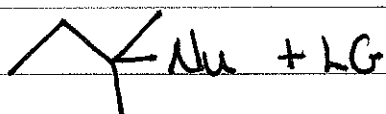
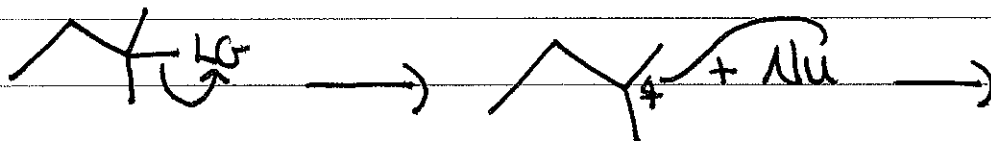
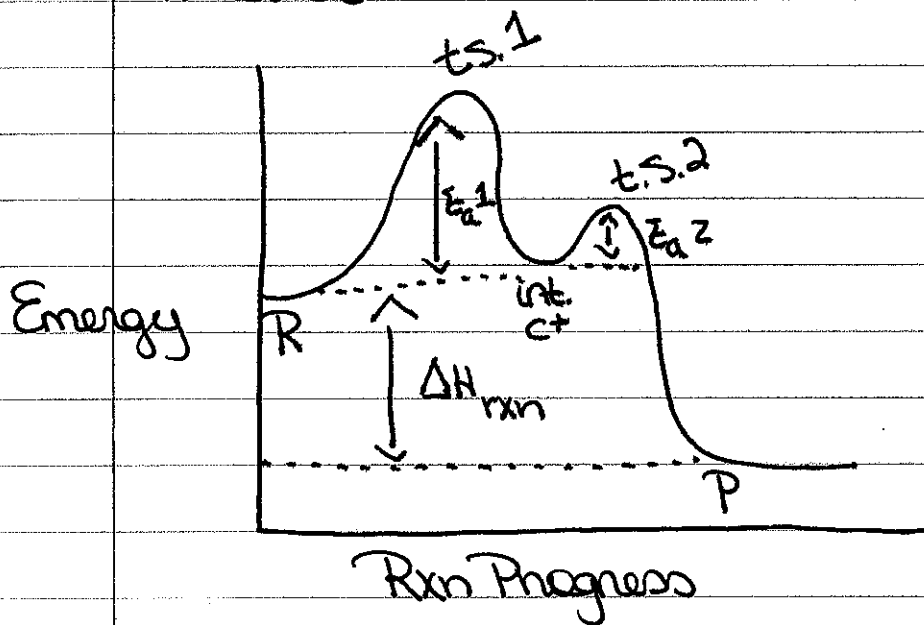


* S_N1 : 1st order Nucleophilic Substitution



* Kinetics



$$\text{rate} = k [RX]$$

* Substrate

$3^\circ > 2^\circ > 1^\circ > \text{Methyl}$ (due to C^+ int.) (part of rds)

* Leaving Group (LG)

Good LG is required b/c part of rate determining step (RDS)

- In order to be a good leaving group,

it must be:

① Electronegative (Cl)

② Big (Br, I)

③ Resonance Stabilized (tosylate)

④ Small, neutral molecule (H_2O , NR_3)

* Stereochemistry

Racemic due to C^+ int.

