Chem 342 • Organic Chemistry II

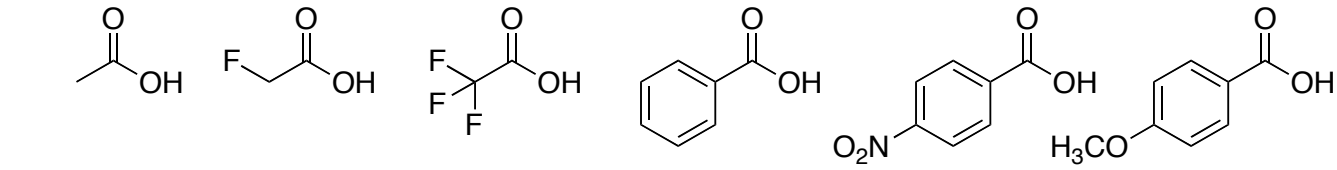
Lecture Summary 24 - 08 Apr 2009

Chapter 20 - Carboxylic Acids

Carboxylic Acid Properties

Acidity

Electron withdrawing and donating groups will influence the acidity of carboxylic acids just like we saw previously with alcohols.

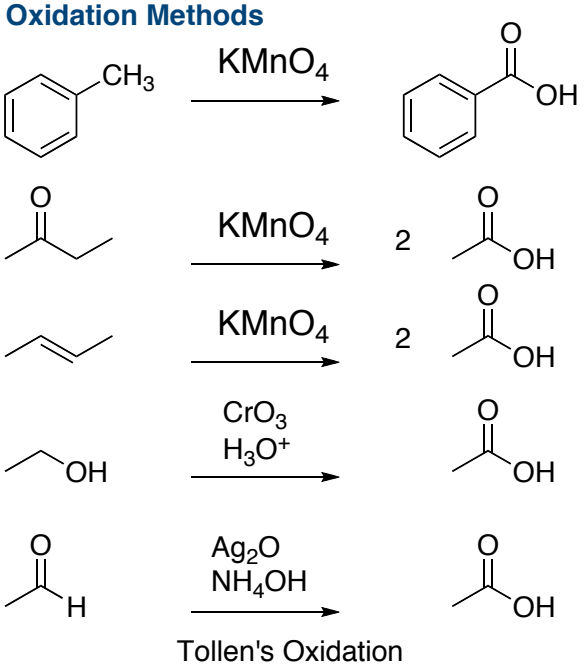


pK_a	4.75	2.59	0.23	4.19	3.41	4.46

Preparation of Carboxylic Acids

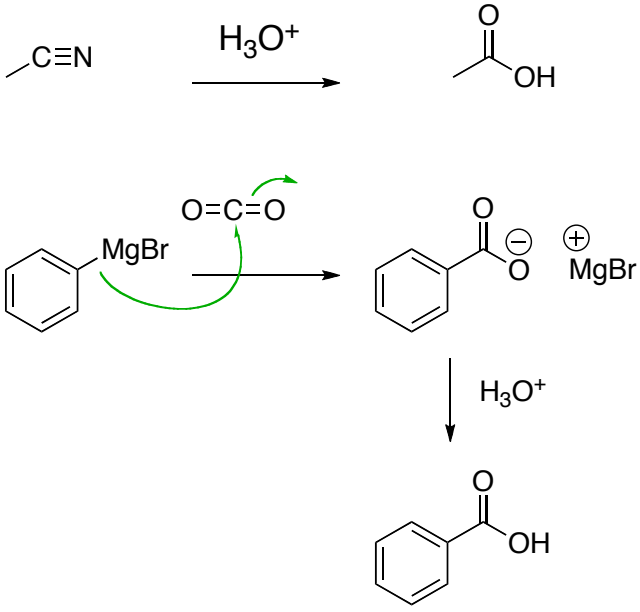
Acids can be made by several types of oxidation reactions, hydrolysis of nitriles, or by the addition of Grignard reagents to carbon dioxide.

Oxidation Methods



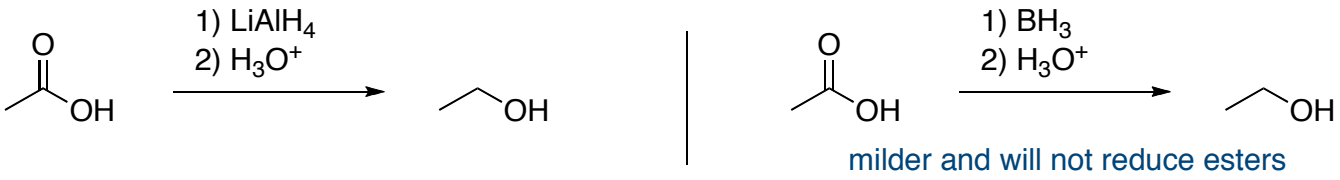
Tollen's Oxidation

Other Methods



Reactions of Carboxylic Acids

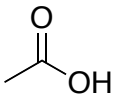
As we saw before, acids can be reduced with lithium aluminum hydride. Borane will also reduce acids under milder conditions. Note that borane will not reduce esters, so it is possible to reduce a carboxylic acid and leave an ester untouched. More reactions of acids in the next chapter.



