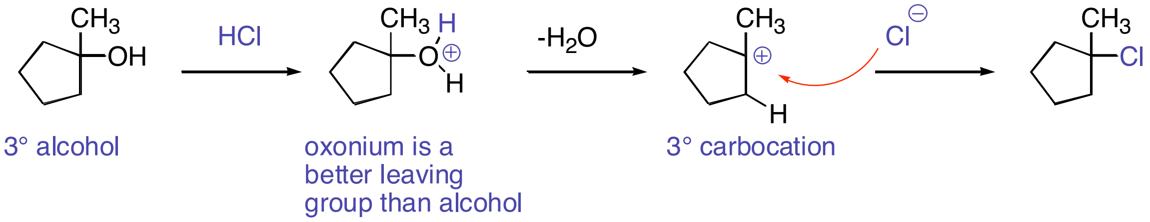
These notes can be obtained at: http://www.ndsu.nodak.edu/instruct/grcook/chem342/notes.shtml

Chapter 17: Alcohols and Phenols

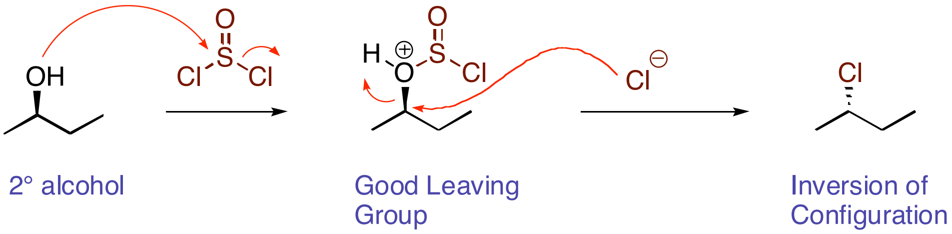
Reactions of Alcohols

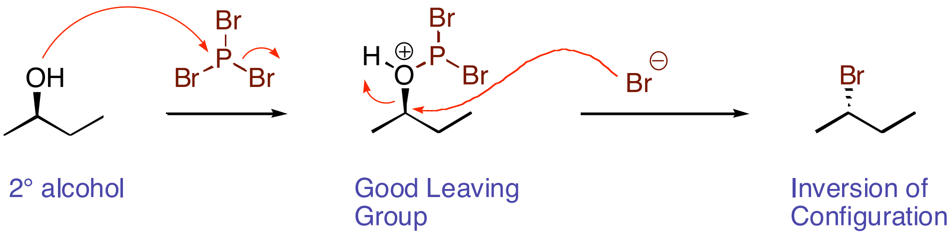
Alcohols can be converted into halides by activation of the OH and substitution with halide. For tertiary alcohols, mineral acids, like HCl affect a S_N1 substitution. For secondary or primary alcohols, $SOCl_2$ and PBr_3 will make the alkyl chloride or bromide, respectively. Note that this a S_N2 substitution and occurs with inversion of configuration if there is stereochemistry at the alcohol.

