

FUNCTIONAL GROUPS II

This section continues the discussion of four other functional groups by examining two oxygen-containing functional groups within hydrocarbon chains such as the ether group

($\text{R-O-R}'$) and the ester group ($\text{R-O-C(=O)-R}'$). We will also be examining two nitrogen-containing

functional groups known as amines (R-NH_2) and amides (R-C(=O)-NH_2).

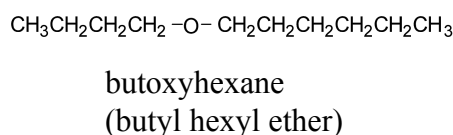
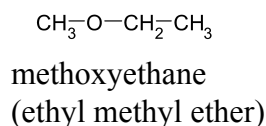
Table 2: Structures and Examples of Ethers, Esters, Amines, and Amides

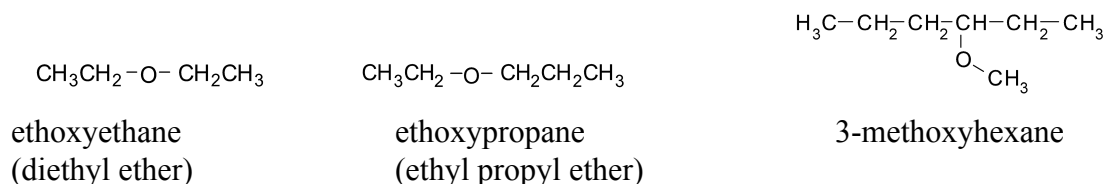
General Structure	Type	Example with IUPAC Name	
$\text{R-O-R}'$	ether	$\begin{array}{cccc} \text{H} & \text{H} & & \text{H} & \text{H} \\ & & & & \\ \text{H}-\text{C}-\text{C}-\text{O}-\text{C}-\text{C}-\text{H} \\ & & & & \\ \text{H} & \text{H} & & \text{H} & \text{H} \end{array}$	ethoxyethane
$\begin{array}{c} \text{O} \\ \\ \text{R-O-C-R}' \end{array}$	ester	$\begin{array}{cccc} \text{H} & \text{H} & & \text{O} & \text{H} \\ & & & & \\ \text{H}-\text{C}-\text{C}-\text{O}-\text{C}-\text{C}-\text{H} \\ & & & & \\ \text{H} & \text{H} & & & \text{H} \end{array}$	ethyl ethanoate
$\begin{array}{c} \text{H} \\ \\ \text{R}-\text{N} \\ \\ \text{H} \end{array}$	amine	$\begin{array}{ccc} & \text{H} & \text{H} \\ & & / \\ \text{H}-\text{C}- & \text{N} & \\ & & \backslash \\ & \text{H} & \text{H} \end{array}$	aminomethane
$\begin{array}{c} \text{O} \\ \\ \text{R}-\text{C}-\text{N}-\text{H} \\ \\ \text{H} \end{array}$	amide	$\begin{array}{ccc} \text{H} & \text{O} & \\ & & \\ \text{H}-\text{C}- & \text{C}-\text{N}-\text{H} \\ & & \\ \text{H} & \text{H} & \end{array}$	ethanamide

Naming of organic compounds involving these functional groups follows similar methods used in previous types of naming but they do have their differences, as explained below.

Ethers

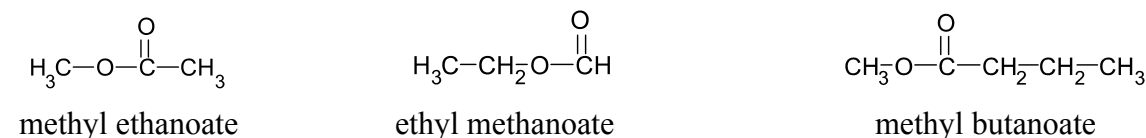
Ethers are molecules whose structure is very similar to water. In an ether the oxygen atom is bonded to two alkyl groups; they can either be the same or different. Ethers are named according to IUPAC by changing the *ane* ending of the *smaller* hydrocarbon name to *oxy* and then joining that to the alkane name of the *longer* hydrocarbon. You may also see the names of ethers written as the names of the two alkyl groups followed by the word ether.





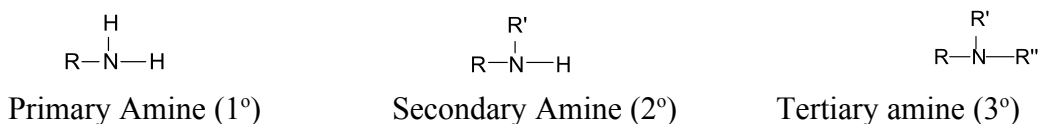
Esters

Esters are formed from a reaction between alcohols and carboxylic acids. To name esters we use this knowledge to help us. The first part of the name is the name of the alkyl group from the alcohol, the second part comes from the acid name but the ending is changed from *-oic acid* to *-oate*.

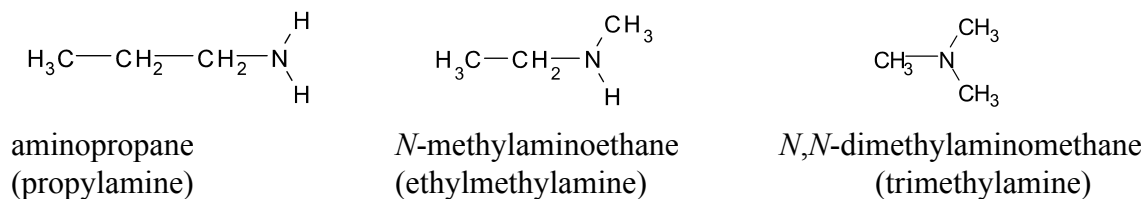


Amines

Amines are classified as primary, secondary or tertiary depending on the number of alkyl groups (R groups) bonded to the nitrogen.



Amines can be named in two ways. The IUPAC way is to name it as a nitrogen derivative of an alkane. In this case you write the word amino and add the name of the alkyl group at the end. If you have a secondary or tertiary amine the name starts with the prefix *N-* followed by the name of the shortest alkyl group followed by amino and the longest alkyl chains' name. The other way amines are commonly named is as an alkyl derivative of ammonia. In this case you write the name of the alkyl group and add amine on the end. If the amine is secondary or tertiary you write the name the same way but include all of the alkyl groups' names.



Amides

The amide has a structure similar to the ester however the oxygen atom in the chain of the ester is replaced by a nitrogen atom, thus giving you the amide. It occurs from a reaction between an acid and an amine. Naming amides is similar to naming esters. The first part of the name comes from the amine. The second part of the name is derived from the acid. The *-oic acid* ending is changed to *-amide*.