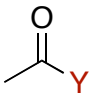
Chapter 21 - Carboxylic Acid Derivatives and Nucleophilic Acyl Substitution

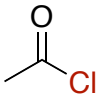
Carboxylic Acid Derivatives

Much of the chemistry of carboxylic acids occur with and to form derivatives. From the most reactive to the least reactive, acid halides, anhydrides, esters, and amides represent the most common carboxylic acid derivatives.

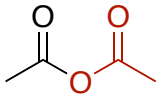


Carboxylic Acid - there are many derivatives with different heteroatoms (not H or C) in place of the OH.

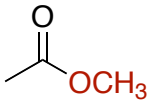




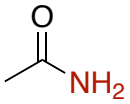
Acid Halides
(acetyl chloride)



Acid anhydrides
(acetic anhydride)

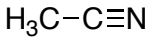


Esters
(methyl acetate)



Amides
(acetamide)

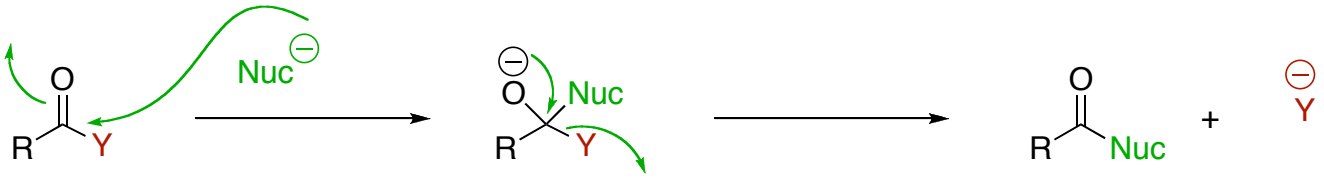
More Reactive ⟶ Less Reactive



Acetonitrile - although they don't have a carbonyl, the nitrile carbon has the same oxidation state as a carboxylic acid and is often referred to as a derivative. They are named after the parent acid.

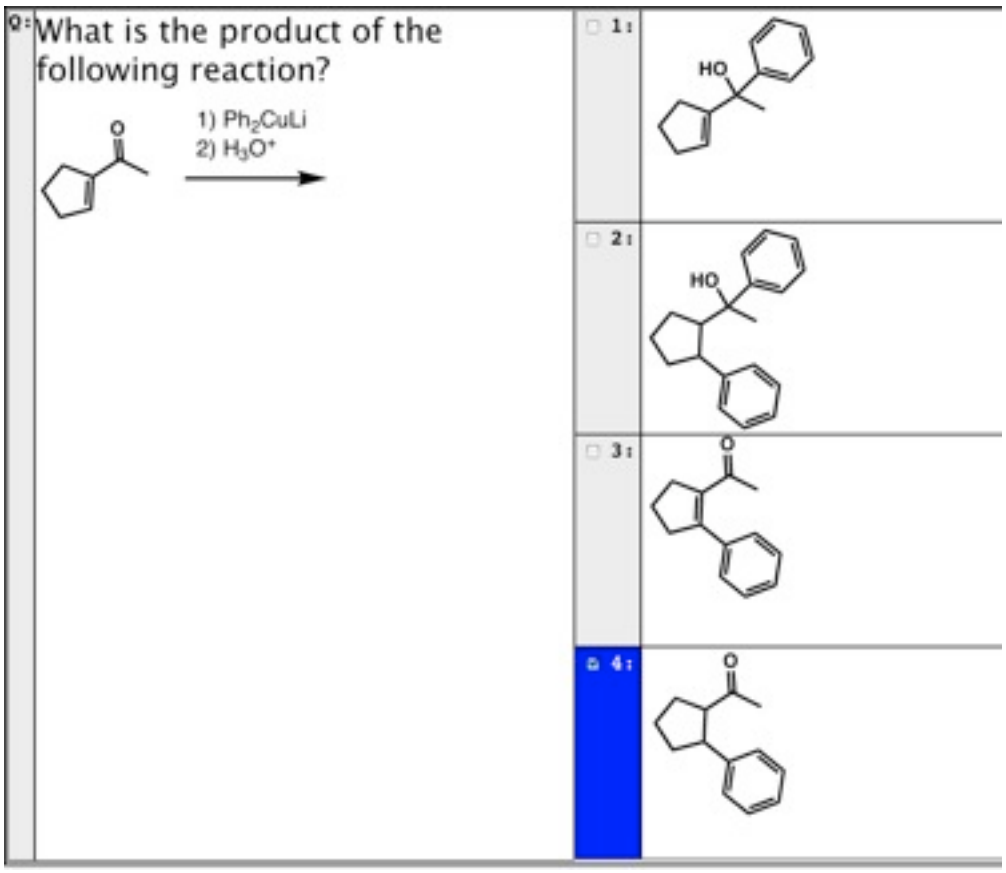
Nucleophilic Acyl Substitution

Nearly all the chemistry of carboxylic acid derivatives involves the addition of a nucleophilic to the carbonyl carbon, breaking the C=O double bond, followed by loss of a leaving group reforming the C=O double bond to affect a nucleophilic substitution on the acyl carbon. This is a two step process. Often the leaving group is very electronegative and the nucleophile is weak (neutral).



It is generally easy to go from a more reactive carboxylic acid derivative to a less reactive one. It is very difficult to go the other direction.

Daily Quiz


Q: What is the product of the following reaction?
1) Ph_2CuLi
2) H_3O^+
1:
HO
2:
HO
3:
4: