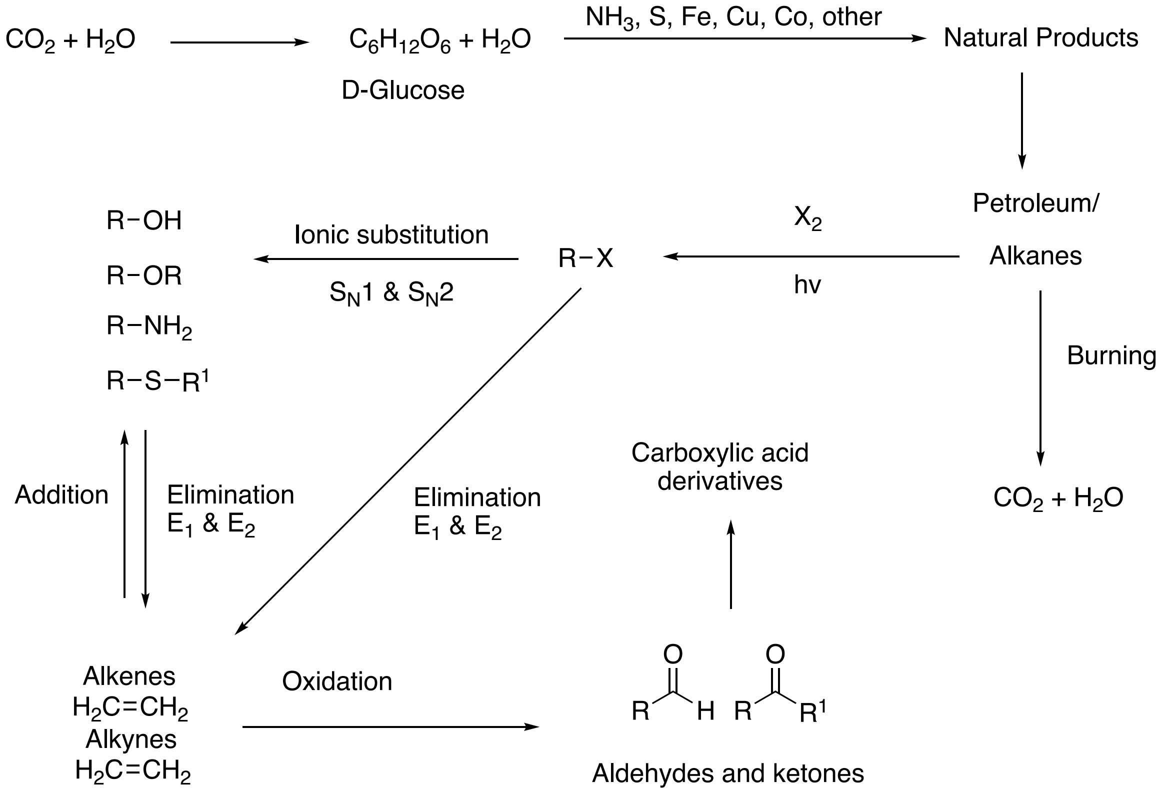
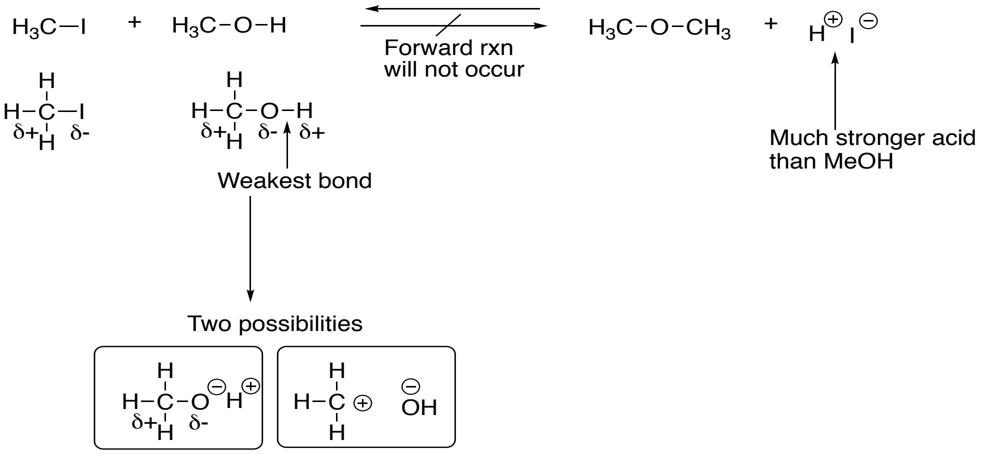
Photosynthesis and Related Reactions



