1. Melting and boiling temperatures of organic compounds

Hydrocarbons are non-polar, covalent compounds with only weak van der Waals forces of attraction between the molecules. The more surface there is in contact between the molecules, the more forces will act. Therefore, the longer the chain length, the higher the boiling point.

2. Naming organic compounds

Functional group: The atom or group of atoms in a compound that gives the compound its characteristic properties.

Homologous series: A 'family' of compounds that have the same functional group. They can be represented by a general formula, e.g. alkanes, C_nH_{2n+2}. They differ from their neighbour in the series by one CH_2 unit. Having the same functional group means that they have similar chemical properties. Their physical properties vary with a general trend as the M_r varies.

Hydrocarbon: A compound containing hydrogen and carbon only.

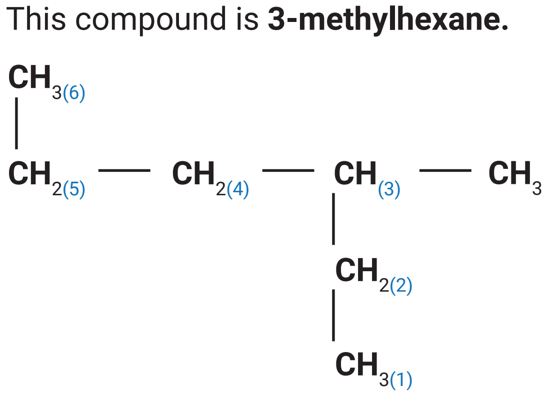
The name of a compound also depends on the number of carbon atoms in the molecule.

No. of C atoms	Prefix	No. of C atoms	Prefix
1	meth-	5	pent-
2	eth-	6	hex-
3	prop-	7	hept-
4	but-	8	oct-

Rules for naming:

1. Identify the compound's functional group/type.
2. Find the longest continuous carbon chain that contains the functional group (be careful as branches can be misleading).
3. Number the carbon atoms in the longest chain, starting from the end that gives any side chains or functional groups the smallest numbers possible.
4. Name any branched groups/substituted groups and give their position on the carbon chain (e.g. 3). If there is more than one of the same group attached, then use the prefix di- or tri-. If there is more than one type of group attached, they are written in alphabetical order.
5. A $-CH_3$ group is called methyl, a $-CH_2CH_3$ group is called ethyl, etc.
6. Combine the parts of the name into one word; branched groups, prefix, name ending (suffix). If there are two consecutive numbers, a comma is placed between them. A dash separates words from numbers.

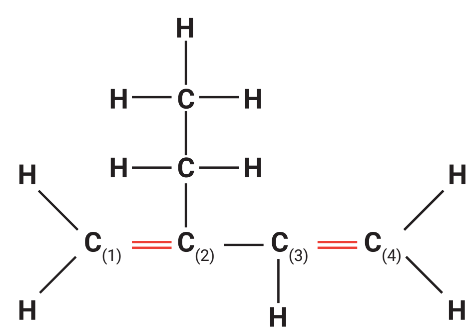
This compound is **3-methylhexane.**



Note that there are six carbon atoms in the longest chain – not four. The carbon atoms have been numbered so that the methyl branch is on the third and not the fourth.

Alkenes

Functional group: C=C (they are saturated hydrocarbons)



Two C=C groups … -diene

Longest chain containing both functional groups has four carbon atoms … but-

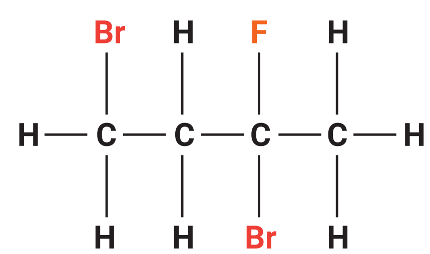
Ethyl group on carbon number 2

⟶ **2-ethylbut-1,3-diene**

Halogenoalkanes

Functional groups:

—F (fluoro-), —Cl (chloro-), —Br (bromo-), —I (iodo-)



Longest chain has four carbon atoms … based on the alkane butane

Two —Br atoms … di- … on first and third carbon atoms

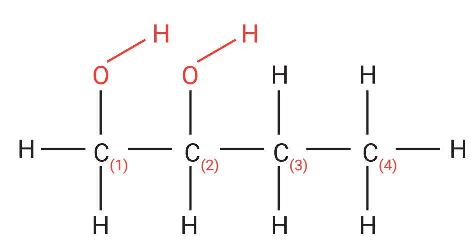
One —F atom on third carbon atom

Alphabetical order so bromo- then fluoro-

⟶ **1,3-dibromo-3-fluorobutane**

Alcohols

Functional group: —OH (-ol)



