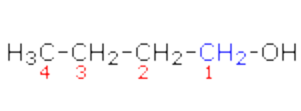
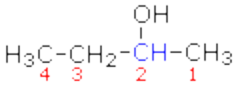
Alcohol Nomenclature and Reactions

In the IUPAC system of nomenclature, functional groups are normally designated in one of two ways. The presence of the function may be indicated by a characteristic suffix and a location number. This is common for the carbon-carbon double and triple bonds which have the respective suffixes **ene** and **yne**. Halogens, on the other hand, do not have a suffix and are named as substituents, for example: $(CH_3)_2C{=}CHCHClCH_3$ is 4-chloro-2-methyl-2-pentene. If you are uncertain about the IUPAC rules for nomenclature you should review them now.

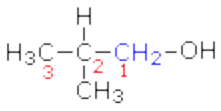
Alcohols are usually named by the first procedure and are designated by an **ol** suffix, as in ethanol, CH_3CH_2OH (note that a locator number is not needed on a two-carbon chain). On longer chains the location of the hydroxyl group determines chain numbering. For example: $(CH_3)_2C{=}CHCH(OH)CH_3$ is 4-methyl-3-penten-2-ol. Other examples of IUPAC nomenclature are shown below, together with the common names often used for some of the simpler compounds. For the mono-functional alcohols, this common system consists of naming the **alkyl group** followed by the word **alcohol**. Alcohols may also be classified as primary, **1º**, secondary, **2º** & tertiary, **3º**, in the same manner as alkyl halides. This terminology refers to alkyl substitution of the carbon atom bearing the hydroxyl group (colored blue in the illustration).



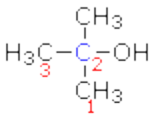
1-butanol
(butyl alcohol)
a 1º-alcohol



2-butanol
(*sec*-butyl alcohol)
a 2º-alcohol

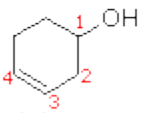


2-methyl-1-propanol
(isobutyl alcohol)
a 1º-alcohol

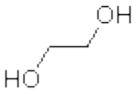


2-methyl-2-propanol
(*tert*-butyl alcohol)
a 3º-alcohol

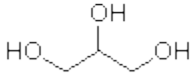
2-propen-1-ol
(allyl alcohol)



3-cyclohexen-1-ol



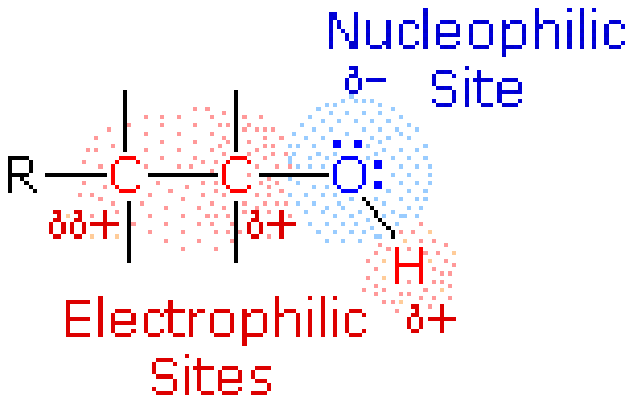
1,2-ethanediol
(ethylene glycol)



1,2,3-propanetriol
(glycerol)

Many functional groups have a characteristic suffix designator, and only one such suffix (other than "ene" and "yne") may be used in a name. When the hydroxyl functional group is present together with a function of higher nomenclature priority, it must be cited and located by the prefix **hydroxy** and an appropriate number. For example, lactic acid has the IUPAC name 2-hydroxypropanoic acid.

Compounds incorporating a C–S–H functional group are named **thiols** or **mercaptans**. The IUPAC name of $(CH_3)_3C–SH$ is 2-methyl-2-propanethiol, commonly called tert-butyl mercaptan. The chemistry of thiols will not be described here, other than to note that they are stronger acids and more powerful nucleophiles than alcohols.



Reactions of Alcohols

The functional group of the alcohols is the hydroxyl group, **–OH**. Unlike the alkyl halides, this group has two reactive covalent bonds, the C–O bond and the O–H bond. The electronegativity of oxygen is substantially greater than that of carbon and hydrogen. Consequently, the covalent bonds of this functional group are polarized so that oxygen is electron rich and both carbon and hydrogen are electrophilic, as shown in the drawing on the right. Indeed, the dipolar nature of the O–H bond is such that alcohols are much stronger acids than alkanes (by roughly 10^{30} times), and nearly that much stronger than ethers (oxygen substituted alkanes that do not have an O–H group). The most reactive site in an alcohol molecule is the hydroxyl group, despite the fact that the O–H bond strength is significantly greater than that of the C–C, C–H and C–O bonds, demonstrating again the difference between thermodynamic and chemical stability.

Source: http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/alcohol1.htm#alcnom