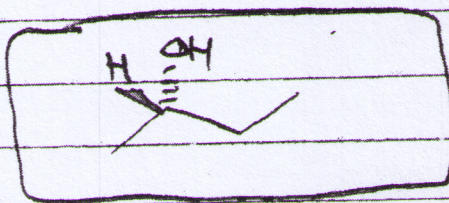
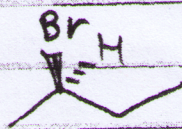


NOTE how everything on 'C' got inverted the other way.

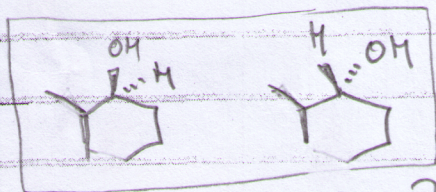


Nuc attacks from opposite side of Lg.

"Backside" Attack



SN2 product

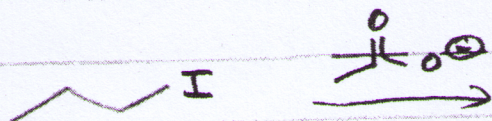


DI C EN?

[E] what's the difference. OH and H are "inverted"

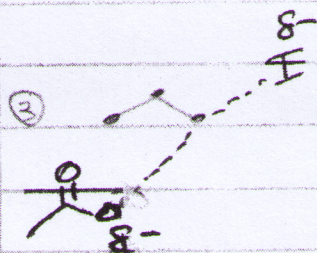
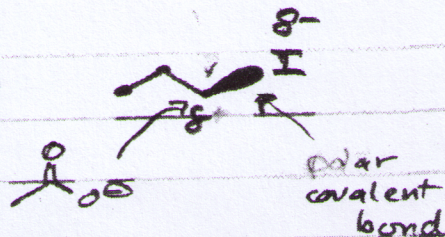
Ch 9-3

S_N2 reactions



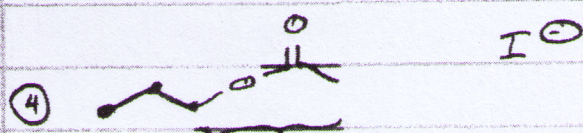
① What is the nucleophile? O=C[O-]

② Where will this nucleophile attack?

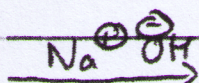
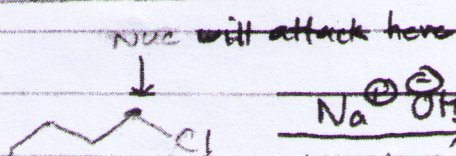


Account for carbons!

There are 3 C and the leaving group is I^-



nucleophile replaces 'I'

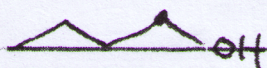


often NaOH $\Rightarrow$ break apart to ions to find Nuc Na^+ [OH^-]

① What is the nucleophile? [OH^-]

② Where will Nuc attack? (see arrowed C above)

③ Account for all atoms in structure, and do substitⁿ.

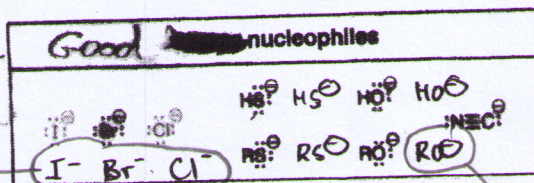
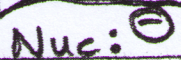


Ch 9-4

SN2 RXNS

① What makes a good nucleophile?

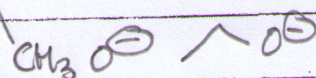
Localized Negative charge - not affected by resonance