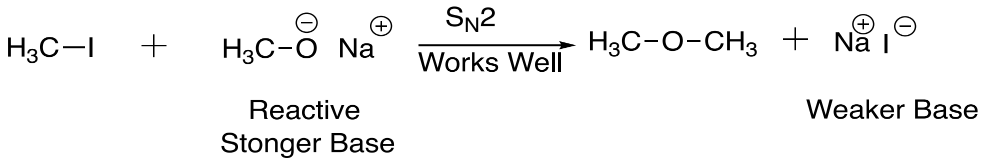
-Plants consume 4x10^{11} metric tons of CO_2 per year and convert it to D-Glucose

Sn Example:

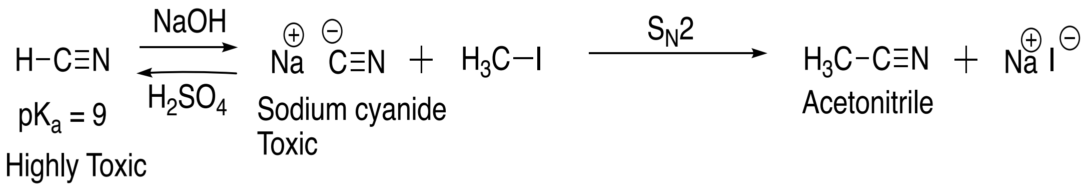


Hydrogen iodide is a strong acid and will drive the reverse reaction, meaning the forward reaction will not occur.

In order to make the above reaction occur, a stronger base (such as sodium methoxide) must be used to drive the forward reaction.



Example:

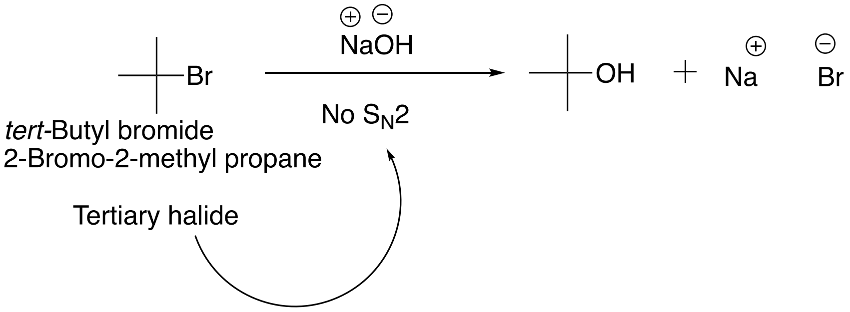


The above reaction will not occur unless hydrogen cyanide is converted into sodium cyanide using NaOH.

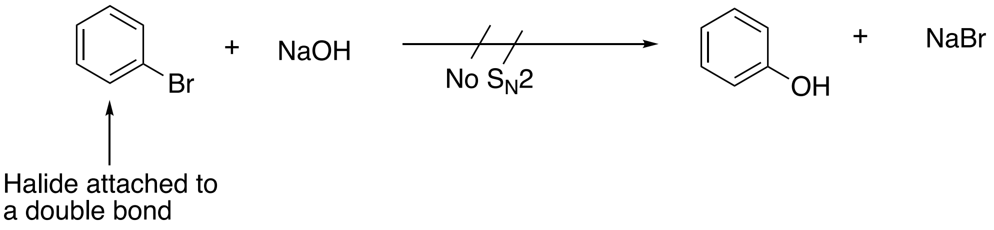
The product is acetonitrile, a common laboratory solvent.

<u>REVIEW:</u> S_N2 yes or no ? Examples

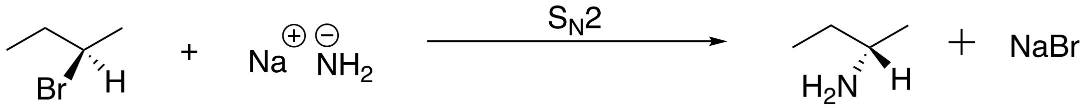
Ex #1) Will <u>NOT</u> proceed – no S_N2



Ex #2)