* Nucleophile

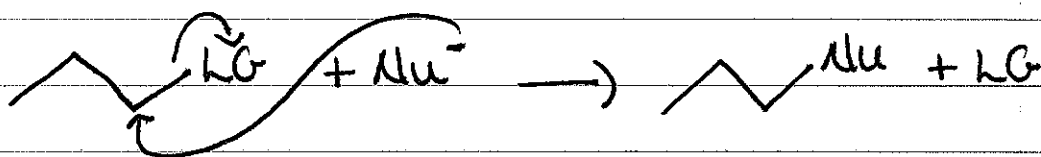
Any will do b/c not part of RDS

* Solvent

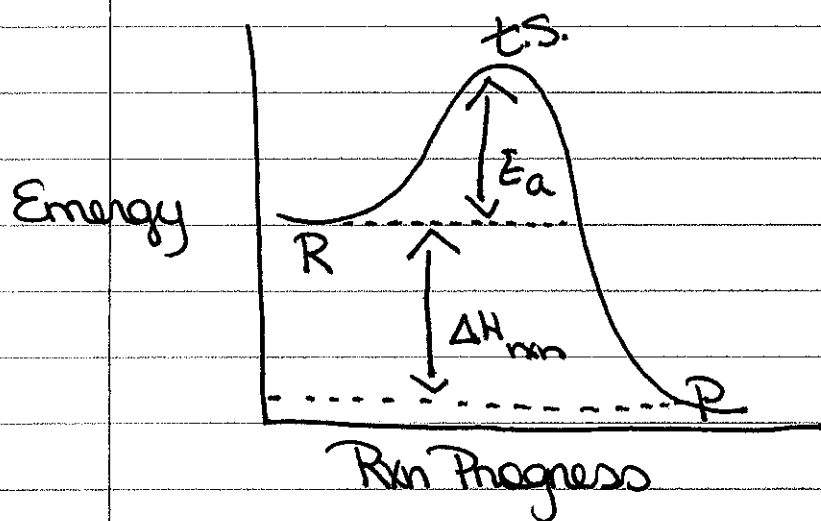
A polar protic solvent is preferred:
protic solvents solvate & stabilize the C^+ int.

- Protic Solvents: H_2O , ROH , $RCOON$

* S_N2 : 2nd order Nucleophilic Substitution



* Kinetics



$$\text{rate} = k [RX] [Nu^-]$$

* Substrate

Methyl $> 1^\circ > 2^\circ > 3^\circ$ (less hindered so Nu^- has room to attack C)

* leaving Group (LG)

Good l.g. is required b/c part of RDS

* Stereochemistry Inversion

* Nucleophile

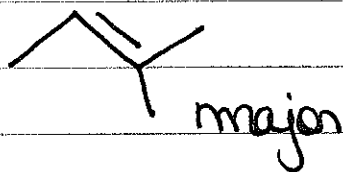
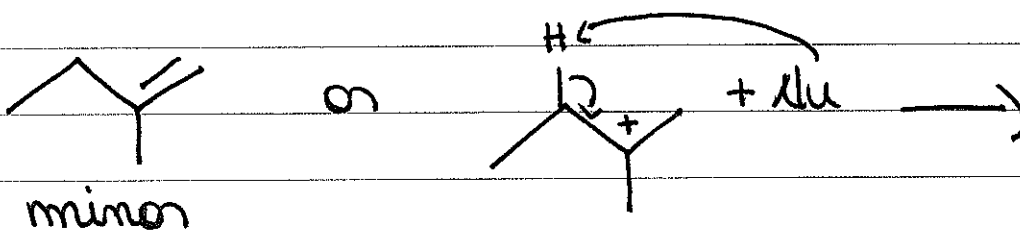
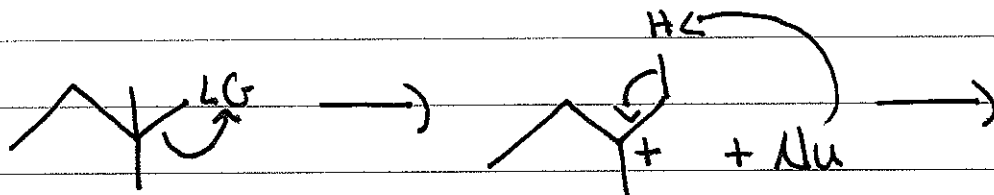
Good, strong, negative nucleophile is required b/c part of RDS