NOTICE

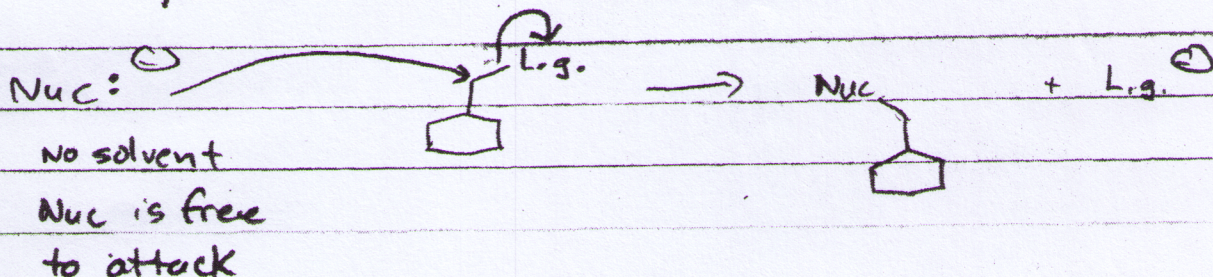
(-) charges

will often be drawn as NaX but separate to find Nuc (X^-)

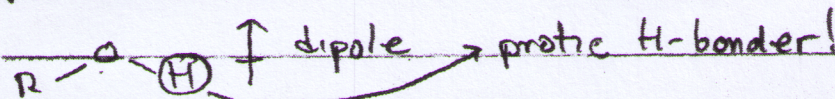
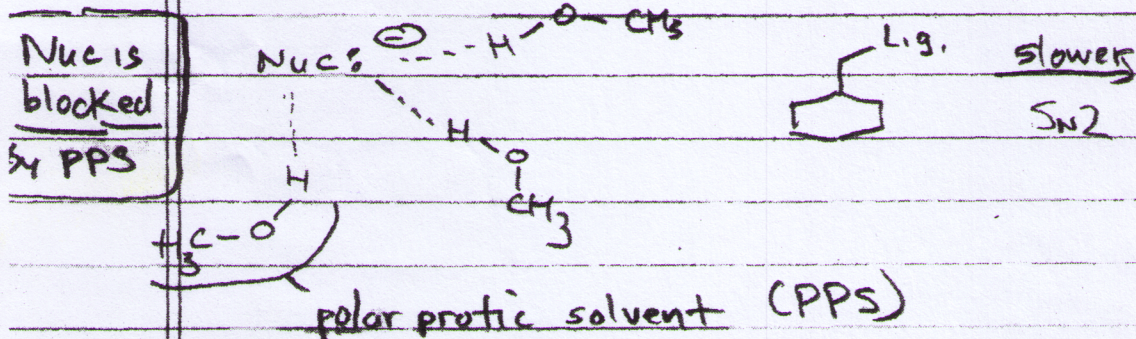


② How does solvent affect Nucleophilic Rxn rate in SN2?

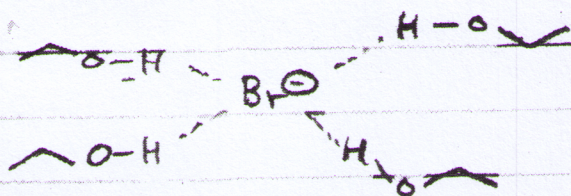
Ⓐ Solvents that can H-bond to Nuc: $\ominus$ will hinder/slow ability of Nuc to attack!



(PPS) A polar protic solvent can H-bond w/ Nuc: $\ominus$
 $\therefore$ SN2 rxn is slowed down



Ch 9-5



a PPS stabilizes (-) chrg of Nucleophile making it less likely to attack the δ^+ of a polar covalent bond attached to L.g.

$r \propto [N][R-L_g]$
 $r \propto [Nuc][R]$

PPS

Slows S_N2 attack since rate is dependent on $[Nuc:]$

⑥ S_N2 reactions prefer polar Aprotic Solvent
 Non H-bonding

PPS

Protic solvents			Polar aprotic solvents		
Water	Methanol	Ethanol	Acetone	Dimethylformamide (DMF)	Hexamethylphosphoramide (HMPA)
Ammonia	Acetic acid		Dimethylsulfoxide (DMSO)	Acetonitrile	

