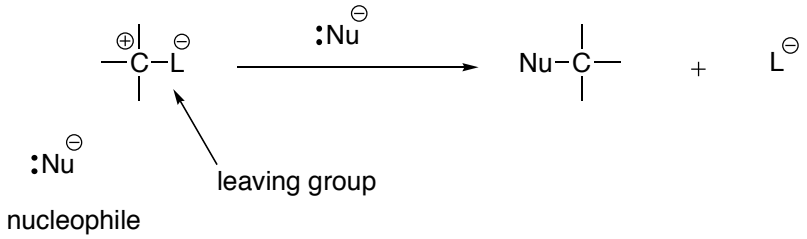
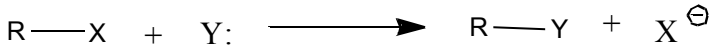
Substitution Reactions – 2 types: S_N1 and S_N2

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°& 2° carbons, Never 3° centres
- polar aprotic solvents e.g; Dimethyl formamide(DMF), Dimethyl Sulfoxide (DMSO), acetonitrile.

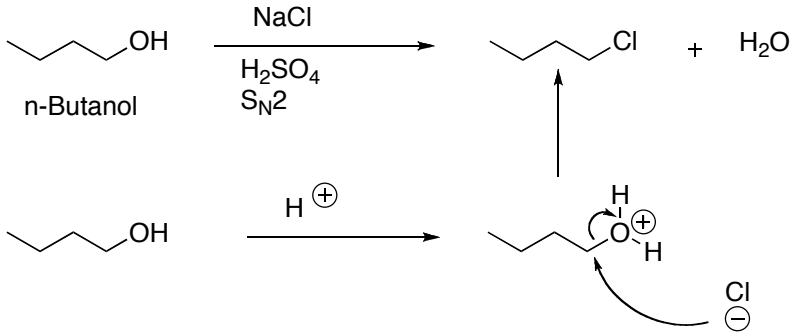




R= Alkyl
X= Halides
$I^{\ominus} > Br^{\ominus} > Cl^{\ominus} >> F^{\ominus}$
never; $OH^{\ominus}$, $OR^{\ominus}$, $NR^{\ominus}$

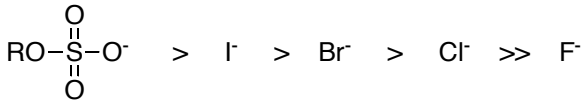
Other possible Leaving Groups – ACID required

Eg.



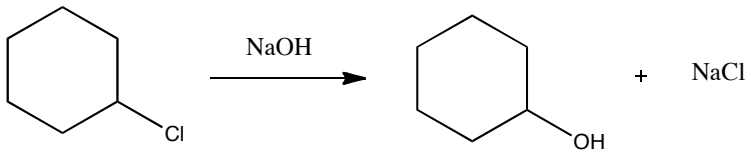
Excellent to Good Leaving Groups

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



very good poor

Eg.



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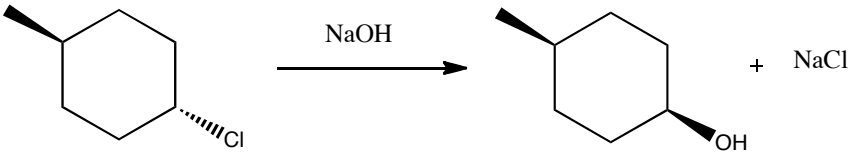

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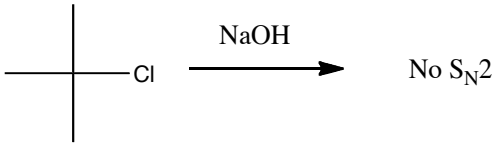
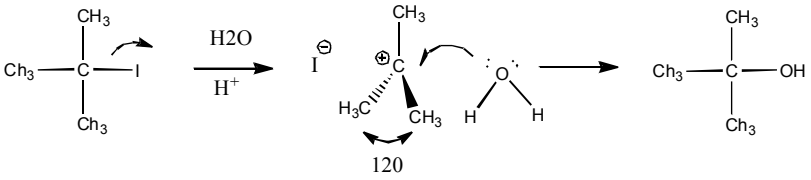


