

Alcohols

Alcohol is an organic compound with a hydroxyl (OH) functional group on an aliphatic carbon atom. Because OH is the functional group of all alcohols, we often represent alcohols by the general formula ROH, where R is an alkyl group.



Methanol (CH₃OH) and ethanol (CH₃CH₂OH) are the first two members of the homologous series of alcohols.

Classification of alcohols

1- Depending on the number of hydroxyl groups:

Mono-hydroxyl; general formula: C_nH_{2n}+2O, Example: methyl alcohol CH₃OH

Di-hydroxyl; general formula: C_nH_{2n}+2O₂, Example: glycol

Tri-hydroxyl; general formula: C_nH_{2n}+2O₃, Example: glycerol

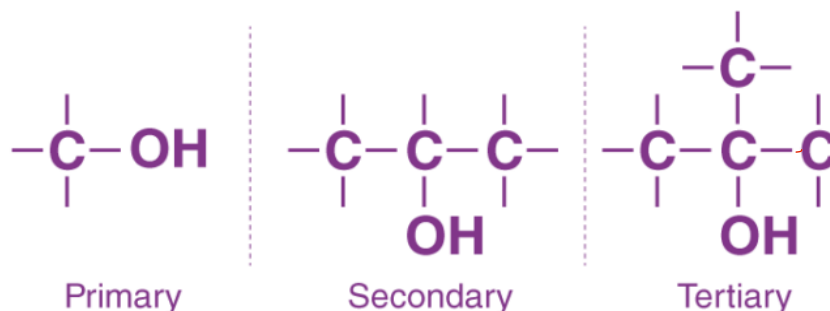
Poly-hydroxyl; general formula: C_nH_{2n}+2O_x, Example: glucose

2- Depending on the number of carbon atoms attached to the carbon atom into:

Primary alcohol: Alcohol is primary if the (OH) group is on the first carbon atom. Primary alcohols are those alcohols where the carbon atom of the hydroxyl group (OH) is attached to only one single alkyl group. Some examples of these primary alcohols include Methanol (propanol), ethanol, etc., the general formula: R-CH₂-OH.

Secondary alcohol: Alcohol is secondary if the (OH -) group is on any carbon atom except the first. Secondary alcohols are those where the carbon atom of the hydroxyl group is attached to two alkyl groups on either side. The two alkyl groups present may be either structurally identical or even different, with the general formula R₂-CH-OH.

Tertiary alcohol: Alcohol is tertiary if the hydroxyl group is on the carbon atom bonded in turn to three other carbon atoms (with three alkyl groups), general formula: R₃-C-OH.



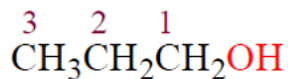
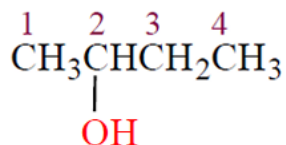
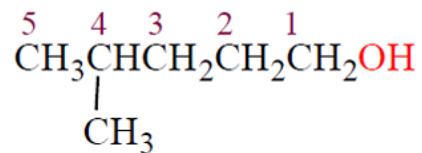
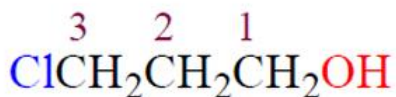
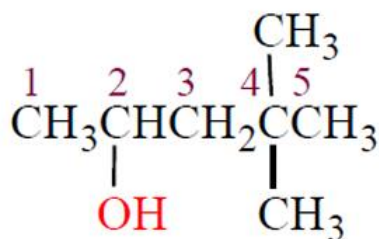
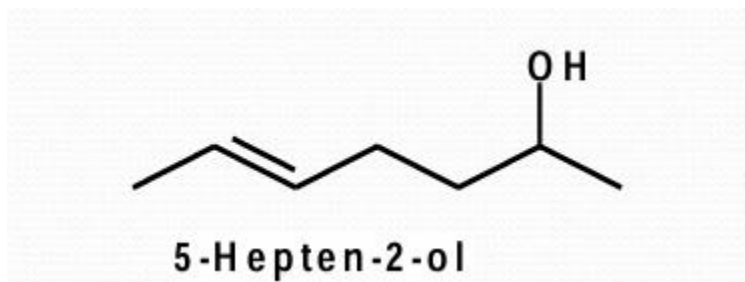
Uses of Alcohols

There are several uses of alcohols:

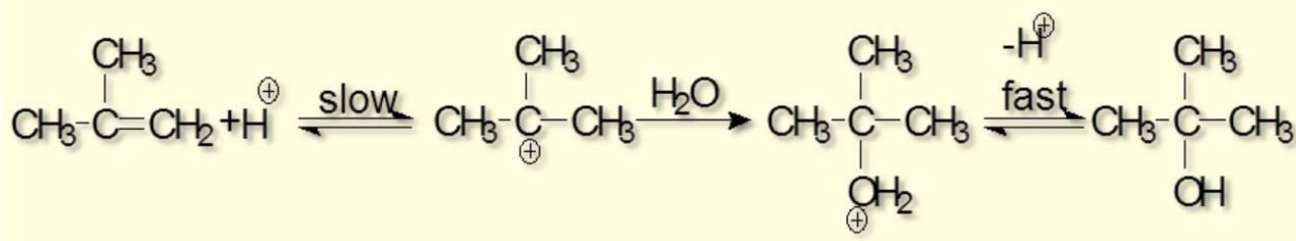
- These are used as an **anti-freezing agent** with a mixture of a solution containing ethylene glycol dissolved in water.
- Alcohol ethanol is used as an **antiseptic agent**.
- Some alcohols are used as **fuels** in internal combustion engines like the methanol.
- In the field of medicine, a few of them are used as **preservatives** for the specimens in laboratories.

