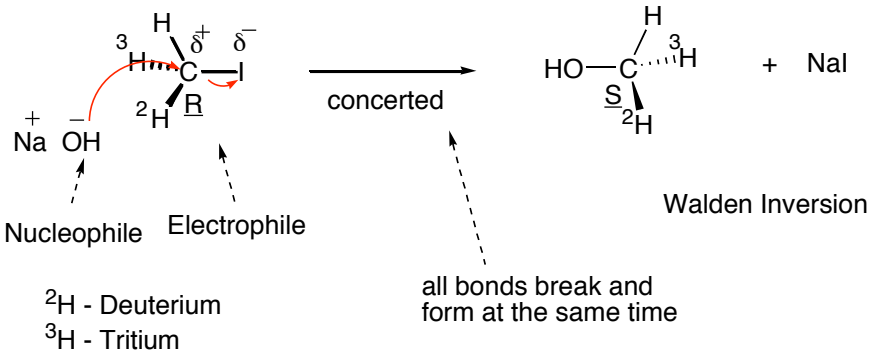
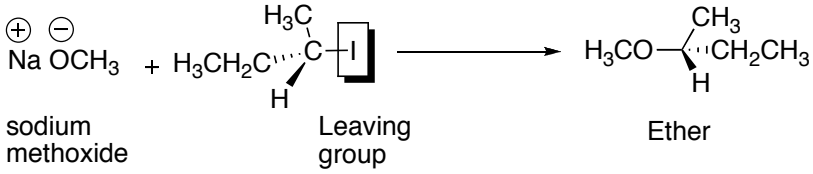
S_N2 Substitution- Nucleophilic 2 (rate depends on 2 concentrations Bimolecular)



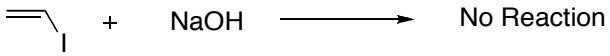
Eg.



S_N2

-Stereospecific (inversion of configuration)
-Concerted
-Bimolecular
-Best if 1° halide
-Works if 2° halide
-Never if 3° halide
-Never if leaving group is on C=C

Eg.

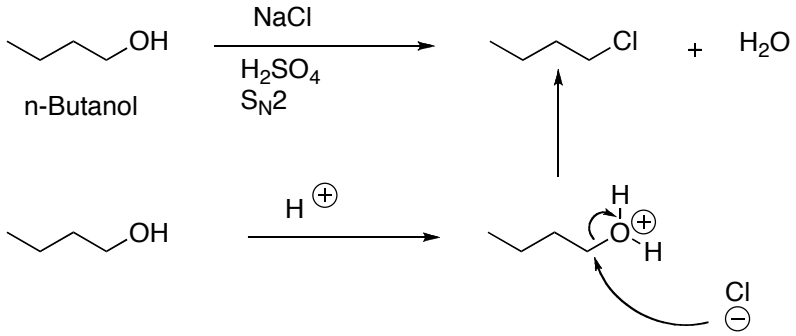


Leaving group ability
Worst

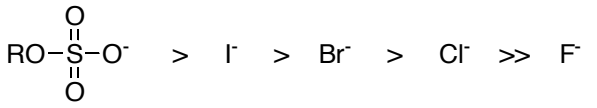
F OH OR NR_2 Never

Possible Leaving Groups – ACID required

Eg.



Excellent to Good Leaving Groups

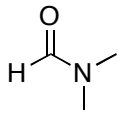


The order of halide leaving group ability is due to solvation and size.

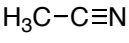
Solvent : Polar, Aprotic (no O-H) Best

(R-OH, H_2O will work often)

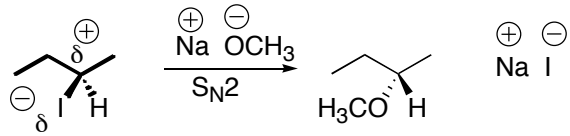
eg.


dimethylformamide (DMF)


dimethylsulfoxide (DMSO)

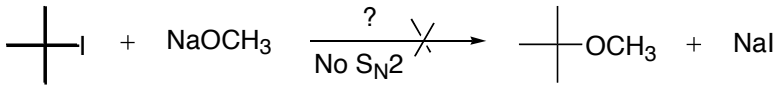


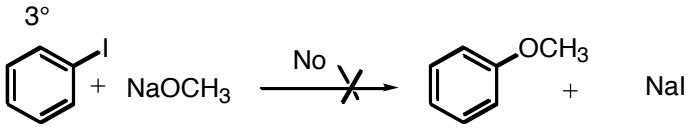
Acetonitrile



2° alkyl halide

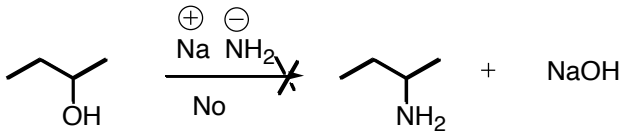
Will these reactions work?





