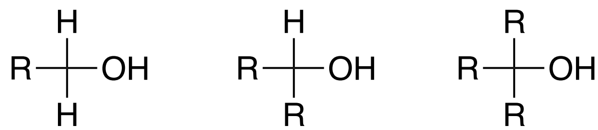
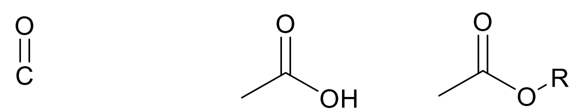
Alcohol and Ether Nomenclature **Dec 1, 2022**

Alcohol	Ether
R-OH	R-O-R



Primary 1° Secondary 2° Tertiary 3°

R ≠



Carbonyl **Acid** **Ester**

Alcohols are classified as primary (1°), secondary (2°), or tertiary (3°), depending on the number of organic groups bonded to the hydroxyl bearing carbon.

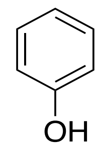
Note: –OH is called hydroxyl, hydroxy or alcohol

Naming:
1. Find the longest chain, with the maximum number of OH groups.
2. Number in such a way to give the **first OH** the lowest number
3. Drop the "e" of the alkane name, add "ol"

Note: the alcohol (-OH) takes priority over multiple bonds and halogens

Examples:

H_3C-OH
methanol
-toxic
wood alcohol



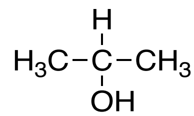
Hydroxybenzene
Phenol
C_6H_6O

CH_3CH_2OH
ethanol

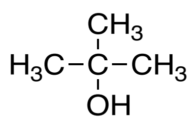
grain alcohol

$CH_3CH_2CH_2OH$

1-propanol
n-propanol
propan-1-ol



2-propanol
propan-2-ol
Isopropyl alcohol
isopropanol



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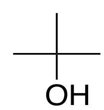
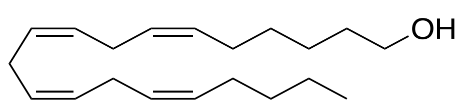


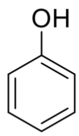
2-methyl-2-propanol
tertiary butyl alcohol
t-BuOH
tert-butyl alcohol



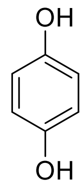
Eicosan-6,9,12,15-tetraen-1-ol
Eicosa-6Z,9Z,12Z,15Z-tetraen-1-ol

Note: most alcohols are flammable, however, as the chain gets longer, the molecules would tend to stick together (i.e., intermolecular forces) and would be less flammable.

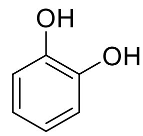
More examples: Aromatic Alcohols



Phenol
Carbolic Acid
C_6H_5OH



Hydroquinone
4-hydroxyphenol
$C_6H_6O_2$



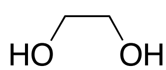
Cathecol
$C_6H_6O_2$

Polyols:

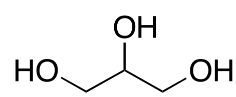
If more than one hydroxyl group is present, a prefix is added to the "ol" :

2 OH's	diol (glycol)
3 OH's	triol
4 OH's	tetraol
5 OH's	pentaol

Some simple and widely occurring alcohols have common names that are accepted by IUPAC. For example:



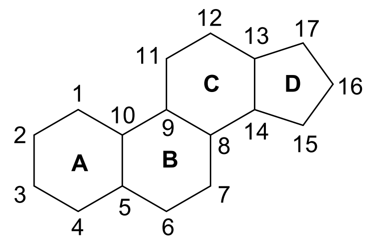
ethylene glycol
or ethan-1,2-diol



glycerol or glycerine
or propan-1,2,3-triol

Ethylene glycol is an antifreeze component.
Glycerol is a precursor to fats (fatty acid esters in cell membranes) and is used in personal lubricants such as KY jelly.