S_N1 reactions - Substitution Nucleophilic Unimolecular

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



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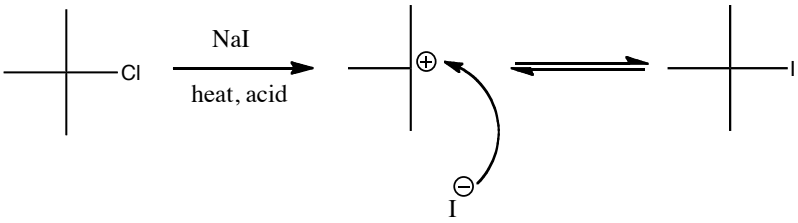

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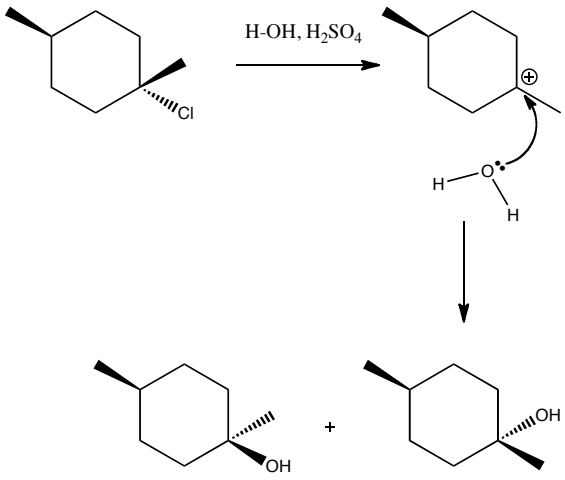

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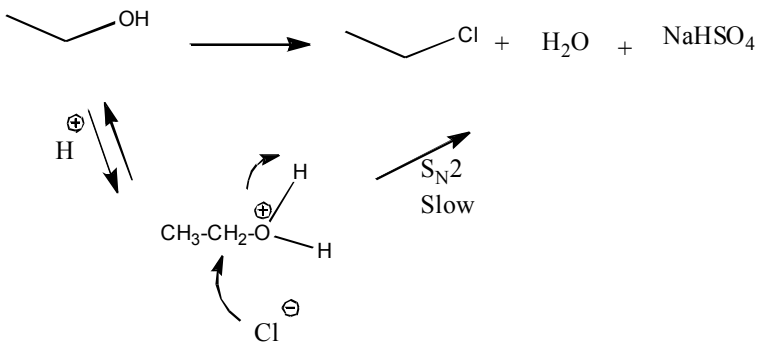

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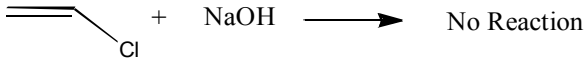

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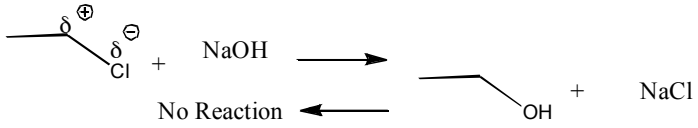


One reason is that the OH^- is not a good leaving group.

S_N1
-Best if 3° carbocation can form
-Never on 1° alkyl halides
-Leaving groups – same as S_N2

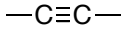
- **OR and OH work if strong acid is present; the HOR and HOH are the leaving groups.**
- **S_N1 and S_N2 can compete with E1 and E2 (alkenes are formed)**

ALKENES AND ALKYNES

Alkenes and Alkynes – Term olefin comes from: oleum facere

▶ Olefin “oil” + “to make”

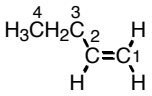
Alkene (olefin)



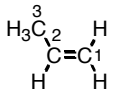
Alkyne (acetylene)

Alkenes – structure and nomenclature

ethylene (common name)
ethene (systematic name)
replace "ane" of corresponding alkane name with "ene"



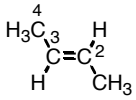
1-butene

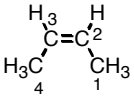


propylene (common name)
or propene(systematic name)

- to name find longest chain containing maximum number of C=C with both multiply bonded carbons in chain

- number from end to give 1st carbon of C=C lowest number, prefix with number to indicate position of first double bonded carbon





trans-2-butene

cis-2-butene

Stereoisomers (Diastereomers)

- cis = two large groups on same side
- trans = two large groups on opposite side

These 2-butenes are structural isomers with respect to the 1-butene above