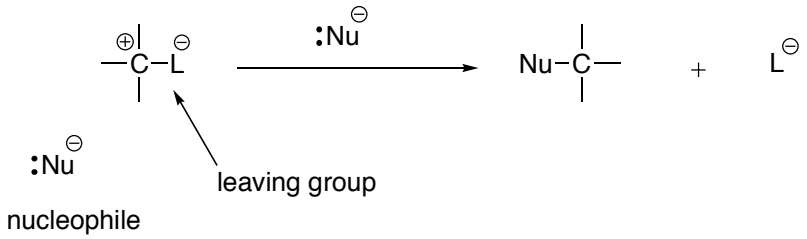
Substitution Reactions – 2 types: S_N1 and S_N2

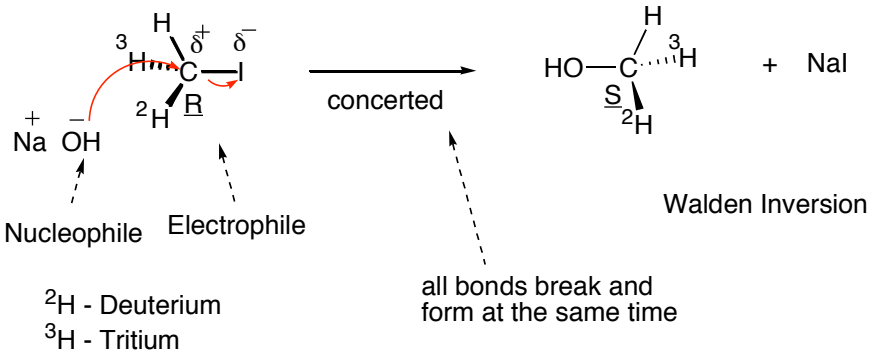
S_N2 reactions:

S = Substitution
N = nucleophilic
2 = bimolecular reaction (rate of reaction depends on 2 reagents)

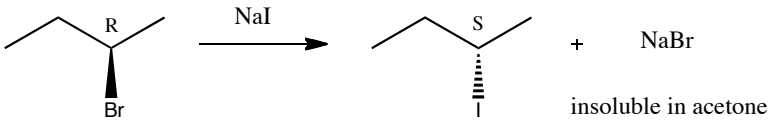
- stereospecific reaction
- inversion of configuration
- concerted reaction
- rate depends on two reagent concentration: [Nu] and [SM]
- favored for primary 1° carbons



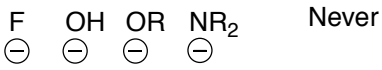
Eg.



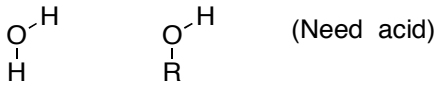
Eg.



Leaving group ability
Worst



Possible Leaving Groups – ACID required



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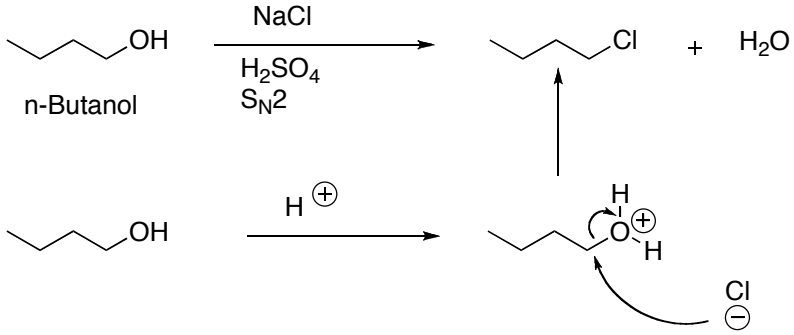
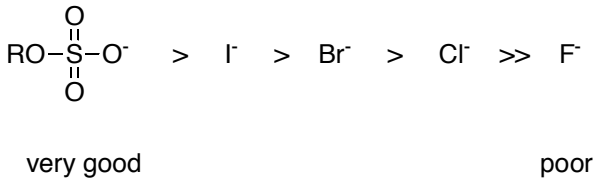
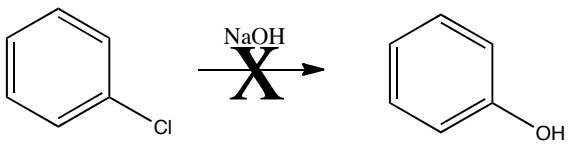


Excellent to Good Leaving Groups



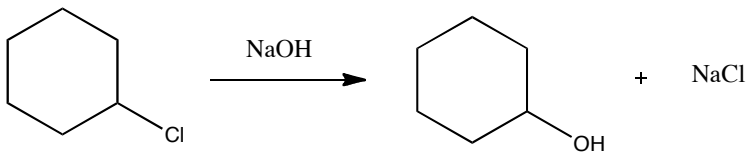
The order of halide leaving group ability is due to solvation and size.

