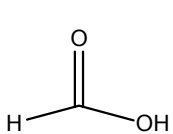


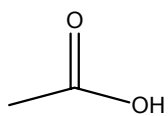
Organic Nomenclature
Carboxylic Acids and Derivatives
Spring 2006

Single carboxylic acids

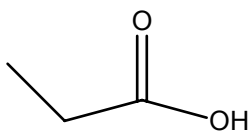
Carboxylic acid nomenclature is very tough for a couple of reasons. First, most carboxylic acids are called by their common names. These names do not allow you to identify the structure. Secondly, there is the IUPAC method for naming carboxylic acids. The stated IUPAC method for naming carboxylic acids is to drop the -e ending of the corresponding alkane and add -oic acid. Finally, many compounds are called acids that are not carboxylic acids. Some examples of each method are given below. IUPAC names will be in *italics*.



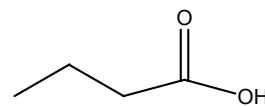
Methanoic acid
Formic acid



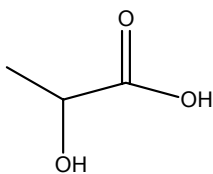
Ethanoic acid
Acetic acid



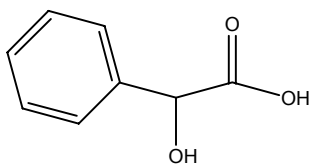
Propanoic acid
Propionic acid



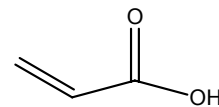
Butanoic acid
Butyric acid



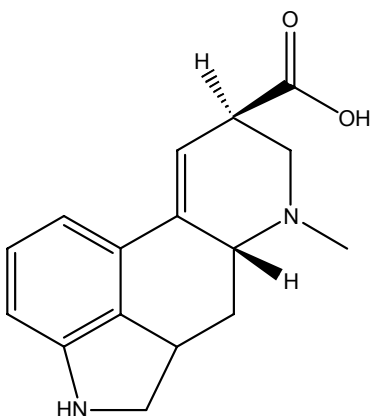
2-Hydroxypropanoic acid
Lactic acid



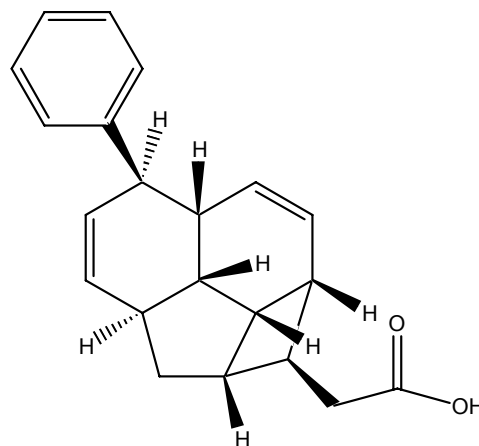
2-Hydroxy-2-phenylethanoic acid
Mandelic acid



Propenoic acid
Acrylic acid



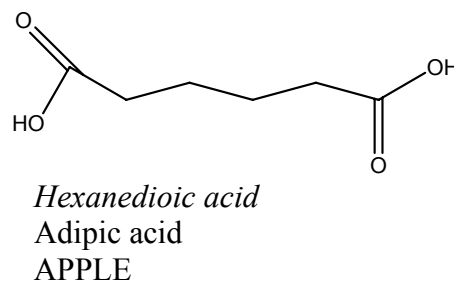
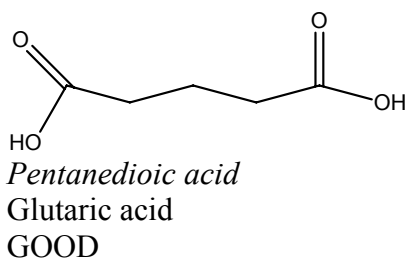
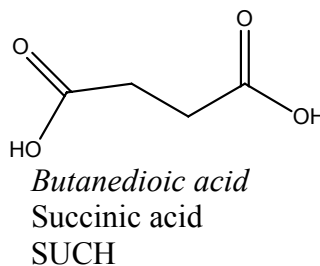
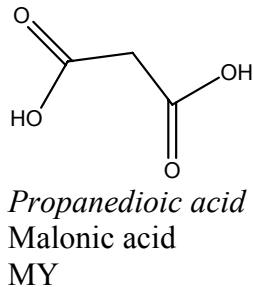
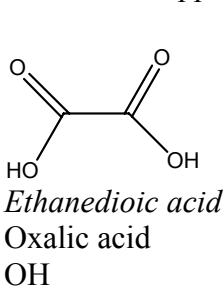
*9,10-didehydro-6-methyl
ergoline-8-carboxylic acid*
Lysergic Acid



