Organic Chemistry

Organic Chemistry Table

Homologous Series	Functional Group	Structure of Group	Name Example
Alkane	Single bond	-	Propane
Alkene	Double bond	=	Propene
Alkyne	Triple bond	≡	Propyne
Chloroalkane	H’s replaced by Cl’s	- Cl	Chloropropane
Alcohol	Hydroxyl	- OH	Propanol
Aldehyde	Carbonyl (end)	- C=O(H)	Propanal
Ketone	Carbonyl (middle)	- C=O	Propanone
Carboxylic Acid	Carboxyl	- C=OOH	Propanoic Acid
Ester	Bridging oxygen	-COO-	Methyl ethanoate

Organic Chemistry Terms & Prefixes

Organic Chemistry: The study of the compounds of carbon.

Hydrocarbons: Compounds that contain carbon and hydrogen only.

Saturated: Contain only single bonds.

Homologous Series: A series of compounds of uniform chemical type, showing graduation in physical properties with a general formula for it's members. They have a similar method of preparation.

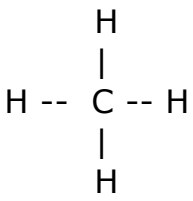
Prefix	No. of Carbons
Meth -	1
Eth -	2
Prop -	3
But -	4
Pent -	5
Hex -	6
Hept -	7
Oct -	8
Non -	9
Dec -	10

Mike Eats Pringles But Prefers Hula Hoops On Nasty Days.

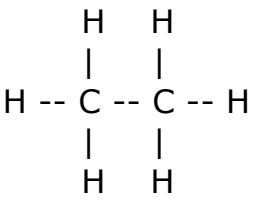
1 - Alkanes

- Shape: tetrahedral - never planar.
- Bonds: All single bonds - saturated.
- General Formula: C_NH_{2N+2}
- Ending: -ane (eg: propane)

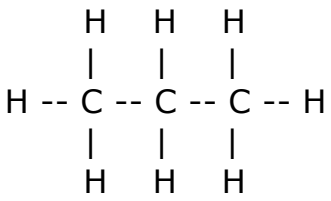
CH_4 - Methane



C_2H_6 - Ethane



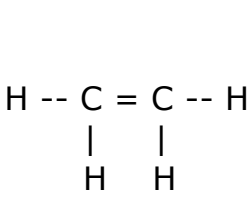
C_3H_8 - Propane



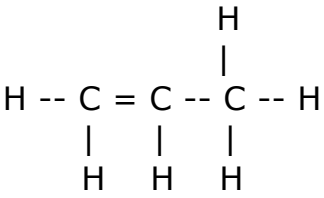
2 - Alkenes

- Shape: both tetrahedral and planar - tetrahedral everywhere but where the double bond is.
- Bonds: Unsaturated - contains a double bond.
- General Formula: C_NH_{2N}
- Ending: -ene (eg: propene)

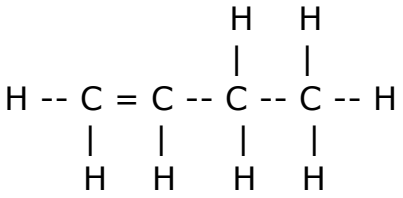
C_2H_4 - Ethene



C_3H_6 - Propene



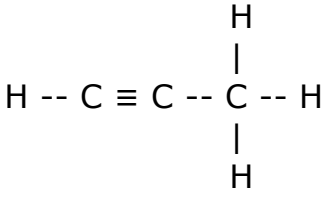
C_4H_8 - Butene



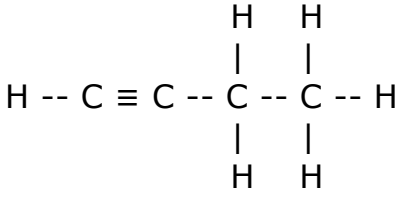
3 - Alkynes

- Shape: both tetrahedral and planar - tetrahedral everywhere but where the triple bond is.
- Bonds: Unsaturated - contains a triple bond.
- General Formula: C_NH_{2N-2}
- Ending: -yne (eg: propyne)

C_3H_4 - Propyne



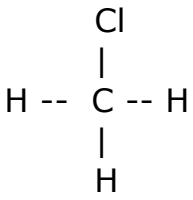
C_4H_6 - Butyne



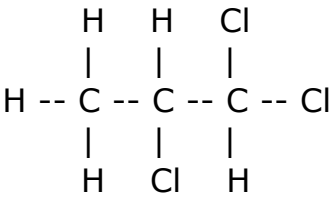
4 - Chloroalkanes

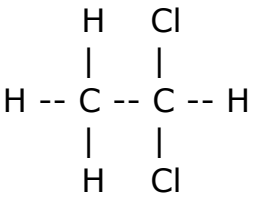
- An alkane with one or more of it's hydrogens replaced by chlorines.
- Shape: tetrahedral - never planar.
- Bonds: All single bonds - saturated.
- Ending: Chloro-ane (eg: chloropropane)
- If there are two chlorines it's di-chloro-ane, if there are three chlorines it's tri-chloro-ane, if there are four chlorines it's tetra-chloro-ane.

CH_3Cl - Chloromethane



$C_3H_5Cl_3$ - 1,1,2-triChloropropane





$C_2H_4Cl_2$ - 1,1-diChloroethane

5 - Alcohols

A homologous series similar to alkanes but with a hydrogen replaced by an -OH (hydroxyl) group. The ending is -anol (eg: propanol). The general formula is $C_NH_{2N+1}OH$.

