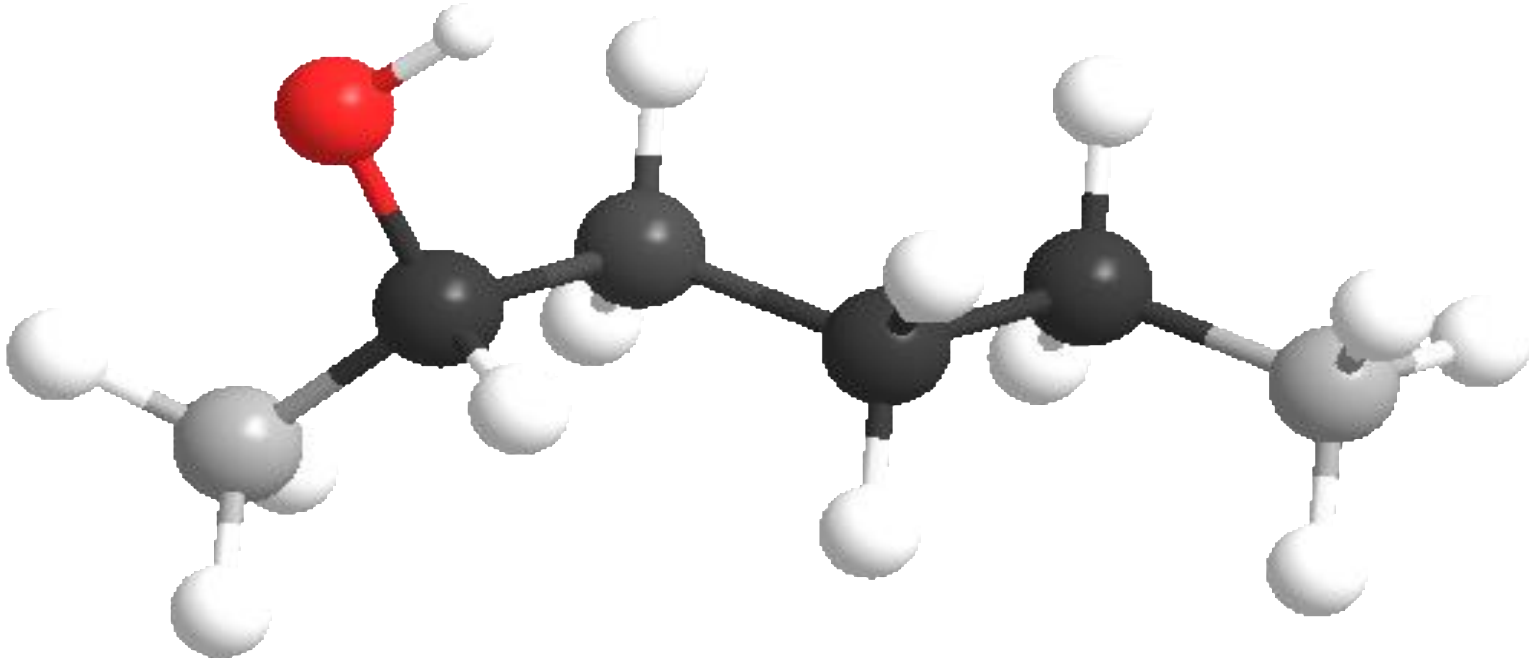
الكلية	العلوم
القسم	الكيمياء
المادة باللغة الانجليزية	Organic Chemistry
المادة باللغة العربية	الكيمياء العضوية
المرحلة الدراسية	الاولى
اسم التدريسي	محمد عدنان عبد منديل
عنوان المحاضرة باللغة الانجليزية	Saturated hydrocarbons
عنوان المحاضرة باللغة العربية	الهيدروكابونات المشبعة
رقم المحاضرة	الخامسة
المصادر والمراجع	الكيمياء العضوية لمؤلفه (كلايدن)
	مبادي الكيمياء العضوية لمؤلفيه (موريون و بويد)