*1a,2,2a,5,5a,7a,7b,7c-octahydro-5-phenyl-1H-cyclo
but[bc]acenaphthylene-1-acetic acid*
Endiandric acid A

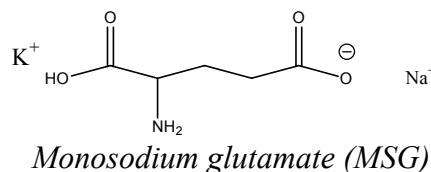
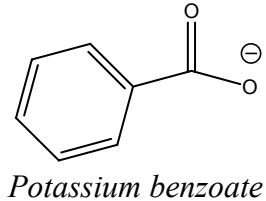
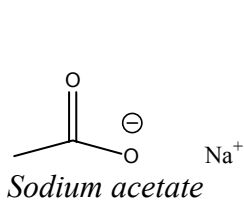
Double carboxylic acids

There are many ways to remember the dicarboxylic acids. My favorite is “Oh My Such Good Apple Pie.”



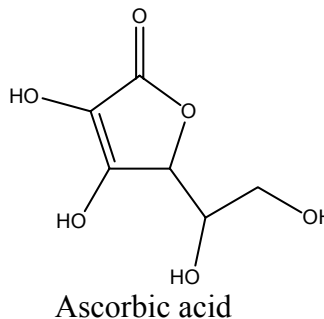
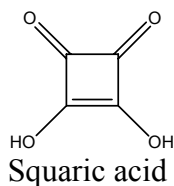
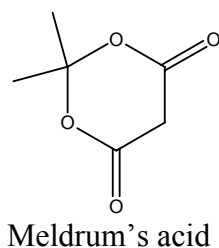
Salts of carboxylic acids

Salts of carboxylic acids are made by deprotonation of the carboxylic acid(s). The IUPAC rule is to drop the ic or oic acid and add the suffix -ate.



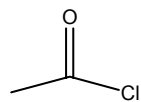
Compounds that are called acids even though they are not carboxylic acids

There are many compounds that are called acids even though they are not carboxylic acids. I have included a few examples below.

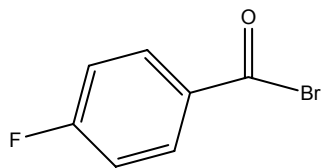


Acid Chlorides

Acid halides are named by replacing –ic acid endings with –yl followed by the appropriate halide. Some examples are shown below.



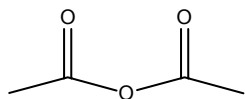
Acetyl chloride



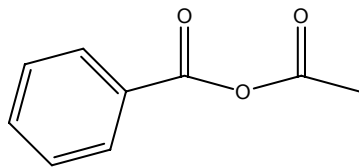
p-Fluorobenzoyl bromide

Acid Anhydrides

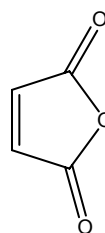
Acid anhydrides are named by replacing acid with anhydride. If the acyl groups are different, the groups are listed in alphabetical order. Some examples are shown below. Anhydrides are made from two carboxylic acids with water removed which is why they are called anhydrides.