There are primary, secondary and tertiary alcohols. Primary alcohols are when the carbon attached to the hydroxyl group touches one other carbon. Secondary alcohols are when the carbon attached to the hydroxyl group touches two other carbons. Tertiary alcohols are when the carbon attached to the hydroxyl group touches three other carbon.

*Always indicate the position of the hydroxyl group when naming alcohols. For example 2methylbutan-1-ol which has a methyl group attached to the second carbon and the hydroxyl group is attached to the first carbon.

The hydroxyl group of the alcohols changes their chemistry drastically from their corresponding alkanes. In particular, it affects their boiling points and solubility.

<u>Boiling Points</u>
The hydroxyl group (-OH) undergoes hydrogen bonding, resulting in them having very strong bonds. As a result, their boiling points are higher than those of the corresponding alkanes as it takes more energy to break apart the bonds.

<u>Solubility</u>
The solubility changes as the length of the carbon chain increases. The OH group is highly polar and if the chain is short it forces the non-polar carbon chain to dissolve in polar substances such as water. If the chain becomes too long the OH group can no longer force the chain to dissolve in polar substances so it dissolves in non-polar substances instead (cyclohexane). (Like dissolves like.)

6 & 7 - Aldehydes & Ketones

Aldehydes and Ketones both contain the functional group C=O (carbonyl). However, in aldehydes it is positioned at the end of the carbon chain and in ketones it is positioned in the middle. As a result the first of each contains 3 carbons (prop-). The carbonyl group for aldehydes is sometimes written as C=OH or CHO as it's at the end of a chain there is a hydrogen as well.

The ending for aldehydes is -anal (eg: propanal) and for ketones it's -anone (eg: propanone).

The result of the addition of the carbonyl group is the boiling points and solubility change.

Boiling Point
As the carbonyl group contains dipole-dipole forces they have a higher boiling point than their corresponding alkanes but a lower boiling point then their corresponding alcohols.

Solubility
The first few aldehydes and ketones are soluble in water (polar) and the rest are soluble in cyclohexane (non-polar) as the dipole-dipole forces can only force a few carbons to dissolve in a polar substance.

8 - Carboxylic Acids

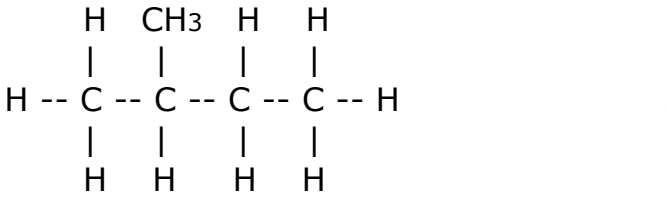
Carboxylic acids have a carboxyl functional group -C=OOH. Carboxylic acids have hydrogen bonds and they therefore have a high boiling point as it takes a lot of energy to break them.

Carboxylic acids have characteristic unpleasant odours such rancid butter and sweat.

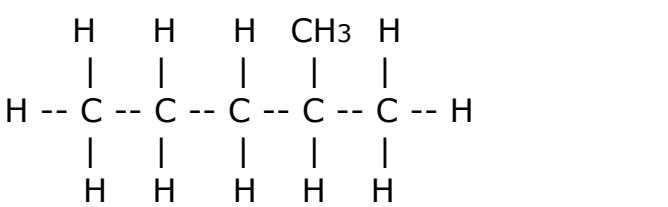
The ending for Carboxylic acids is -anoic acid (eg: propanoic acid).

Alkyl Groups

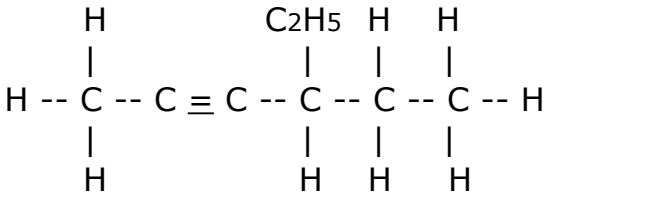
Any carbon which does not form part of the main chain of carbons forms part of an alkyl group.



2 - methyl - butane



2 - methyl - pentane



3 - ethyl - hex-2-yne

Note: When there is a double or triple bond the compound must be named so it describes where the bond is.

To do this, count along the carbons until you reach the carbon with the bond after it from both right to left and left to right and use whichever direction gives you a lower number. You then must use this direction for any other counting needed.

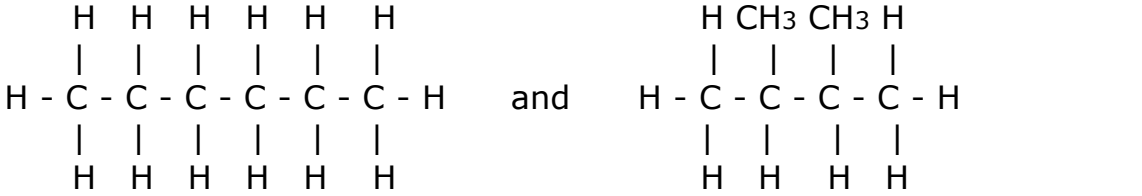
You also have to do this for alkyl groups using the same method.

For examples see above.

Isomers

Isomers are compounds with the same molecular formula but a different structural formula.

Eg:



hexane - C_6H_{14} 2,3 - dimethylbutane - C_6H_{14}

How to find isomers:

1. Shorten it by one, add a methyl group to anywhere but either end.
2. Repeat as necessary.