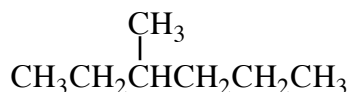


IUPAC System of Nomenclature

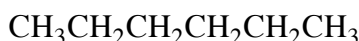
The IUPAC (International Union of Pure and Applied Chemistry) is composed of chemists representing the national chemical societies of several countries. One committee of the IUPAC, the Commission on Nomenclature of Organic Chemistry, has set a system for naming organic compounds. The last syllable in the name of a compound designates the family to which it belongs. The alkanes all end in **-ane**.

Naming Alkanes

1. The name ending for all alkanes (and cycloalkanes) is **-ane**.
2. The parent chain is the longest continuous chain of carbons in the structure. For example, the branched-chain alkane:



is regarded as being "made" from the following parent:



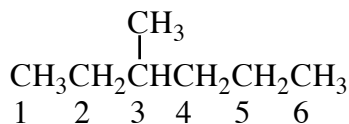
by replacing an H on the third C from the left with CH_3 .

3. A prefix that specifies the number of carbon atoms in the parent chain is attached to the name ending, **-ane**. These prefixes up to 10 carbon atoms are and should be learned:

meth-	1 C	hex-	6 C
eth-	2 C	hept-	7 C
prop-	3 C	oct-	8 C
but-	4 C	non-	9 C
pent-	5 C	dec-	10 C

The parent chain in the example above has 6 carbon atoms, therefore, it is a derivative of hexane.

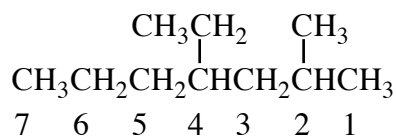
4. The carbon atoms of the parent chain are numbered starting from whichever end of the chain gives the location of the first branch the lower of two possible numbers. For the example above, the correct direction is from left to right.



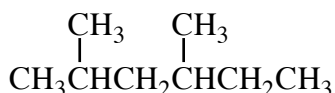
The branch is therefore located on the 3rd carbon. If it was numbered from right to left, the branch would be located on the 4th carbon, which is a higher number, which is not allowed by IUPAC.

5. Name each branch attached to the parent chain according to alkyl groups. In this case, the branch would be methyl.
6. Attach the name of the alkyl group to the name of the parent as a prefix. Place the location number of the alkyl group in front of the resulting name. In this case, it would be 3-methylhexane.

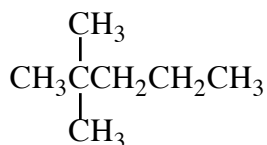
7. When two or more groups are attached to the parent, name each and locate each with a number. The alkyl substituent names are assembled in alphabetical order. Always use hyphens when separating numbers from words. The following is 4-ethyl-2-methylheptane:



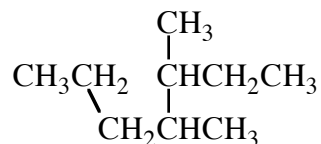
8. When two or more substituents are identical, use prefixes such as di- (2), tri- (3), tetra- (4), and specify the location number of every group. Always separate a number from another number in a name by a comma. The following is 2,4-dimethylhexane:



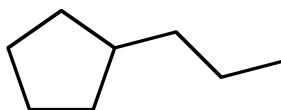
9. When identical groups are on the same carbon, repeat the number of the carbon in the name. The following is 2,2-dimethylpentane:



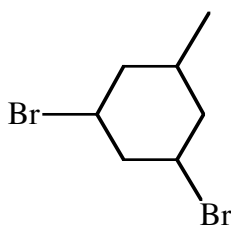
10. Sometimes, you may need to go around corners and zigzag to find the longest (parent) chain. The following is 3,4-dimethylheptane:



11. Monocyclic alkanes or alkenes, those where the carbon chain forms a single closed ring, are named by putting the prefix **cyclo-** in front of the name based on the number of carbons in the ring. All other rules for substituents and numbering are the same, and written as prefixes to the ring name.