Acetic anhydride



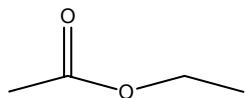
Acetic Benzoic anhydride



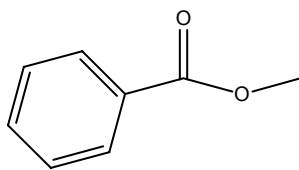
Maleic anhydride

Esters

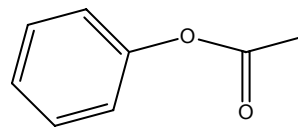
Esters have two names. The first name is the alkyl group attached to the sp³ hybridized oxygen. The second name is of the carboxylic acid portion. The –ic or –oic acid is dropped from this portion and replaced with –ate. Some examples follow.



Ethyl acetate

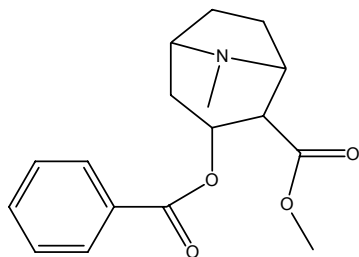


Methyl benzoate

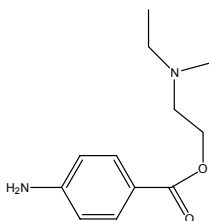


Phenyl acetate

The (CAINE)s are esters. (Cocaine, Novocain)



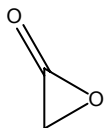
Cocaine (free base)



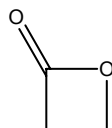
Novocain

Cyclic esters (Lactones)

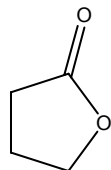
There are three ways to name lactones. First, the number of carbons between the carbon double bond oxygen and the oxygen are counted. If there is one carbon, it is an alpha lactone. If there are two carbons, it is called a beta lactone. If there are three carbons, a gamma lactone. This continues thru the Greek alphabet.



α -lactone

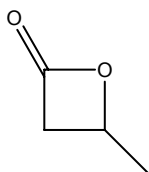


β -lactone

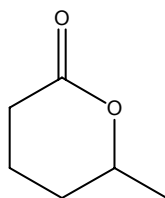


γ -lactone

In the second method, the ester name is generated by dropping the word -acid from the carboxylic acid and adding -olide. Esters can also be named by adding the word -olactone instead of -olide and by using a Greek letter. Some examples follow. Common and IUPAC names are both used.



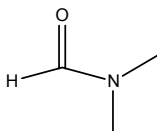
3-butanolide
 β -butyrolactone



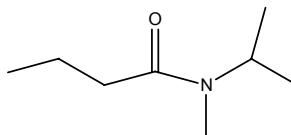
5-Hexanolide (six carbons in the lactone but the sp^3 hybridized oxygen is on the 5th carbon.
 δ -Caprolactone

Amides

Amides are named by dropping the -oic or -ic acid and replacing it with -amide. Substituents on the nitrogen are preceded by N to signify they are on the nitrogen. Some examples follow. Again, common and IUPAC names can be used.



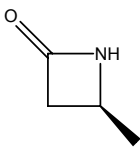
N,N-Dimethylformamide



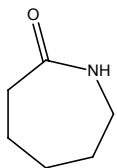
N-Isopropyl-N-methylbutanamide

Cyclic amides (Lactams)

Lactams are named similar to lactones above. A few examples follow.



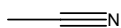
(S)-3-Butanolactam
a β -lactam
 β -Butyrolactam



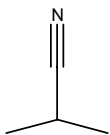
6-Hexanolactam
a ϵ -lactam
 ϵ -Caprolactam

Nitriles

Nitriles are named by replacing the $-ic$ or $-oic$ acid of the carboxylic acid with $-onitrile$ or $-nitrile$. Common and IUPAC names can be used and the nitrile may be named as a cyanide.



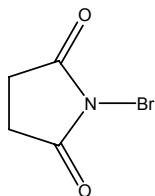
Ethanenitrile
Acetonitrile



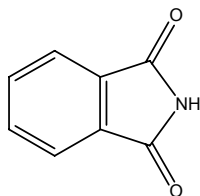
2-Methylpropanenitrile
Isopropyl cyanide

Imides

Imides have a nitrogen atom between two acyl groups. They are named by replacing $-ic$ or $-oic$ acid of the carboxylic acid with imide. Some examples follow.



N-bromosuccinimide
NBS



Phthalimide