Leaving group on 3° carbon

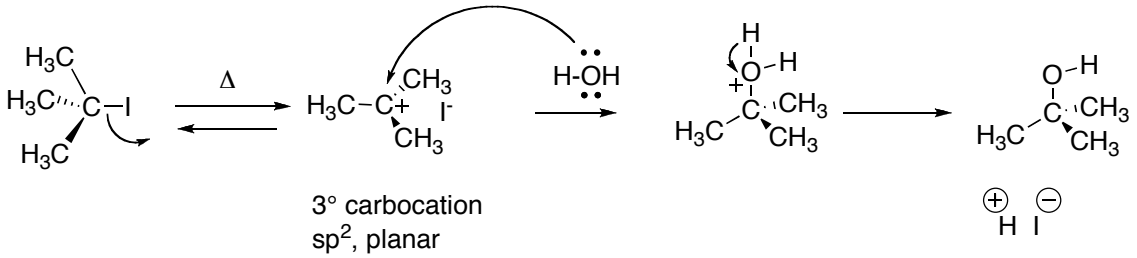
Leaving group on alkene



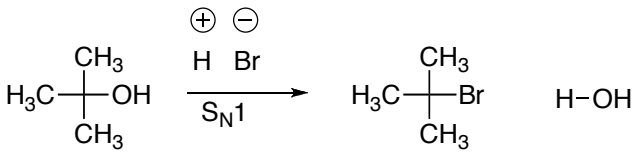
$^{-}$OH is terrible leaving group

S_N1- Substitution Nucleophilic Unimolecular (rate depends on 1 concentration)

- **stepwise (not concerted)**
- **carbocation intermediate**
- **not stereospecific**

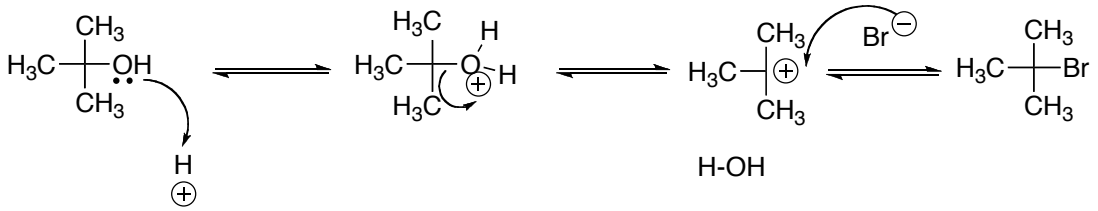


3° carbocation
sp^2, planar
120° angles

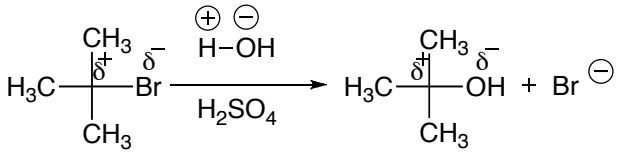


Tertiary butyl alcohol

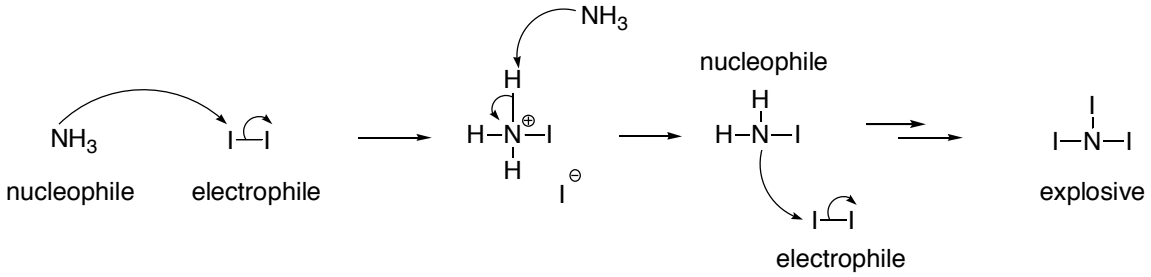
Mechanism



To do the reverse? Sn1 only possible mechanism for substitution as 3°



Demo.