* Solvent

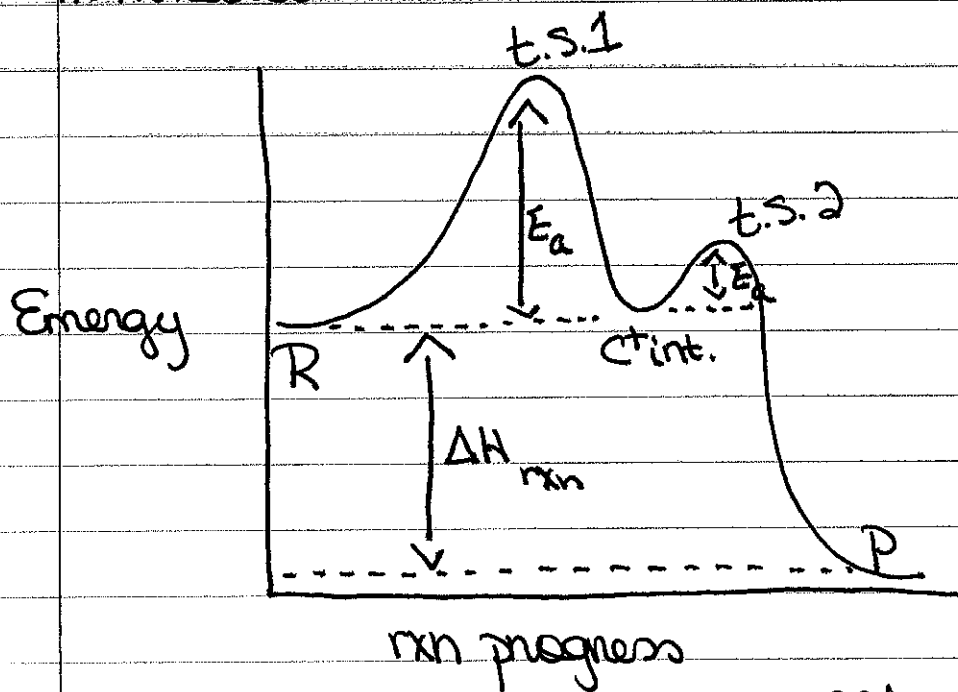
A polar aprotic solvent is preferred:
protic solvents solvate & hinder the nucleophile

- Aprotic Solvents: THF, DMF, DMSO,
NMPA, Acetone, Acetonitrile

* E1: 1st order Elimination



* Kinetics



$$rate = k [R_x]$$

* Substrate

$3^\circ > 2^\circ > 1^\circ > \text{Methyl}$ due C^+ int. (part of RDS) +
want to form most stable alkene

* Leaving Group (LG)