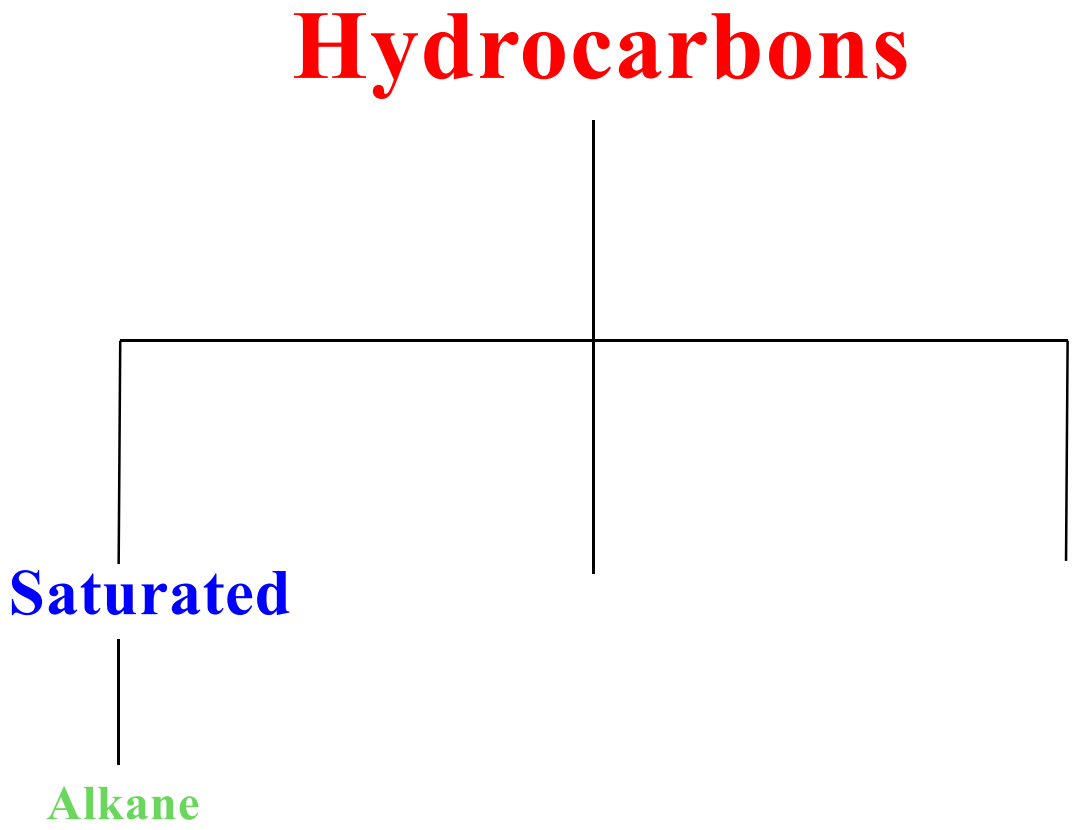
Hydrocarbons

by

Mohammed Adnan Abid

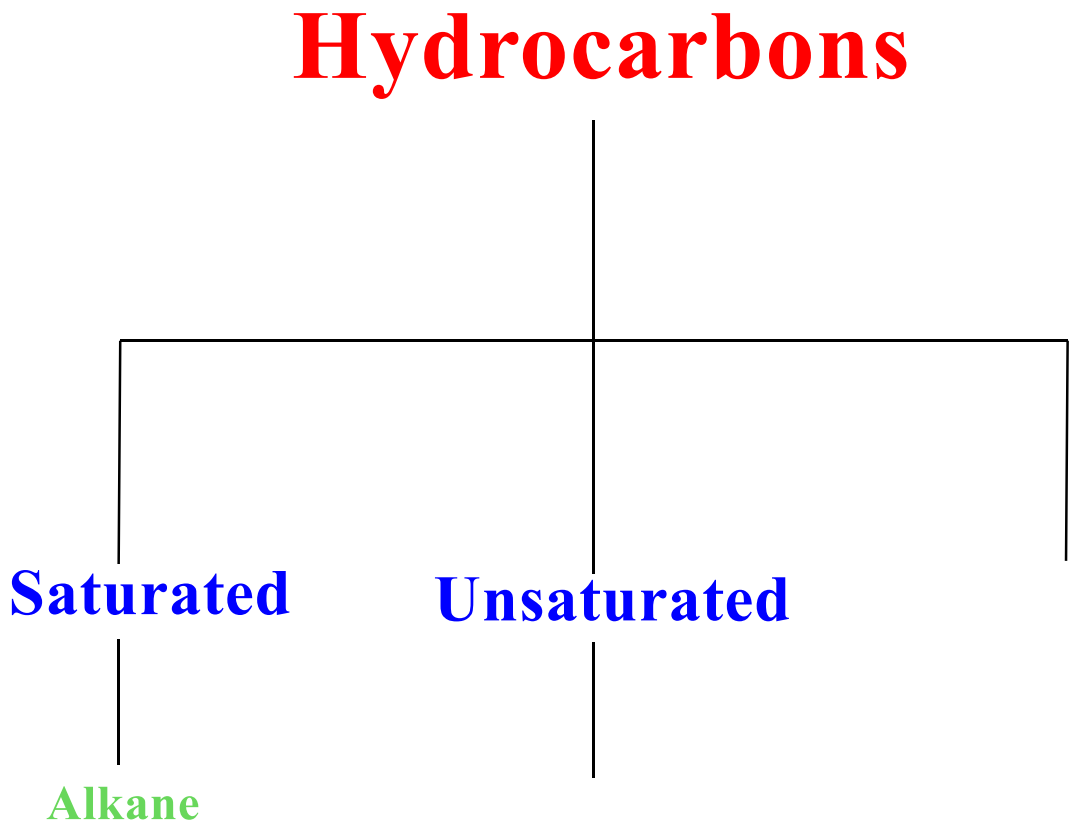
Hydrocarbons

Saturated hydrocarbons