S_N1

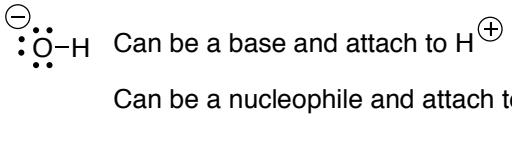
-Best if 3° carbocation can form
-Never on 1° alkyl halides
-Leaving groups – same as S_N2

OR and OH work if strong acid present
HOR and HOH are leaving groups

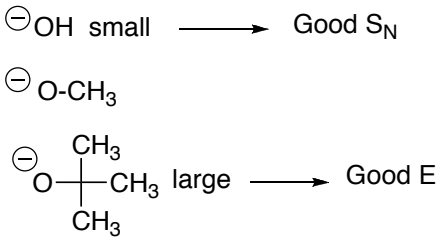
S_N1 and S_N2 can compete with E1 and E2 (alkenes formed)

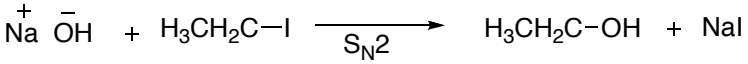
Base $:^{\ominus}$ **For elimination**

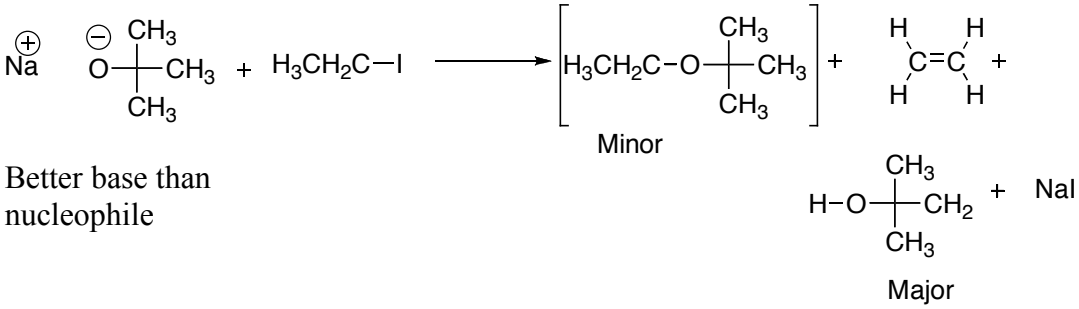
Nucleophile $:^{\ominus}$ **For substitution**

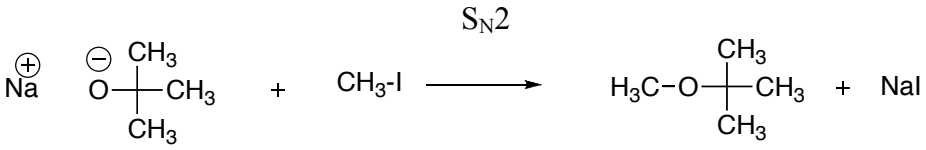


How can you tell which?

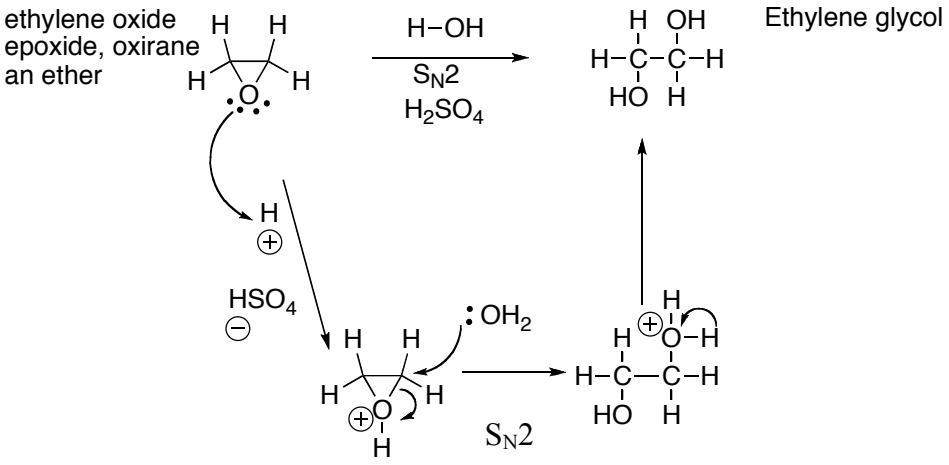


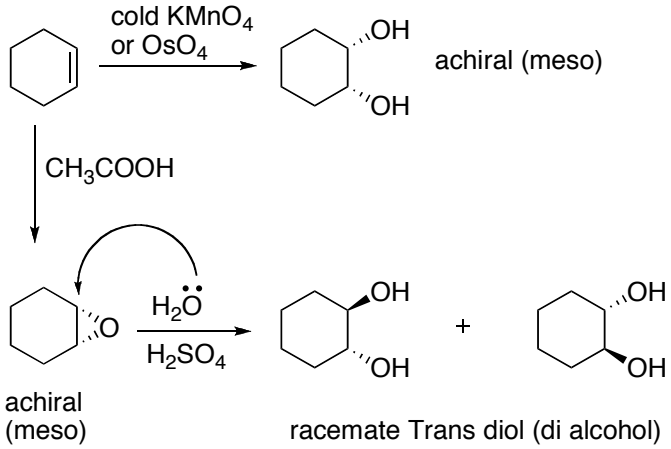






Elimination not possible as no adjacent carbon with H





achiral + achiral ⟶ overall achiral product