

## Nomenclature of some carbonyl compounds

This is an extension and supplement to the previous document on organic nomenclature. **All of the compound families listed here take precedence of suffix naming over those listed in the previous document.**

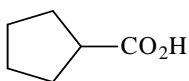
Functional groups in the table at right are listed in order of precedence. \* Suffixes for lactones and lactams are NOT given in Brown (see below).

Below are some special notes about particular functionalities.

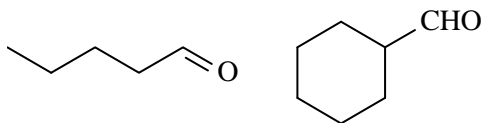
### Acids, ketones and aldehydes

Carboxylic acids are named by naming the main chain (including the acid carbon as carbon #1), and adding the suffix “-carboxylic acid.” They are almost never named as substituents, but when they are, they take the prefix “carboxy” and the acid group is called a “carboxy” group.

Pendant carboxylic acids take the suffix “-carboxylic acid,” so that a five-membered ring with a carboxy side group is called “cyclopentanecarboxylic acid.”



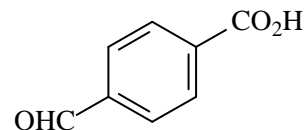
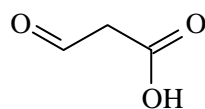
Aldehydes, just below carboxylic acids in precedence, have a similar naming convention. They take “-al” and “-carbaldehyde” suffixes (for example, pentanal and cyclohexanecarbaldehyde).



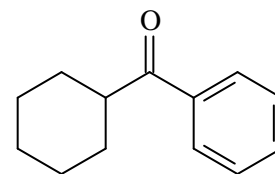
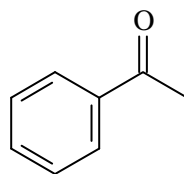
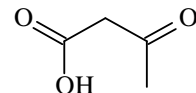
But aldehydes can also be named as substituents. If they are along the main chain, they take the “oxo” prefix – naming the =O as a side group – but if they are pendant groups they take the “formyl” or “methanoyl” prefix, from formic acid (methanoic acid). For example, a three-carbon

| <u>Family</u>   | <u>as Prefix</u>              | <u>as Suffix</u>                                |
|-----------------|-------------------------------|---|
| Carboxylic acid | carboxy-                      | -oic acid<br>-carboxylic acid                   |
| Acid anhydride  | <i>alkanoyloxycarbonyl-</i>   | -oic anhydride<br>-carboxylic anhydride         |
| Ester           | <i>alkoxycarbonyl-</i>        | <i>alkyl</i> -oate<br><i>alkyl</i> -carboxylate |
| Acid halide     | <i>halocarbonyl-</i>          | -oyl <i>halide</i><br>-carbonyl <i>halide</i>   |
| Amide           | carbamoyl-                    | -amide<br>-carboxamide                          |
| Nitrile         | cyano-                        | -nitrile<br>-carbonitrile                       |
| Aldehyde        | oxo-<br>formyl-<br>methanoyl- | -al<br>-carbaldehyde                            |
| Ketone          | oxo-<br><i>alkanoyl-</i>      | -one  |

chain with an acid at one end and an aldehyde at the other is 3-oxopropanoic acid; but benzene with carboxyl and formyl groups *para* to each other is 4-methanoylbenzoic acid.



In a similar way, ketones (which take the “-one” suffix) can be named as substituents. If the ketone is along the main chain, it takes “oxo” (3-oxobutanoic acid), but a pendant ketone group takes the “oyl” name corresponding to the similar acid chloride—for example, ethanoylbenzene and benzoylcyclohexane (see acid chlorides, below).



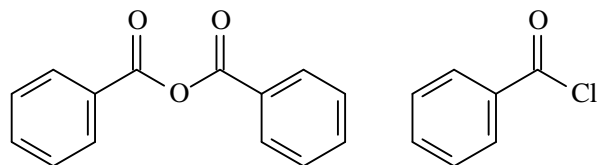
\* See the IUPAC Rules of Organic Nomenclature, [www.acdlabs.com/iupac/nomenclature/93/r93\\_326.htm](http://www.acdlabs.com/iupac/nomenclature/93/r93_326.htm)

## Carboxylic acid derivatives

Acid derivatives (all families between “aldehyde” and “carboxylic acid” in the table) often take names based on those of the parent acid. Exceptions (amides, lactams, lactones, and nitriles) are discussed below.

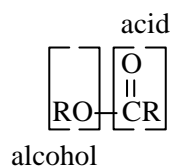
Anhydrides are the easiest: they take the name of the acid, drop “acid” and add “anhydride.” Acid chlorides are similar; but they drop “-oic” or “-carboxylic” in favor of “-oyl” or “-carbonyl”.

For example, the anhydride of benzoic acid is “benzoic anhydride,” while the corresponding acid chloride is “benzoyl chloride” (or “benzene-carbonyl chloride”). The *-oyl ending is also used for ketone substituents* (see above).

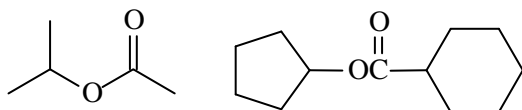


## Esters

Esters are composed of an alcohol and an acid:



The alcohol portion is named first, followed by the acid portion, in a two-word name of the form *<alcohol>yl <space> <acid>oate*. For example, ester of 2-propanol and ethanoic acid (acetic acid) is called *isopropyl acetate* (or *2-propyl ethanoate*), while the ester of cyclopentanol and cyclohexanecarboxylic acid is called *cyclopentyl cyclohexanecarboxylate*.

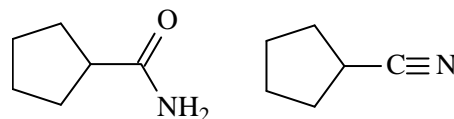


## Amides and nitriles

Amides and nitriles take the name of the main chain, with an “-amide” or “-nitrile” suffix. *The carbon atom in the functional group is always carbon atom #1.*

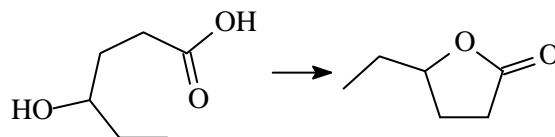
For example,  $\text{CH}_3\text{CH}_2\text{CN}$  is “propanenitrile” and  $\text{CH}_3\text{CH}_2\text{CONHCH}_3$  is “*N*-methylpropanamide.”

Amide groups that depend from rings or other complicated structures take the “-carboxamide” suffix, as for acids; but pendant nitriles are often named as “cyano” substituents. For example, compare cyclopentanecarboxamide and cyanocyclopentane (more correctly named as “cyclopentanecarbonitrile”).



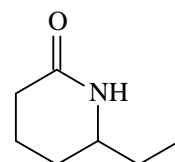
## Lactones and lactams

Lactones and lactams, often encountered in living systems, are cyclic esters and amides respectively. They are named in a curious way.



For example, suppose we make 4-hydroxyhexanoic acid into a lactone by reacting the hydroxy group with the acid group as shown above. The name of the lactone is not “4-ethylsomething-or-other” but “4-hexanolactone.” Notice that the full chain of the parent hydroxyacid is named.

The same principle is used for lactams, so that the lactam whose parent is 5-aminoheptanoic acid is called 5-heptanolactam.



These names are **not** IUPAC, and you will **not** be held responsible for them, but you should be aware of them.