IUPAC Nomenclature

- Choose the longest carbon chain attached to the hydroxyl group. The chain number from the end closest to the hydroxyl group.
- The branched group/s (alkyl) or (Substituents) and the number of the carbon atom attached to each are indicated.
- Put the number of the carbon atom attached to the hydroxyl group if necessary (if the number of carbon atoms exceeds two).
- Alcohols are named by adding the syllable (ol) to the corresponding alkane name.
- After locating the hydroxyl group (by writing the number of the carbon atom attached to it), write the sign (-) then the name of the alkane after writing the names of all the branches.
- The hydroxyl group is preferred over double and triple bonds in the numbering.

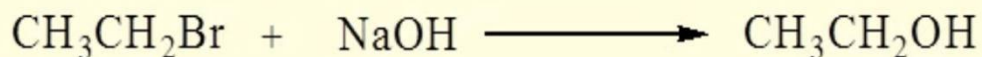
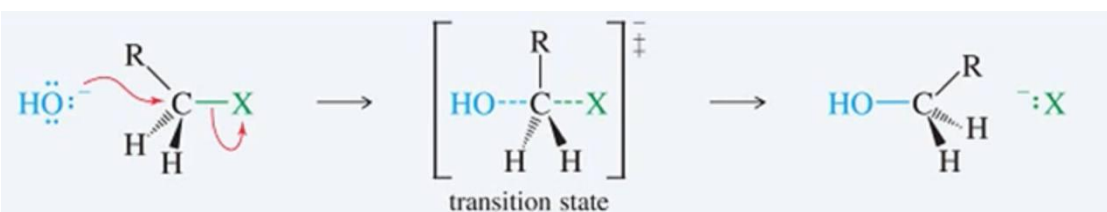
Examples:**1-Propanol****2-Butanol****4-Methyl-1-pentanol**
(not 2-methyl-5-pentanol)**3-Chloro-1-propanol****4,4-Dimethyl-2-pentanol****Physical properties of alcohols**

- 1- Neutral effect on litmus paper.
- 2- The first individuals are liquids that are completely miscible with water, medium oily, Upper individuals are solid, waxy materials weakly acidic alcohols.
- 3- Alcohols are polar compounds because oxygen has a higher electronegativity than carbon and hydrogen.
- 4- solubility in water: The solubility of alcohols in water is high, because water is a polar compound and thus forms hydrogen bonds between its molecules and

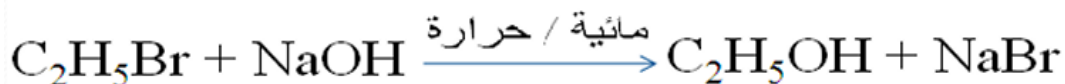
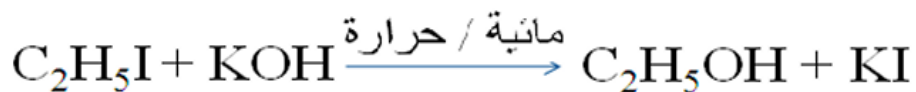


Hydrolysis of Halides

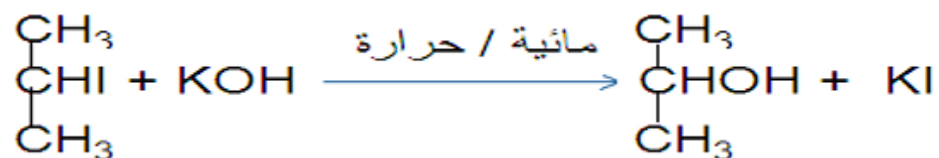
Hydrolysis of alkyl halides - such as chloride, bromide, or alkyl iodide - where the hydrolysis of an alkyl halide is carried out by a hot concentrated aqueous solution until the boiling point, where the halogen atom is replaced by a hydroxyl group (Nucleophilic substitution of Alkyl halides).



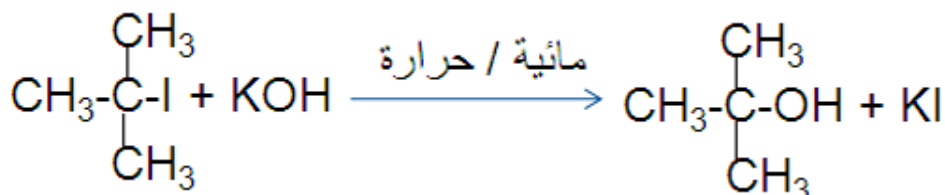
➤ Preparation of a primary alcohol from a primary alkyl halide:



- Preparation of secondary alcohol from secondary alkyl halide:



- Preparation of tertiary alcohol from tertiary alkyl halide:



Note: The ability to decompose water depends on the nature of the halogen - Arrange the halogens according to how easy they are to be extracted from the alkyl halide **I > Br > Cl**.

Why is alkyl iodide preferred when preparing alcohols from alkyl halides?

It is easier to decompose than bromides or chlorides, because iodide is less active than bromide and chloride, so it is easier to break the bond between the iodide atom and the alkyl radical.

Reduction of Carbonyl Compounds

Alcohol in this process is produced by reducing aldehydes and ketones corresponding alcohols by the process of catalytic hydrogenation, which refers to the addition of hydrogen in presence of catalysts. Some commonly used examples of these catalysts include platinum, nickel.

