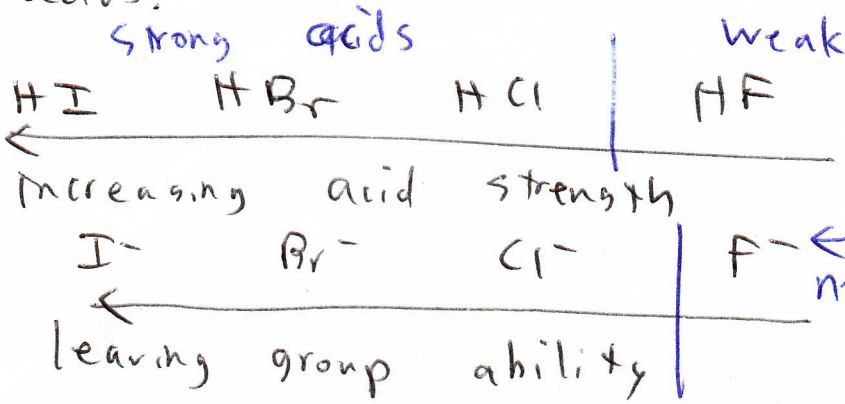
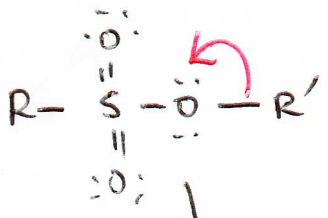
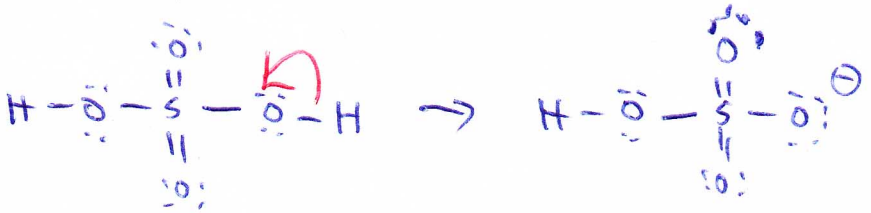
3) Leaving groups

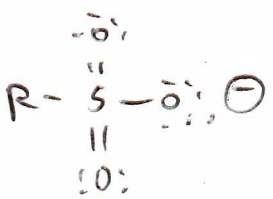
Good leaving groups are the conjugate bases of strong acids.



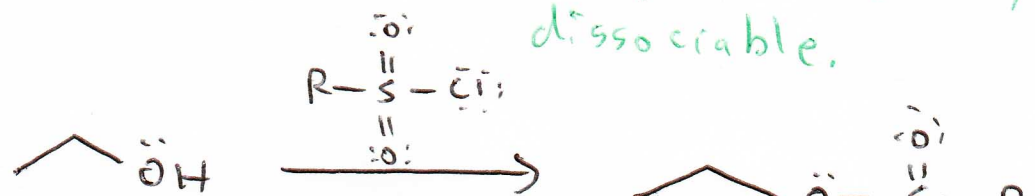


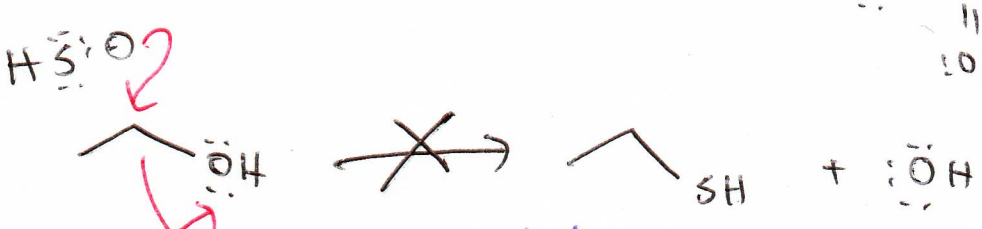
alkyl sulfonate

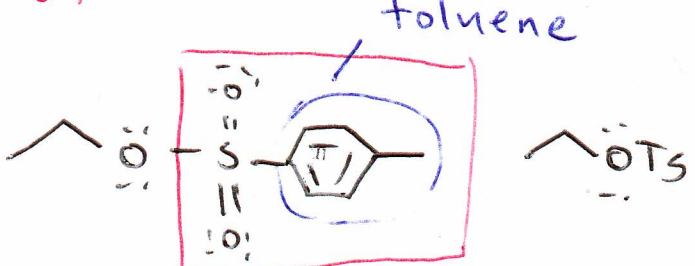




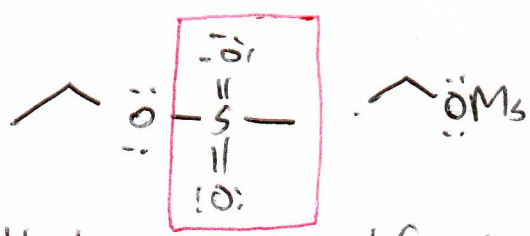
Sulfonates make good leaving groups because they are easily dissociable.