Example: Steroids

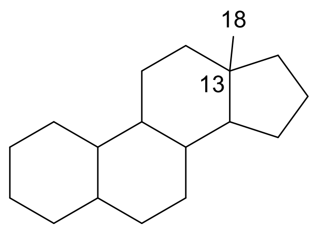


Steroid Skeleton

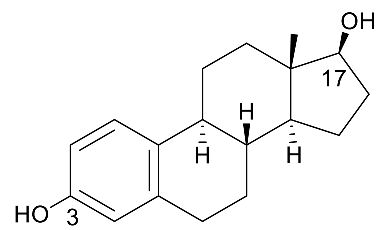
Groups above: β (beta)

Groups below: α (alpha)

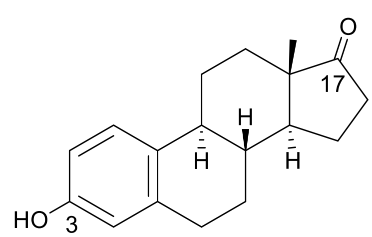
Types of Steroids



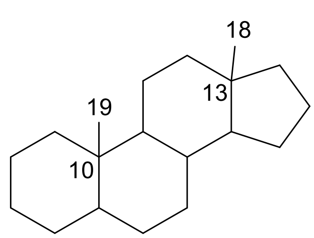
Estrane
Characterized by a methyl group in C13



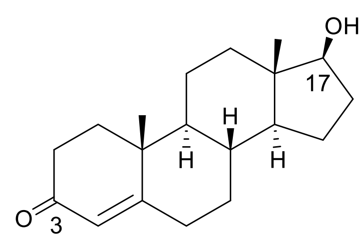
Estradiol



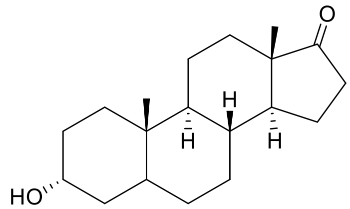
Estrone



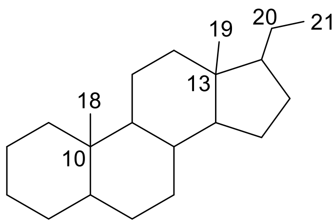
Androstane
Characterized by the presence of $-CH_3$ groups in C10 and C13



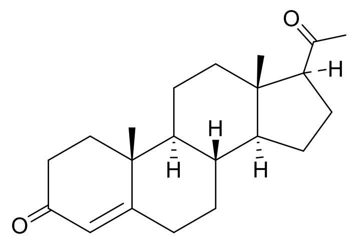
Testosterone



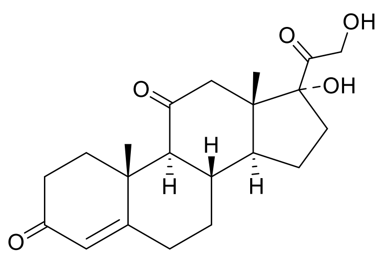
Androsterone



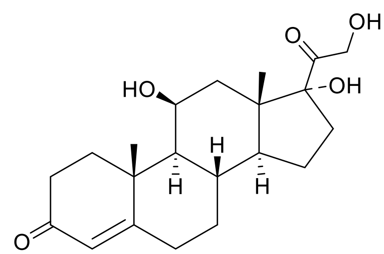
Pregnane
- Characterized by two -CH_3 groups in C10 and C13, and a substituent in C17.
- Not biologically active



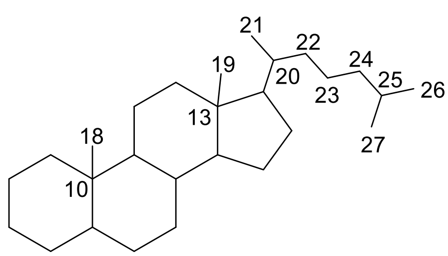
Progesterone
Pregnancy Hormone



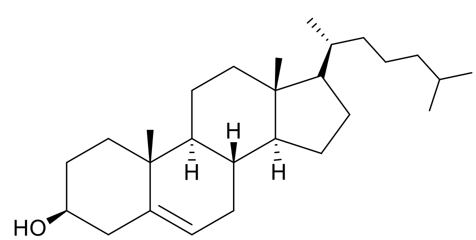
Cortisone
(Adrenocorticoid)
Characterized by a carbonyl at C11 and pregnane skeleton