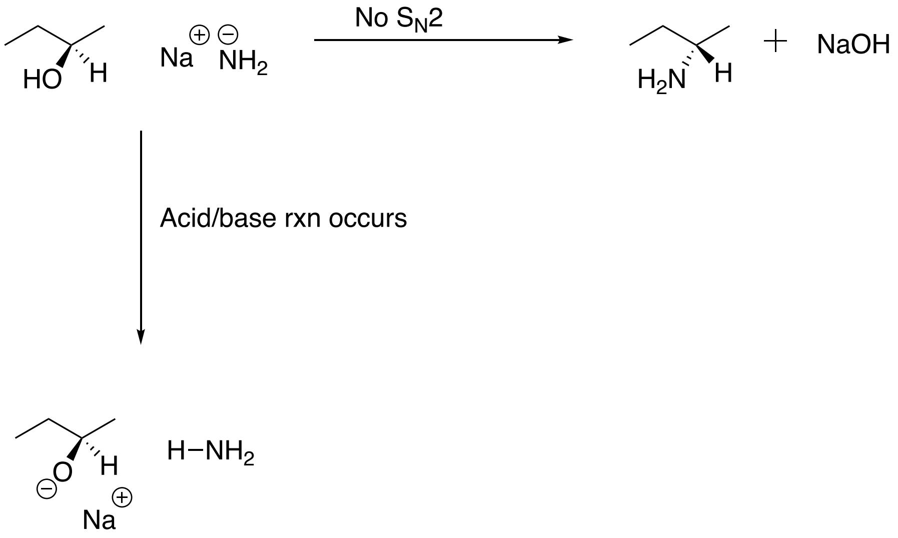
Ex #3) This one can work in principle



2-Bromobutane

Ex #4) The one belo does NOT work

$^{\ominus}$OH, $^{\ominus}$OR, $^{\ominus}$NR$_2$ are never good leaving groups



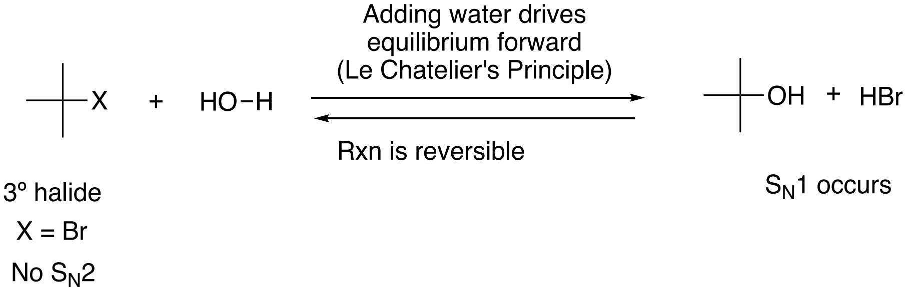
In this reaction, the NH_2 species will pull off the most acidic proton (the one on the alcohol) to from an **alkoxide** instead of undergoing an S_N2 reaction,

S_N1 reactions - Substitution Nucleophilic Unimolecular

- Rate depends on 1 concentration (concentration of the starting material)
- Not concerted – has a carbocation intermediate
- Not stereospecific
- Works if leaving group is tertiary (not primary, slow on secondary)

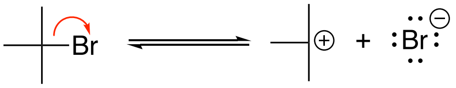
Example: Tertiary Halide

-No S_N2 possible, sterically crowded – does work by S_N1



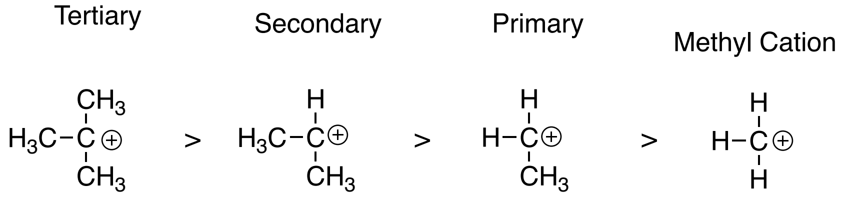
Mechanism:

The bromine group leaves with its electrons from the covalent bond, leaving behind a reactive carbocation intermediate



Carbocation intermediate

Carbocation Stability:

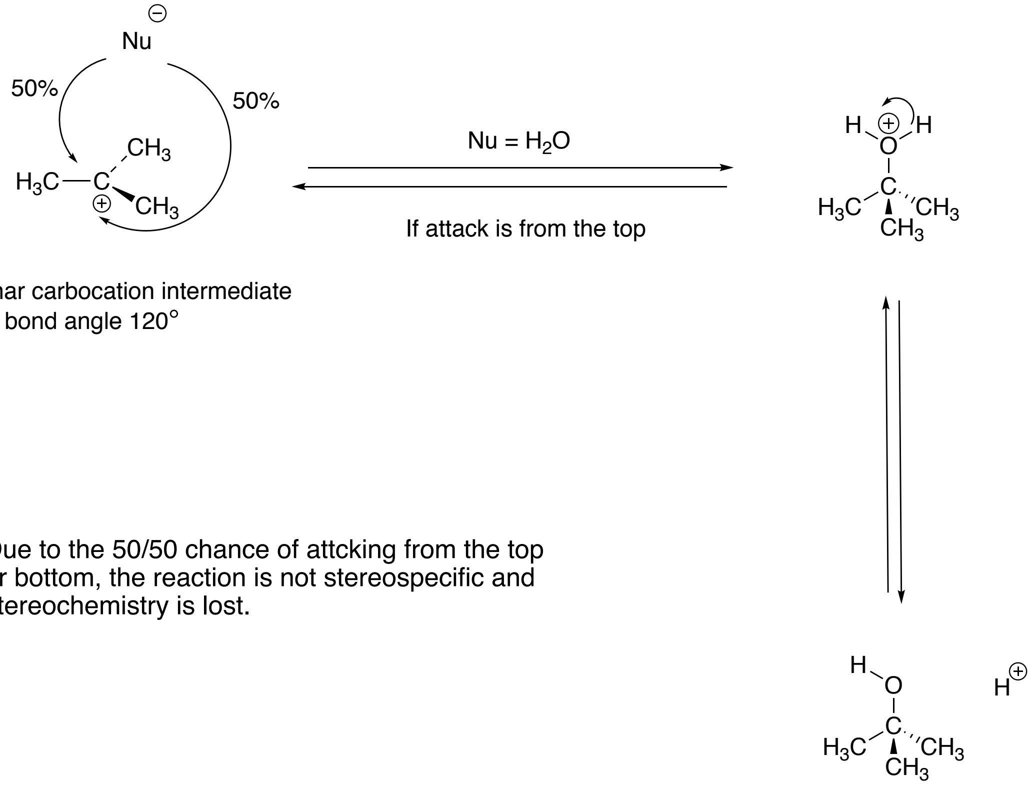


Most stable

Least stable (no S_N1)

The 3 alkyl groups donate e^- density into the positive charge

Mechanism of Nucleophilic Attack on Carbocation



Planar carbocation intermediate
sp^2, bond angle 120°

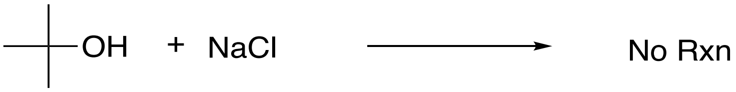
Due to the 50/50 chance of attcking from the top or bottom, the reaction is not stereospecific and stereochemistry is lost.

sp^3, tetrahedral, bond angle 109°

The result of an S_N1 mechanism is often a racemic mixture or mix of diastereomers

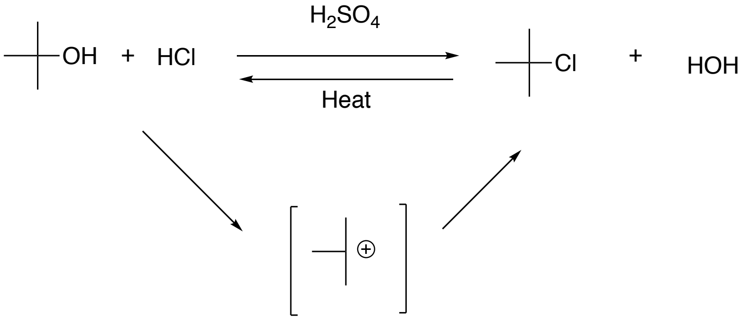
S_N1 and S_N2 Examples:

Ex #1)



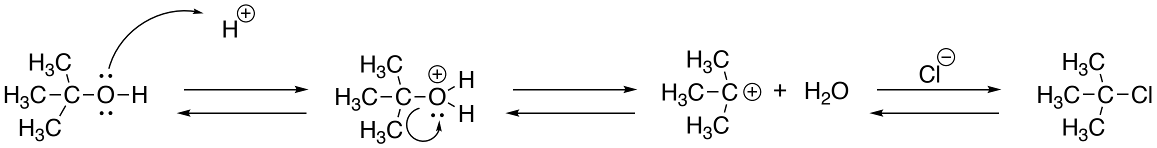
$^{\ominus}$OH is never a good leaving group