Acid Promoted Substitution - S_N1 - 3° Alcohols

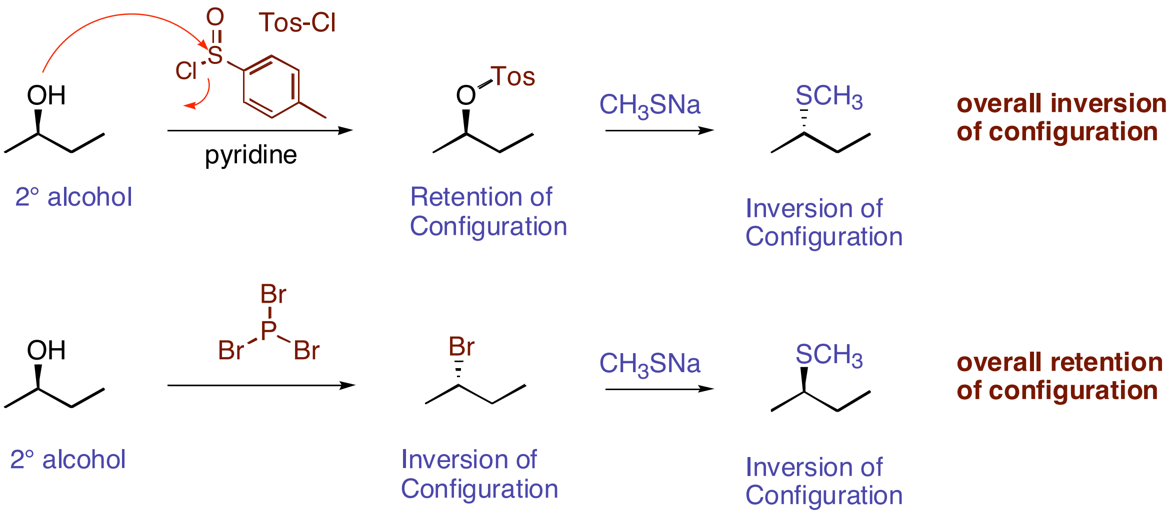


Electrophile Promoted Substitution - S_N2 - 1° and 2° Alcohols

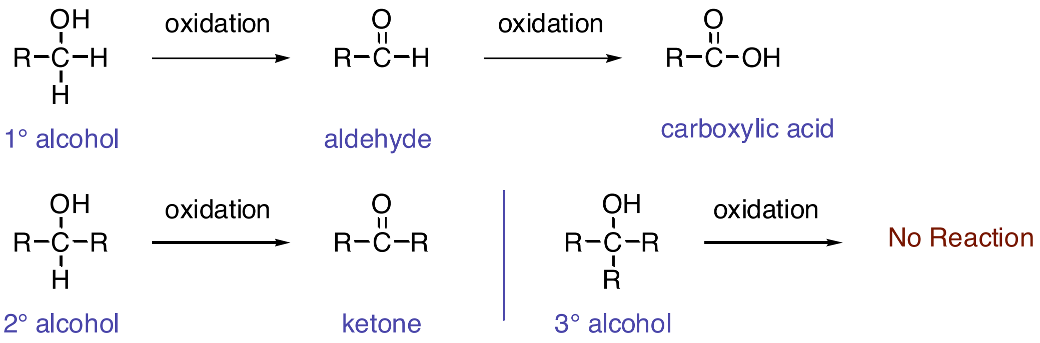


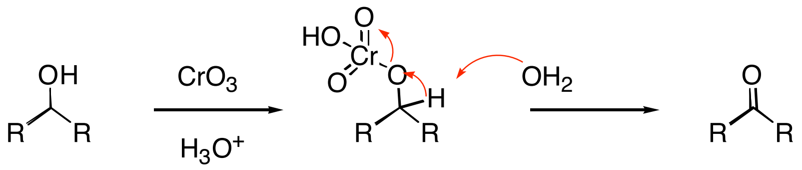


Alkyl halides are useful electrophiles for other substitution chemistry. One can activate an alcohol without inversion of configuration by preparing the tosylate. Thus, the stereochemistry of any subsequent substitution chemistry can be controlled by the choice of activation of the alcohol.

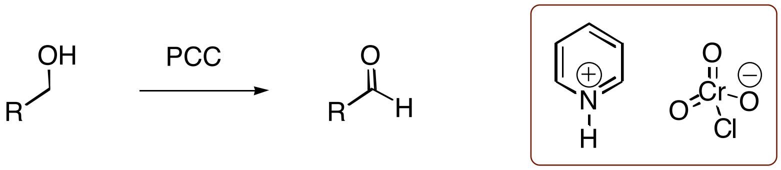


Primary and Secondary alcohols can be oxidized to carbonyl compounds. Tertiary alcohols are inert to oxidation. Depending on the oxidizing agent, one can oxidize a primary alcohol to the aldehyde stage, or oxidize fully to the carboxylic acid.





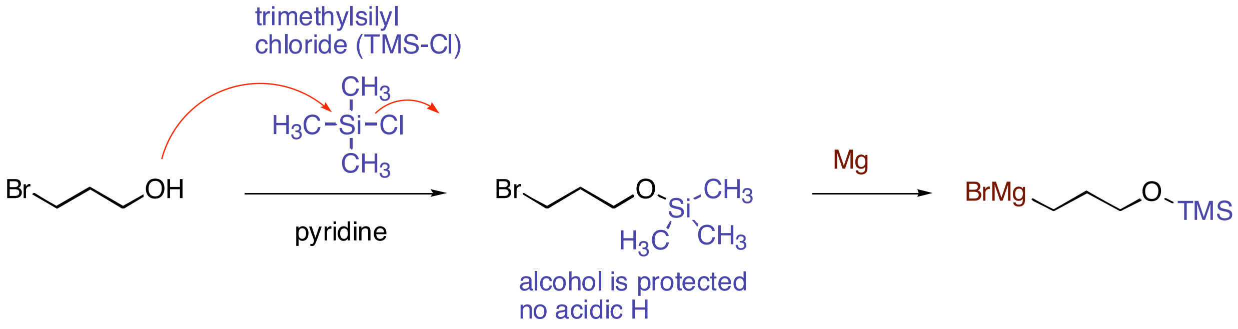
2° alcohols form ketones
1° alcohols form carboxylic acids



PCC
pyridinium chlorochromate

Stops at the aldehyde stage

Sometimes it is necessary to prevent an alcohol from reacting when you want to carry out a different reaction. An example would be a Grignard addition to a carbonyl when you have an alcohol present. The alcohol is not compatible with Grignard reagents. Thus, a Protecting Group can be put on the oxygen to prevent its reactivity, and then the group can be taken off later. Silicon compounds are good protecting groups for alcohols. A Trimemethylsilyl (TMS) group can be removed under acidic conditions.



trimethylsilyl chloride (TMS-Cl)

alcohol is protected
no acidic H