alkyl p-toluenesulfonate
tosylate



alkyl methanesulfonate
mesylate

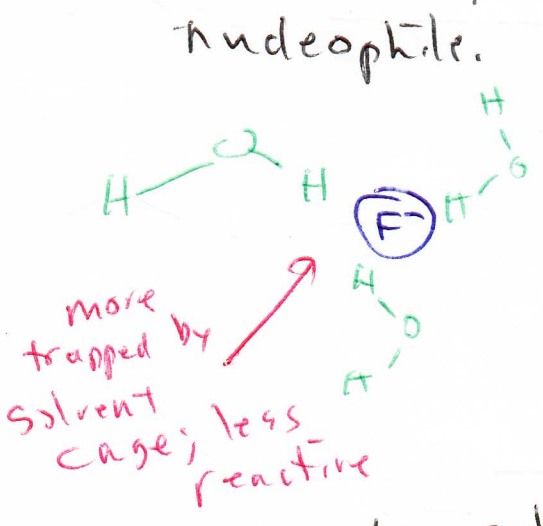
4) Solvent

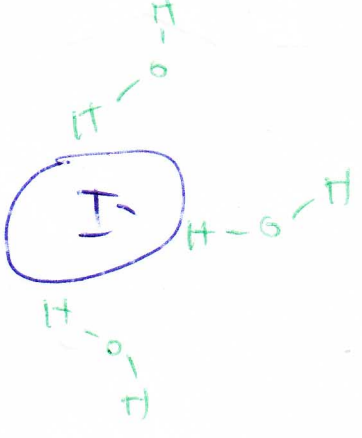
S_N2 rxns occur more rapidly in polar aprotic solvents,

Aprotic solvents are solvents that do not have easily dissociable protons (weak acids, pka >>16) and do not have protons that easily hydrogen bond.

In an aprotic environment - in which the nucleophile does not significantly interact with the solvent - fluoride is the most nucleophilic of the halides, due to its basicity (which outweighs the polarizability of iodide,

In protic solvents, the fluoride ion more extensively interacts with (or is "trapped" by) the solvent, so it becomes the poorer nucleophile.





more reactive in aprotic solvents

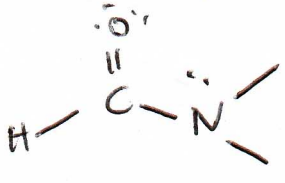
$F^- \quad Cl^- \quad Br^- \quad I^-$

more reactive in protic solvents

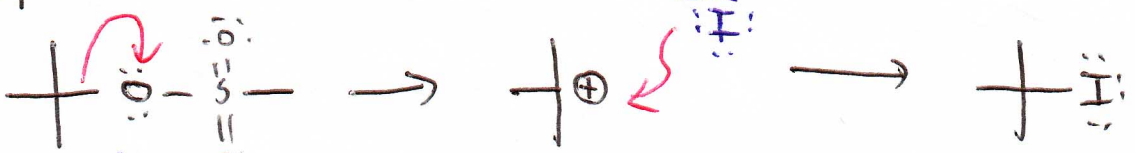
example polar aprotic solvents:

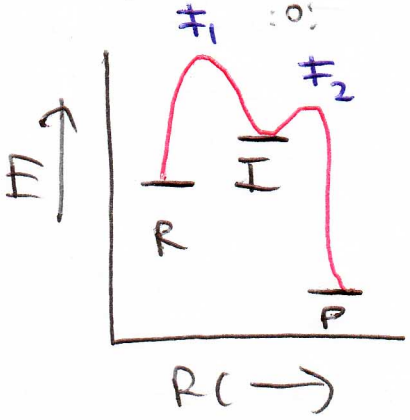
dimethylsulfoxide (DMSO)

N,N-dimethylformamide (DMF)

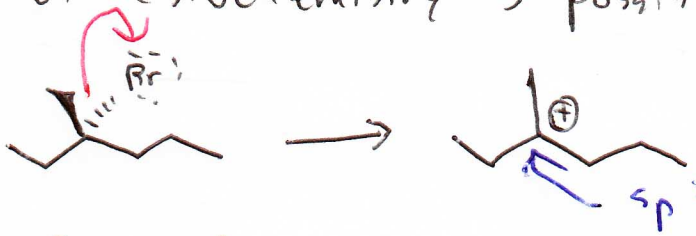


SN1

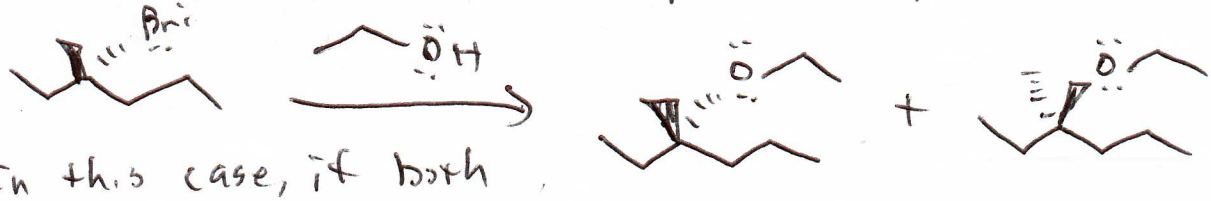




1) utility → alkyl halides → alcohols, ethers, thiols
2) reagents → weak, non-basic nucleophiles
3) conditions → protic solvents
4) mechanism → cationic, stepwise
5) stereochemistry → loss of configuration
6) regiochemistry → possibility of carbocation rearrangement



Since the geometry of the carbocation is planar, attack by the nucleophile could occur from either side, producing two products.



In this case, if both products form in equal proportion, a racemic mixture will result. However, after dissociation, ions can be trapped as an ion pair in a solvent cage. An ion pair can lead to a nucleophile preferentially attacking one side of a carbocation versus another.