fact sheet

How to name hydrocarbons

Hydrocarbons are compounds that contain only carbon and hydrogen. Carbon atoms have four valence electrons, allowing them to bond in many different ways. A carbon atom can bond to two, three or four other atoms, which means that hydrocarbons can form a wide variety of structures.

Aliphatic hydrocarbons form straight chains, alicyclic hydrocarbons form rings of carbon atoms and aromatic hydrocarbons contain a special structure called a benzene ring (C_6H_6).

Aliphatic hydrocarbons can be divided into three types, based on the number of bonds between neighbouring carbon atoms. These different types have different properties due to their bonding.

- Alkanes have only single bonds between carbon atoms.
- Alkenes contain at least one double bond between a pair of carbon atoms.
- Alkynes have at least one triple bond between carbon atoms.

There are so many different hydrocarbon molecules possible that a special naming system called IUPAC (International Union of Pure and Applied Chemistry) is used to identify them. This naming system has specific rules so that each molecule has a unique name.

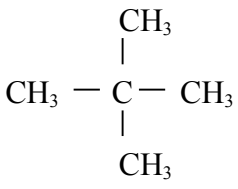
1. The first part of the name is based on the length of the longest carbon chain in the molecule.
2. The end of the name is given by the number of bonds between carbon atoms. If there are only single bonds the name ends with '-ane', if there is at least one double bond (and no triple bonds) the name ends in '-ene', and if there is at least one triple bond the name ends in '-yne'.
3. Functional groups (branches coming off the longest carbon chain) are named according to their length and how many there are.
4. Functional groups are numbered to show where they are attached to the main chain. Carbon atoms in the main chain are numbered from the end closest to the functional groups (or the end closest to a multiple bond if there is one).

Number of carbon atoms	Prefix for main chain	Functional group
1	meth-	methyl
2	eth-	ethyl
3	prop-	propyl
4	but-	butyl
5	pent-	pentyl
6	hex-	hexyl
7	hept-	heptyl
8	oct-	octyl
9	non-	nonyl
10	dec-	decyl

Hydrocarbon class	highest order bond	Suffix / prefix
alkane	C—C	-ane
alkene	C=C	-ene
alkyne	C≡C	-yne
cycloalkane	C—C	cyclo ... ane
cycloalkene	C=C	cyclo ... ene
cycloalkyne	C≡C	cyclo ... yne

REPEATING UNITS	PREFIX
1	
2	di-
3	tri-
4	tetra-

Where there's more than one double or triple bond in a molecule it's conventional to add an 'a' to the prefix. For example, but-1-ene and buta-1,2-diene.



This molecule has only single bonds, so it is an alkane and its name ends in **-ane**.

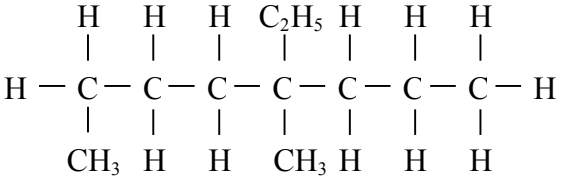
The longest chain has three carbons, so the prefix is **prop-**.

The molecule has two (di-) single carbon (methyl-) branches, so it is a **dimethylpropane**.

Both branches come off the second carbon atom in the chain, so it starts **2,2-dimethyl-**.

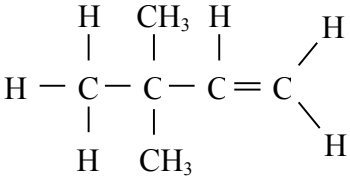
The full name is **2,2-dimethylpropane**.

Examples

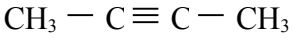


Although this looks at first glance to be a heptane, the methyl group at the left of the chain can be viewed as part of the backbone.

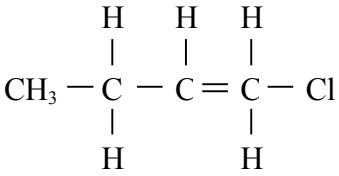
- The longest chain has eight carbon atoms, so it is an **octane**.
- The molecule has two branches, one with a single carbon (**methyl-**) and one with two carbons (**ethyl-**).
- Both branches are attached to the **fourth** carbon atom.
- Full name is **4-ethyl-4-methyloctane**.



- This molecule has a double bond, so it is an alkene with a name ending in **-ene**.
- The double bond is between the first and second carbon atoms, so it is a **but-1-ene**.
- Full name is **3,3-dimethylbut-1-ene**.

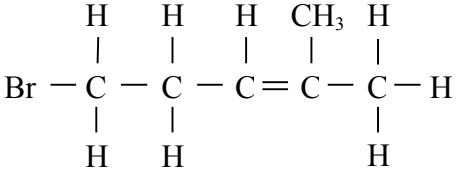


- This molecule is **but-2-yne**.



When a halogen (group 7 or 17 element) is substituted into a hydrocarbon, the halogen is treated as a functional group (prefixes are **fluoro-**, **chloro-**, **bromo-** and **iodo-**).

- This molecule is **1-chlorobut-1-ene**.



- If the chain is numbered from the left this molecule would be called **1-bromo-4-methylpent-3-ene**.
- If the chain is numbered from the right it would be **5-bromo-2-methylpent-2-ene**.
- The chain is numbered in the direction that gives any multiple bonds the lowest possible number, so the correct name is **5-bromo-2-methylpent-2-ene**.