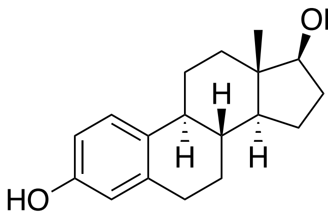
Cortisol
Stress Hormone



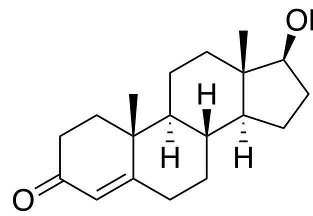
Cholestane



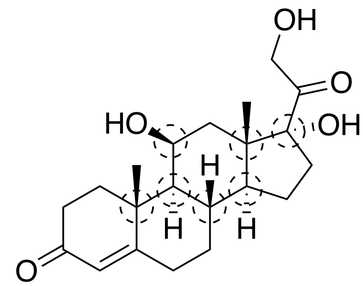
Cholesterol



Estradiol
-Female sex hormone



Testosterone
-Male sex hormone



Cortisol
-Stress hormone

Stereogenic centers

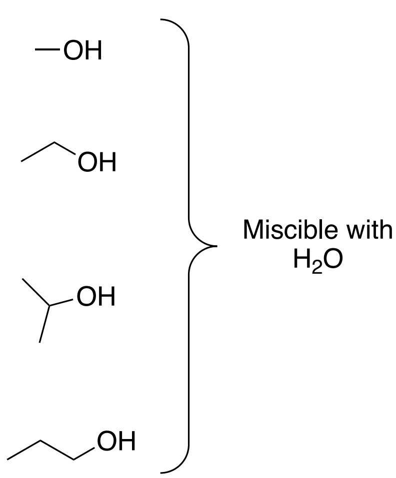
Physical properties

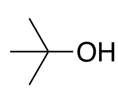
- The hydroxyl group is a very polar group. This allows small alcohols (methanol, ethanol, propanols) to be miscible with water (if the number of C < 4) as they are good hydrogen bond donors *and* acceptors.
- Soluble in H_2O, as the #C increases, the solubility decreases.
- Alcohol densities are usually $\rho < 1.0$ g/cm^3.
- They have high boiling and melting points, again due to their hydrogen bonding capabilities.

Look at the following comparisons:

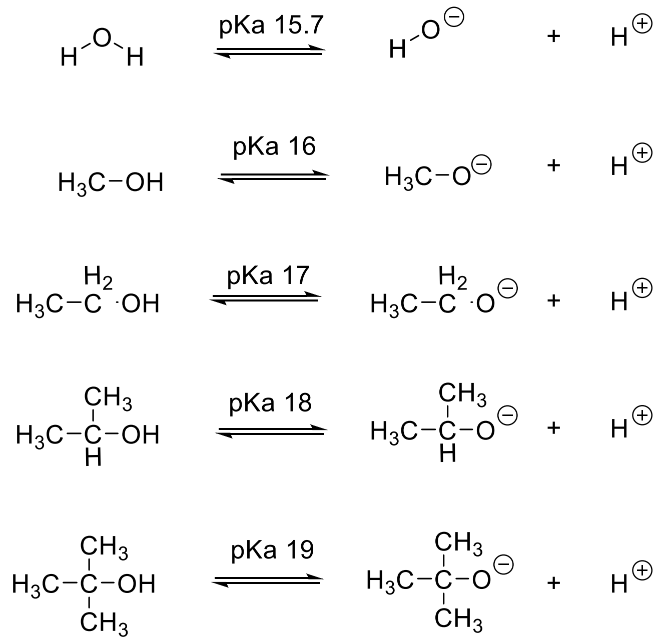
Name	Methanol	Ethane
Formula	CH_3OH	CH_3CH_3
Molecular Weight (g/mol)	32	30
Boiling Point (° C)	65	-89
State (at room temp)	liquid	gas

Ethane has almost the same molecular weight as methanol. However, the boiling point is much lower than methanol. Methanol molecules like to stick together via H-bonding while ethane molecules interact with each other via hydrophobic interactions.



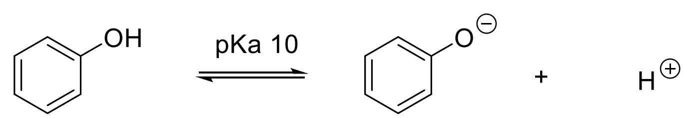


Acidity of R–OH



- Harder to make a t-butoxide than methoxide. The alkyl group donates electron density to the C–O bond and destabilizes the negative charge (less favourable).

<u>Conjugated/Aromatic R–OH</u>



Phenol

- More acidic than H_2O
- Resonance takes electron density away from the O atom, resulting in stabilization of the negative charge.