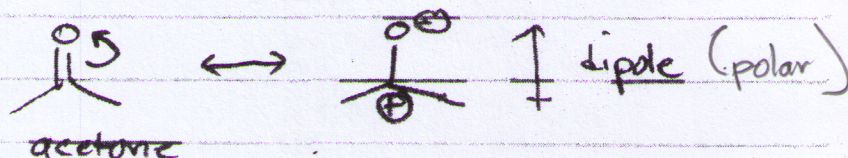
PAS

or PAPS

Do not have H bonded to N, O, S

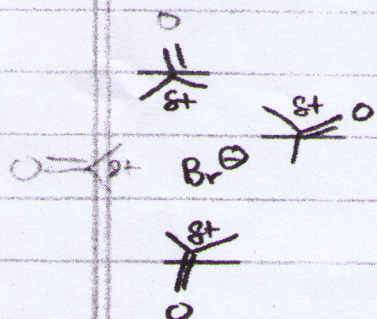
these compounds are polar but not protic!

Resonance reveals this



acetone

Resonance Hybrid =



δ^+ charge don't stabilize

Br^- like H-bonds $\therefore Br^-$ nucleophilicity is free to attack!

Ch 9-6

SN2 rxns like

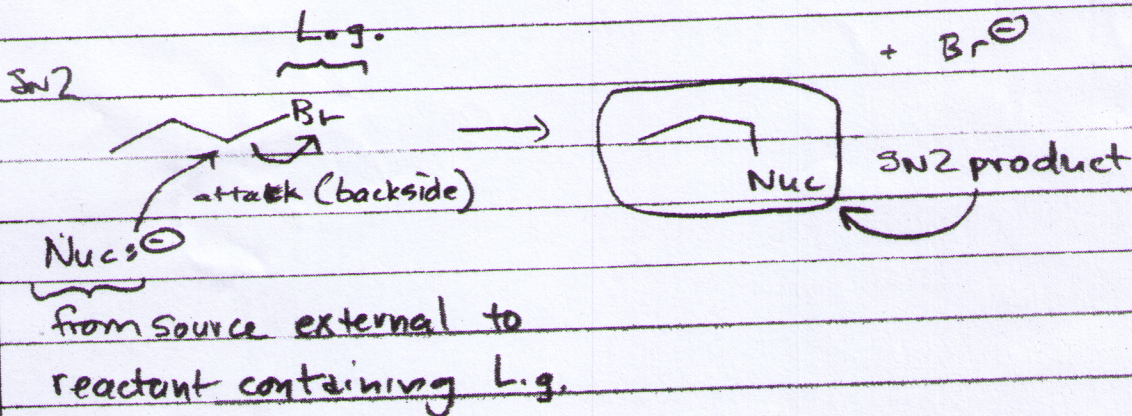
① good Nuc:[⊖] (neg charge) nucleophile

② polar aprotic solvent

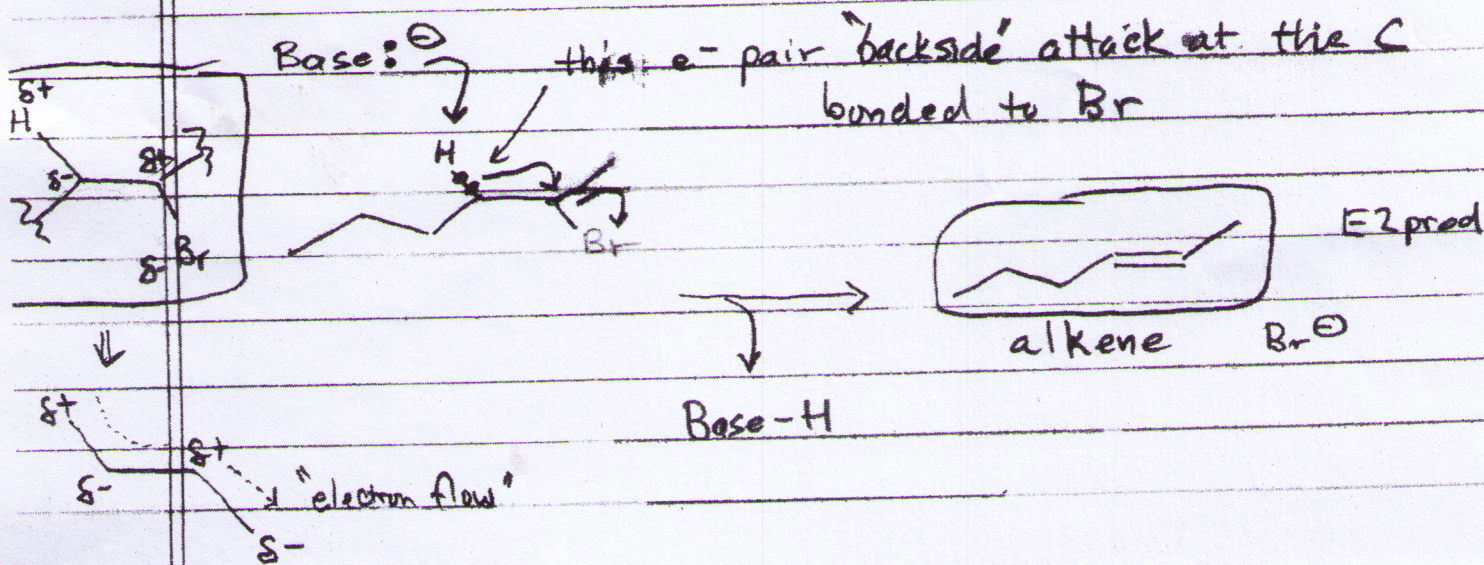
③ Leaving Grp on 1° C center rate: 1° Lg > 2° Lg > 3° Lg