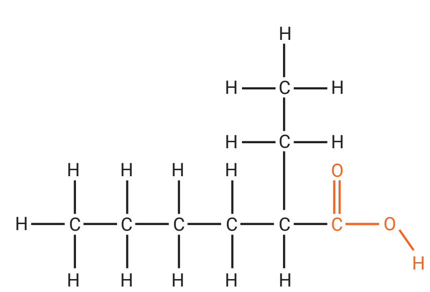
Longest chain has four carbon atoms … based on the alkane butane

Two —OH groups … di- … and … -ol … on first and second carbon atoms

⟶ **butan-1,2-diol**

Carboxylic acids

Functional group: —COOH (-oic acid)



Longest chain containing the functional group has six carbon atoms … based on the alkane hexane

The carbon atom in the —COOH group is defined as carbon atom 1

Ethyl group on second carbon atom

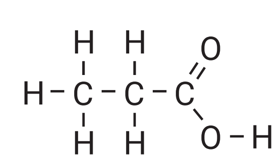
⟶ **2-ethylhexanoic acid**

3. Types of formula (e.g. propanoic acid)

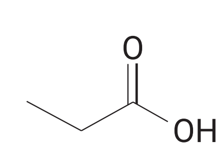
Molecular formula: The number of atoms of each element present in the molecule … $C_3H_6O_2$

Shortened formula: Shows some detail about the structure and the functional group without including bonds … CH_3CH_2COOH

Displayed formula: Shows all the atoms and the bonds in the molecule …



Skeletal formula: Shows the bonds between any carbon atoms in the molecule and any functional group that is attached …



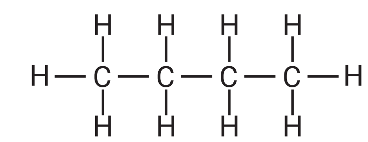
4. Isomerism

Structural isomerism

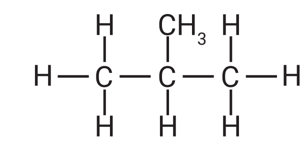
Structural isomers are compounds with the same molecular formula but a different structural formula.

a) Chain isomerism

The carbon chain is arranged differently (branches). A branched isomer has a lower boiling temperature as the chains are further away from one another (reduction in van der Waals forces).



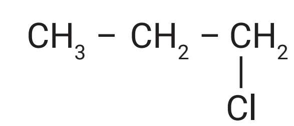
butane



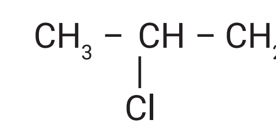
methylpropane

b) Position isomerism

The functional group is in a different position in the molecule.



1-chloropropane

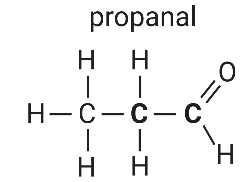


2-chloropropane

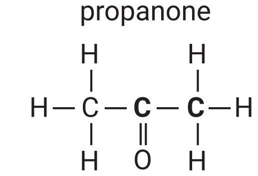
c) Functional group isomerism

The functional group is different, e.g. as in aldehydes and ketones.

propanal

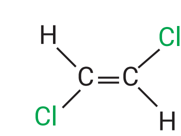


propanone

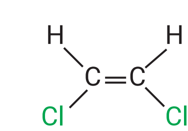


d) *E-Z* isomerism

Only occurs in alkenes because there is restricted rotation about the double bond.

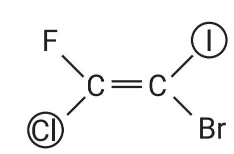


(E) - 1,2-dichloroethane

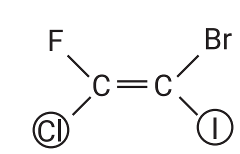


(Z) - 1,2-dichloroethane

***E* or *Z*?** Look at the atoms directly attached to each of the carbon atoms. The atom with the higher atomic number takes priority. If the higher priority atom on both carbon atoms is on the same side of the double bond, the isomer is the *Z* form. If the higher priority atoms are on opposite sides of the double bond, the isomer is the *E* form.



priority groups on opposite sides *E* configuration



priority groups on same side *Z* configuration

Properties of *E-Z* isomers

Both isomers undergo the characteristic reactions of alkenes. However, the restricted C=C rotation means that the substituent groups can behave differently. In the *E* form, the substituent groups are further apart than they are in the *Z* form. For example, in butenedioic acid, the two —COOH groups in the *Z* form can interact in a dehydration reaction. This does not happen with the *E* form as the groups are too far apart.