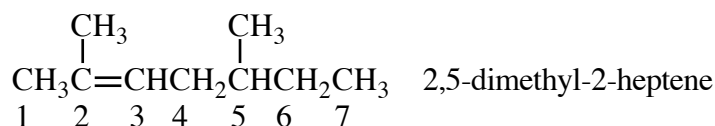
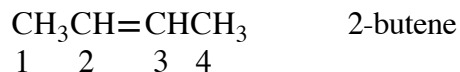
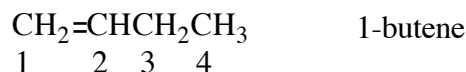
propylcyclopentane



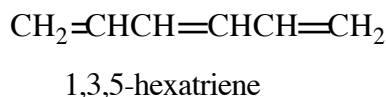
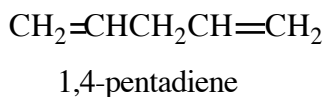
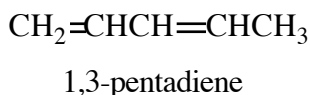
1,3-dibromo-5-methylcyclohexane

Naming Alkenes

The rules for naming alkenes are basically the same as those of alkanes (see previous section), but with two differences. The parent chain must include the double bond even if it makes it shorter than the others. And the parent alkene chain must be numbered from whichever end gives the first carbon of the double bond the lower of two possible numbers. Also, the location number should be given as to where the double bond is (except ethene or propene, where the location will always be 1). The alkenes all end in **-ene**. For example:

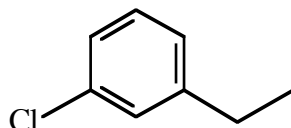


Alkenes which have two double bonds are dienes, those with three are trienes, and so forth. Each double bond has to be located by a number.



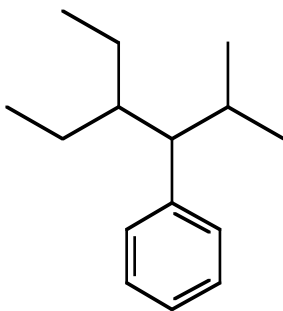
Naming Benzene Derivatives

Simple derivatives of benzene are named by denoting the names and position numbers of substituents on the ring. Proper numbering of carbons in the ring is that which gives the smallest numbers.



1-chloro-3-ethylbenzene

For structures where the benzene ring is attached to a single more complex structure, it is preferable to name the benzene ring as a substituent. The substituent reference to benzene is **phenyl-**.



4-ethyl-2-methyl-3-phenylhexane

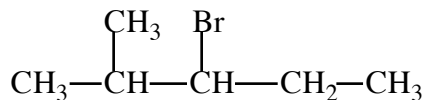
Naming Organic Halides

Organic halides have fluorine, chlorine, bromine, or iodine substituted for hydrogen at one or more positions. The halogen group uses the following prefixes:

F – fluoro Cl – chloro - bromo I - iodo

The location of the halogen is numbered as would an alkyl substituent.

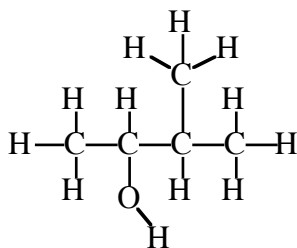
For example:



3-bromo-2-methylpentane

Naming Alcohols

The parent chain of the alcohol must be the longest that includes the carbon holding the OH group. Give the -OH group the lower location number on the chain regardless of where alkyl substituents occur. Name the alkane attached to the OH group and replace the -e with an **-ol**. For example:



parent chain: butyl

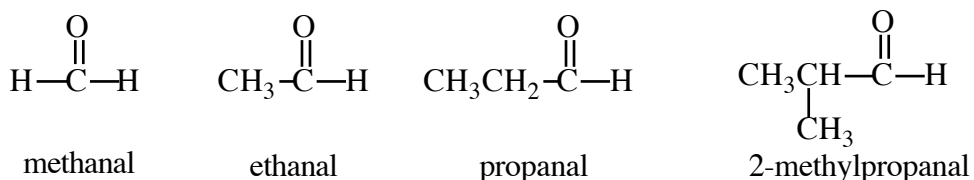
hydroxyl location: 2

substituent location: 3-methyl

name: 3-methyl-2-butanol

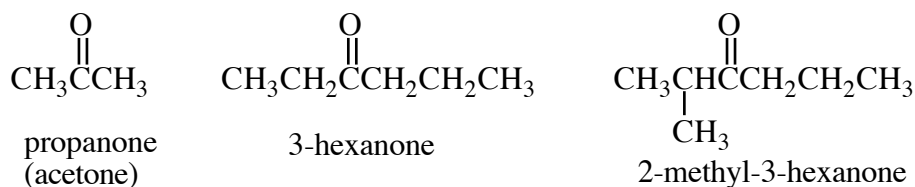
Naming Aldehydes

The parent chain is the longest chain that includes the aldehyde group. Its name is made by replacing the ending -e of parent alkane name with **-al**. The numbering of the chain always starts with the carbon of the aldehyde group being 1. For example:



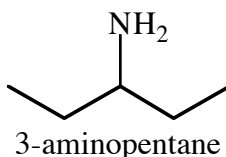
Naming Ketones

In naming ketones, the parent chain includes the carbonyl group and is numbered so that the carbonyl location is the lowest number. The number of the location must be part of the name whenever there would be an uncertainty. Its name is made by replacing the ending -e of parent alkane name with **-one**. For example:

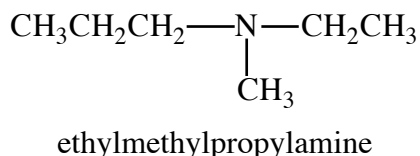


Naming Amines

For amines with a single alkyl group attached to the nitrogen, name the $-\text{NH}_2$ group as the **amino** substituent.

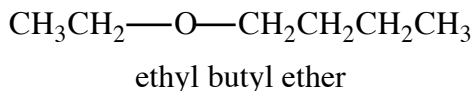


For amines with two or three alkyl groups attached, name the substituents alphabetically and add the suffix **-amine**.



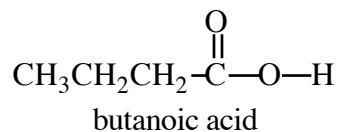
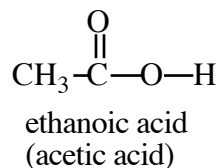
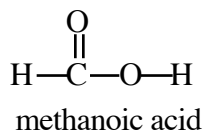
Naming Ethers

Ethers have two alkyl groups bonded to an oxygen. Name these by listing the substituents (smaller first) and adding the name **ether**.



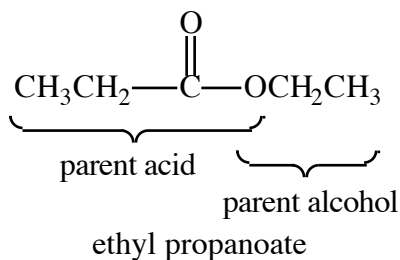
Naming Carboxylic Acids

The parent chain must include the carboxyl carbon, which is given position number 1. The name of the alkane attached is changed by replacing the -e with **-oic acid**. For example:



Naming Esters

Esters can be thought of as the condensation product of a carboxylic acid and an alcohol. The alkyl substituent of the parent alcohol is named first, followed by the name of the parent carboxylic acid, and replacing the -oic acid with **-oate**.



Naming Amides

Amides can be thought of as the condensation product of a carboxylic acid and an amine. The alkyl substituents of the parent amine is named first, preceded by **N-**, which indicates the substituents are bonded to the nitrogen. The name of the parent carboxylic acid follows, and replace the -oic acid with **-amide**.