Elimination RXNS E2

In my view SN2 and E2 rxns are fundamentally identical.



E2 : For E2 the Nuc:[⊖] is NOW a Base



Ch 9-7

(E2)

rxn rate

$$= k [\text{alkyl halide}] [\text{Base}]$$

$1+1=2$
bimolecular

looks similar to

S_N2 rate

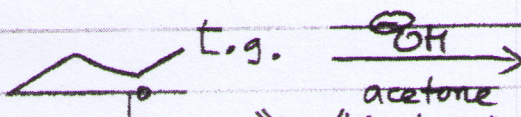
$$k = [\text{alkyl halide}] [\text{Nuc}] \quad S_N2$$

elimination

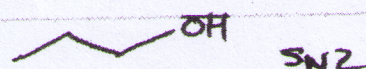
bimolecular

WHY? 1° (primary) vs 3° (tertiary)

L.g. on
 1° C

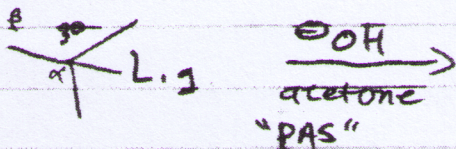


"PAS" (solvent) see pg Ch 7-6

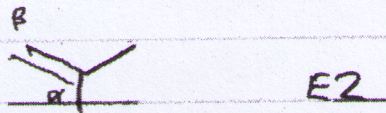


but

L.g. on
 3° C



"PAS"



Substitution

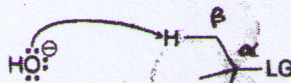
Hydroxide functions as a nucleophile



TOO CROWDED

Elimination

Hydroxide functions as a base



BEST CHOICE

ideal S_N2
or S_N2 , but
crowded!

S_N2 : Difficult for HO^- to backside attack sterically hindered C attached to L.g.

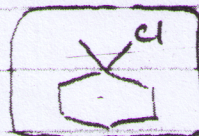
$E2$: HO^- Functions as a base and pulls off accessible $\beta\text{-H}$

Note: C_α is attached to L.g.
 C_β is attached to C_α

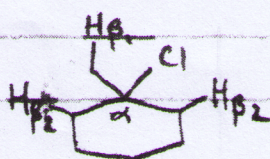
Ch 9-8

Examples

Draw the most abundant E2 product(s)



starting material

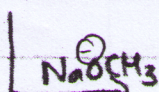


① Alkyl halide is 3°

② I.D. Cx and unique Cp

③ Base ~~is~~ (CH₃O⁻) ∴ Zaitsev product

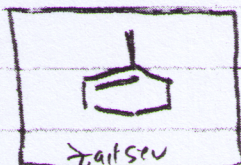
E2/SN2



④ Conditions E2/SN2

⑤ Alkyl halide 3°

⑥ ∴ E2



same



so don't include this as 2nd product