Eg.

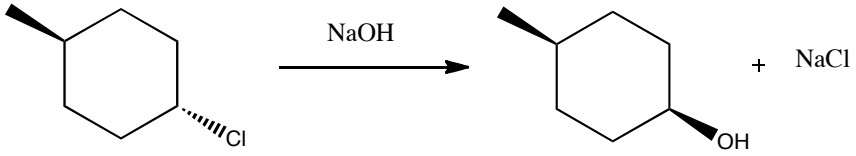


S_N2 **never** occurs at double bonds.

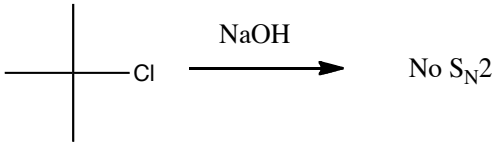
Eg.



Eg.



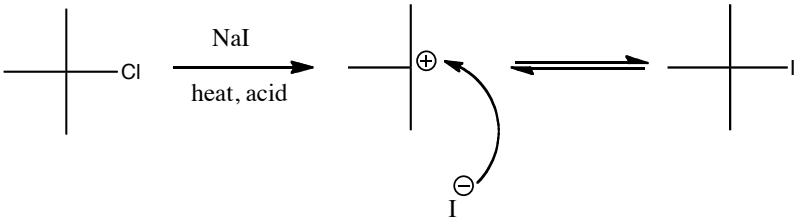
Eg.



S_N1 reactions - Substitution Nucleophilic Unimolecular

- rate depends on 1 concentration: [SM]
- stepwise (not concerted)
- carbocation intermediate
- not stereospecific

Eg.



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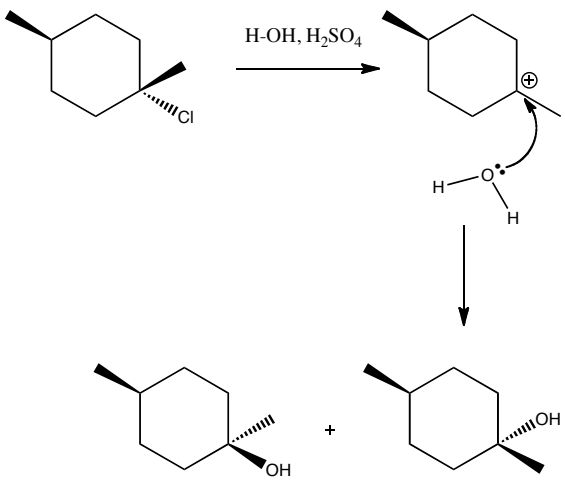
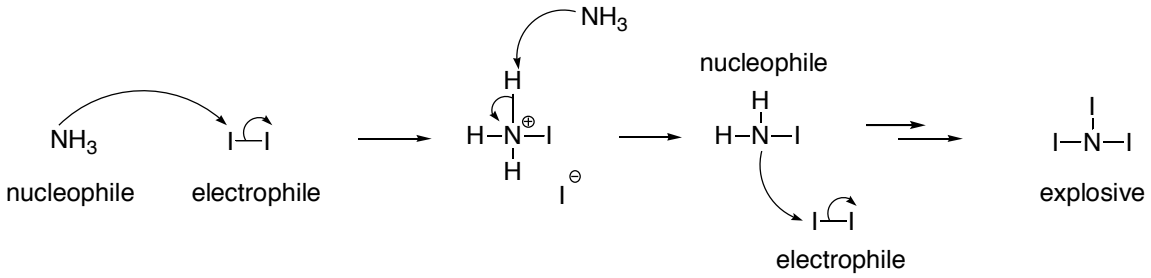


Demo:



S_N1

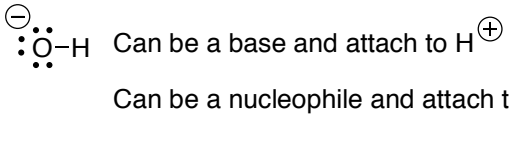
-Best if 3° carbocation can form
-Never on 1° alkyl halides
-Leaving groups – same as S_N2