Good LG is required b/c part of RDS

* Stereochemistry

Follow Zaitsev's rule + make most
stable alkene possible

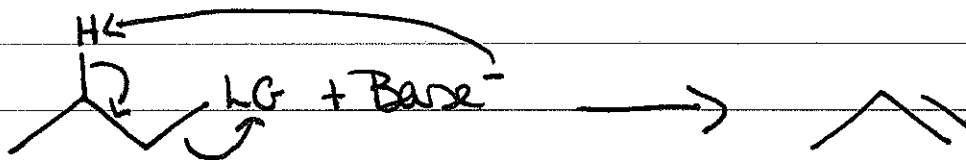
* Nucleophile / Base

Any will do b/c not part of RDS

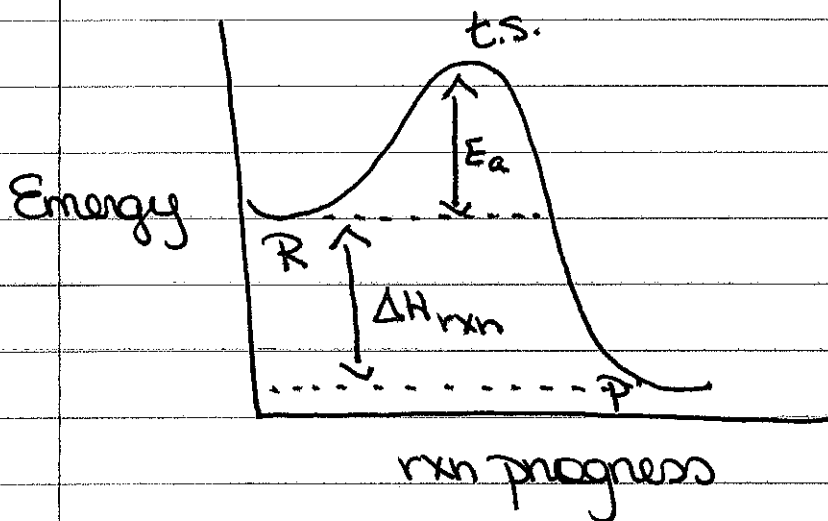
* Solvent

A polar protic solvent is preferred b/c
it will solvate + stabilize the C^+ int.

* E2: 2nd order Elimination



* Kinetics



$$\text{rate} = k[\text{RX}][\text{Base}^-]$$

* Substrate

3° > 2° > 1° > Methyl : want to make most stable alkene possible

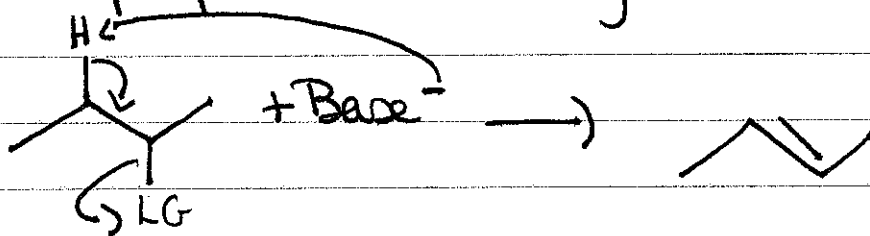
* Leaving Group (LG)

Good L.G. is required b/c part of RDS

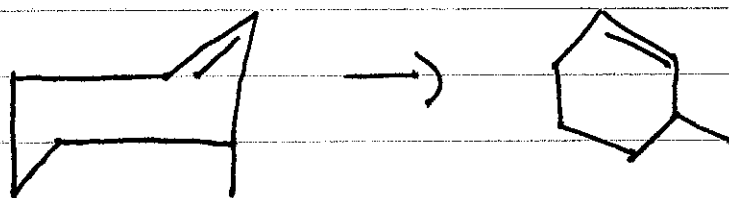
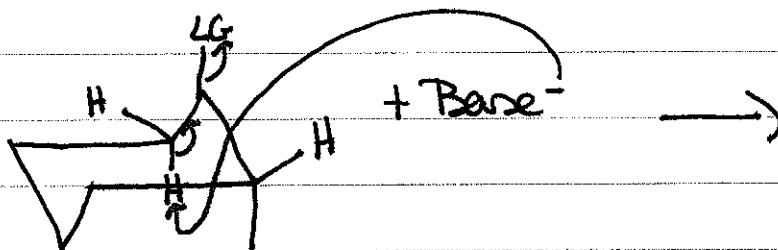
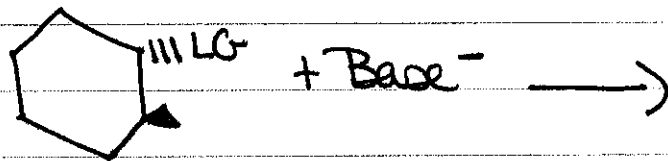
* Stereochemistry

① Follow Zaitsev's rule + make most stable alkene possible

② Antiperiplanar Geometry



③ Trans Diaxial Geometry



* Base

Good, strong, negative base is required
b/c part of RDS

* Solvent

A polar aprotic solvent is preferred b/c
protic solvents will solvate & hinder
the base