Ex #2)

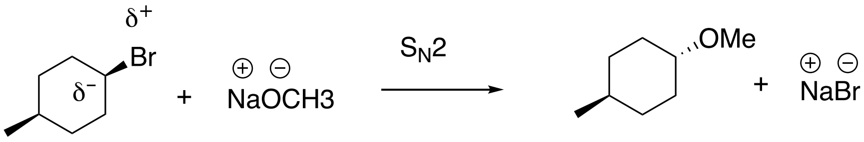


Carbocation intermediate

Mechanism:

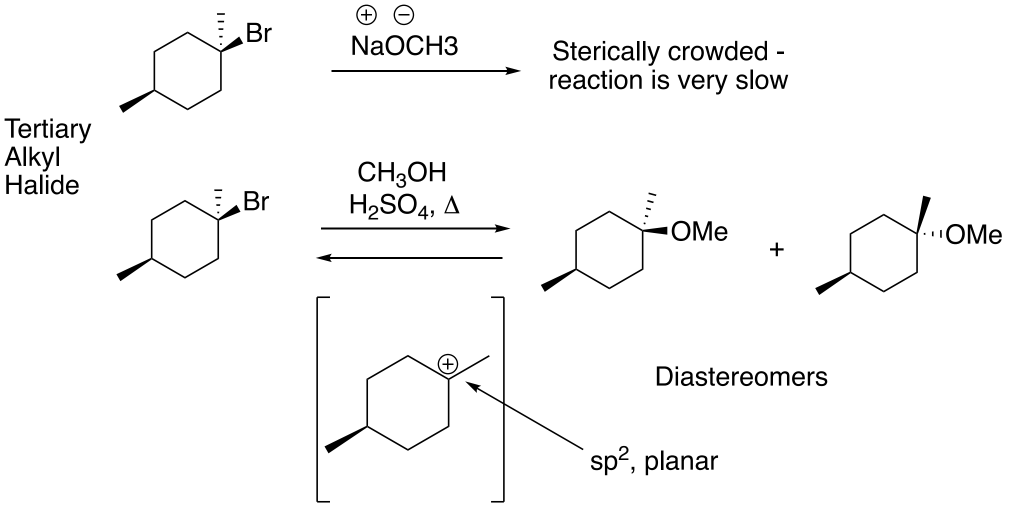


Ex #3)



Secondary
Alkyl Halide

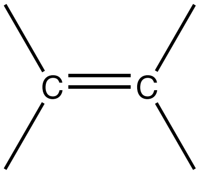
Ex #4)



Alkene and Alkyne Nomenclature

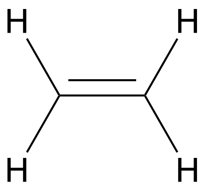
Alkene = double bond = olefin (oleum facere = to make oil)

Alkyne = triple bond = acetylene (as functional group, not compound)

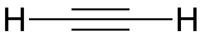


Alkene

Alkyne



Ethylene



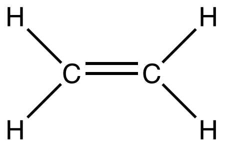
Acetylene

Simplest Alkene and Alkyne Possible

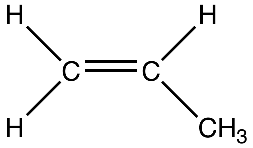
Alkene Nomenclature

Find longest chain, number from end to contain both ends of C=C and give lowest number to 1st C of C=C

Change “ane” to “ene” precede with number to indicate first double bond position



ethylene OR ethene



propylene OR 1-propene

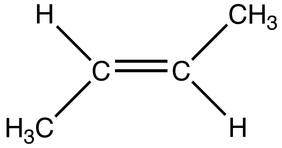
prop-1-ene

$CH_3CH_2CH{=}CH_2$

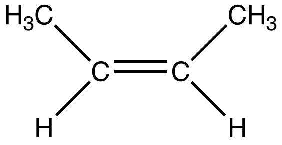
butylene OR 1-butene

but-1-ene

Below are two structural isomers of 1-butene



trans-2-butene



cis-2-butene

diastereomers