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

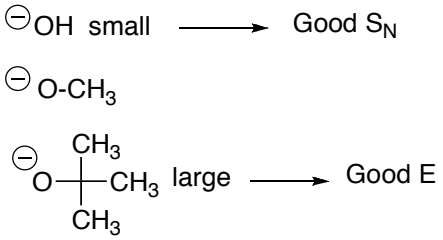
S_N1 and S_N2 can compete with E1 and E2 (alkenes formed)

Base $:^{\ominus}$ Nucleophile $:^{\ominus}$

For elimination **For substitution**



How can you tell which?



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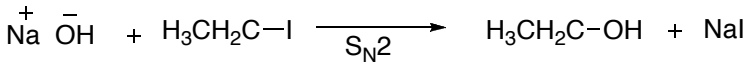

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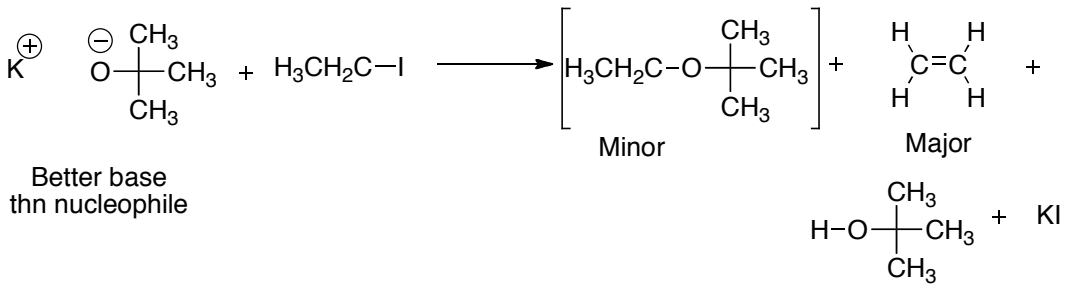

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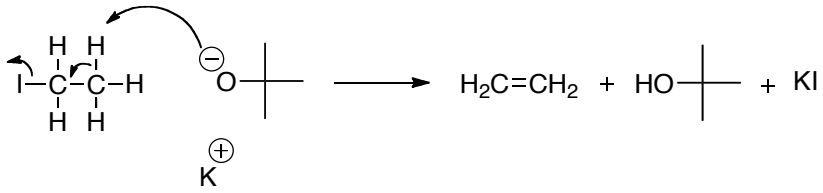
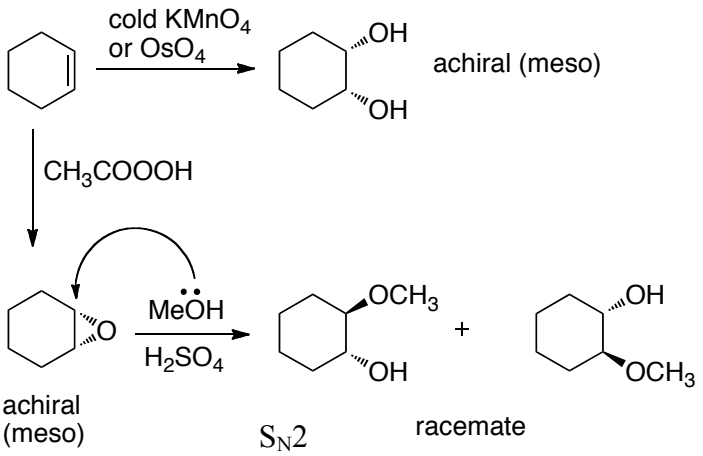


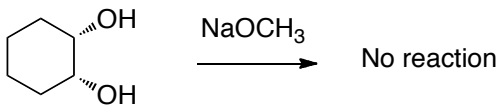
<u>Review</u>

Eg.

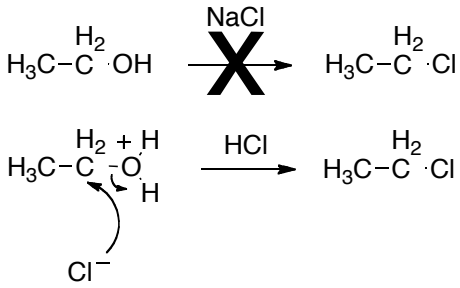


achiral + achiral ⟶ overall achiral product

Eg.



Eg.



Eg.