Hydrocarbons

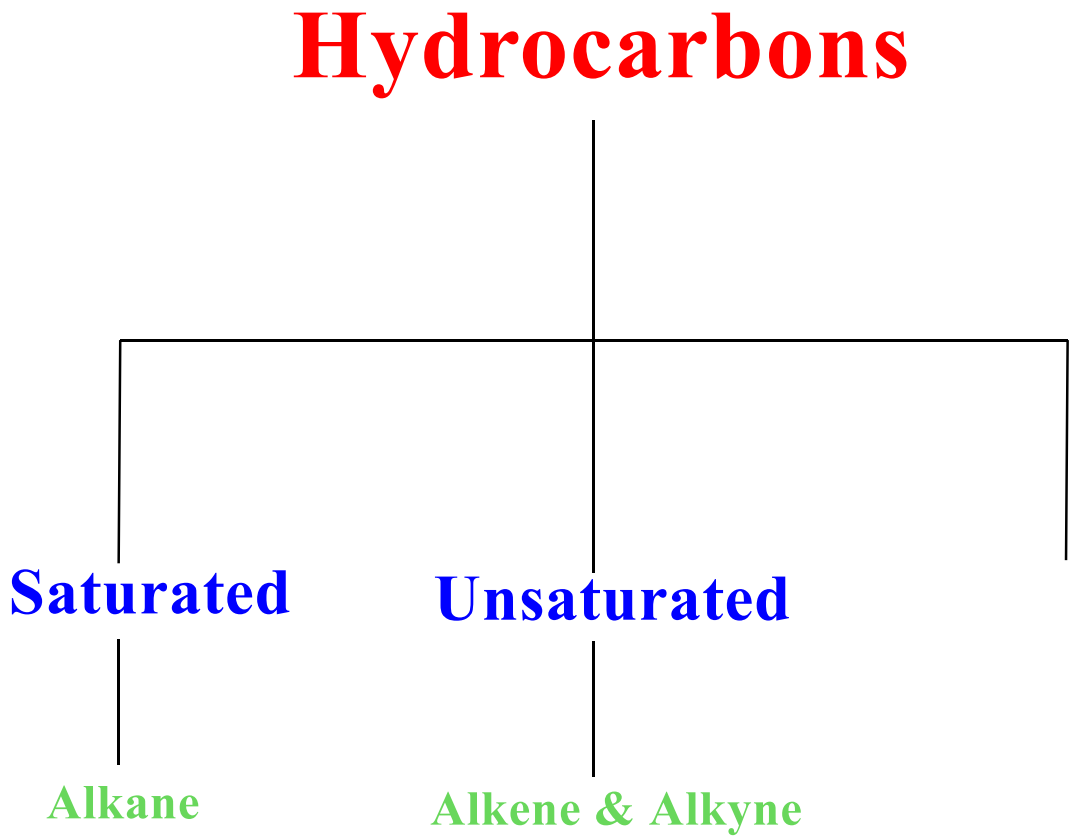
Unsaturated hydrocarbons



Hydrocarbons

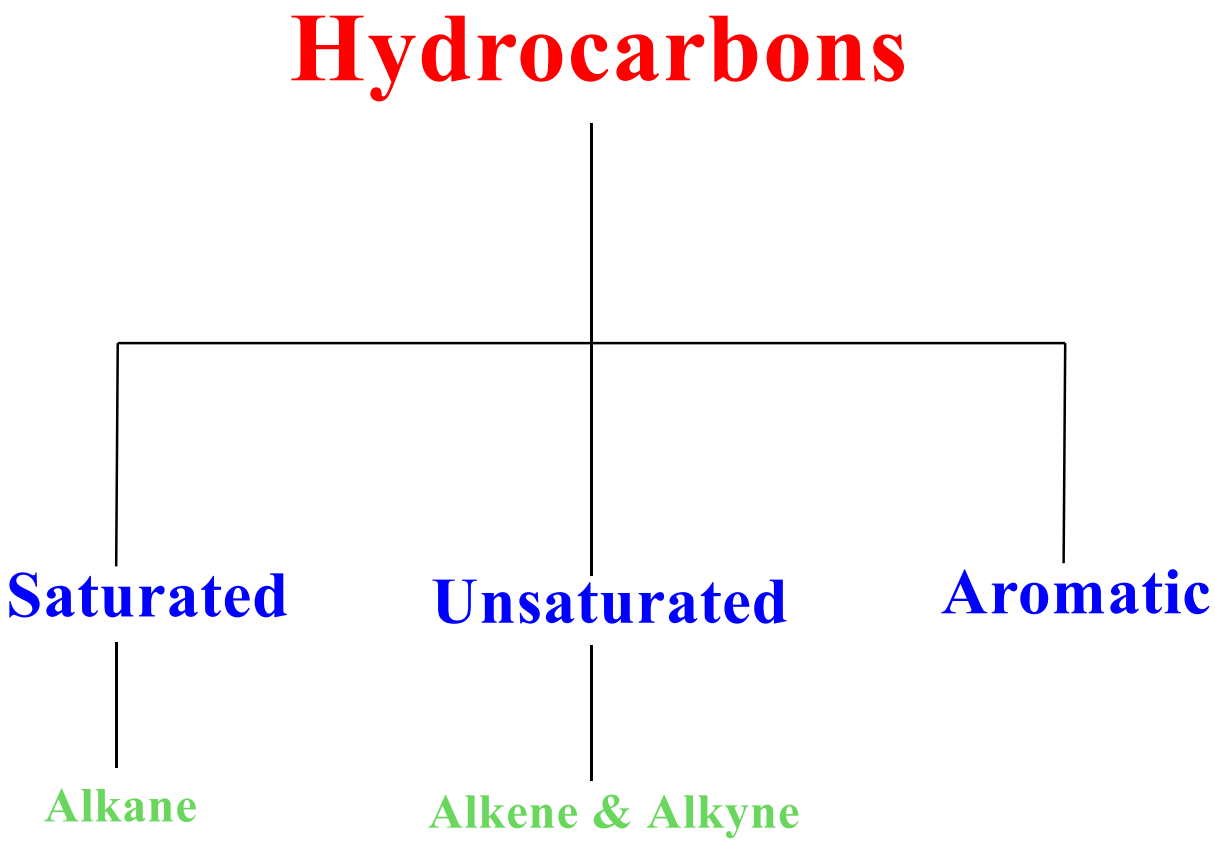
Unsaturated hydrocarbons

Alkene and Alkyne



Hydrocarbons

Aromatic hydrocarbons

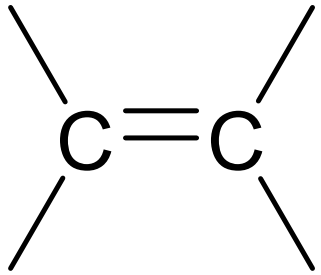


Hydrocarbons

Unsaturated hydrocarbons

Alkene

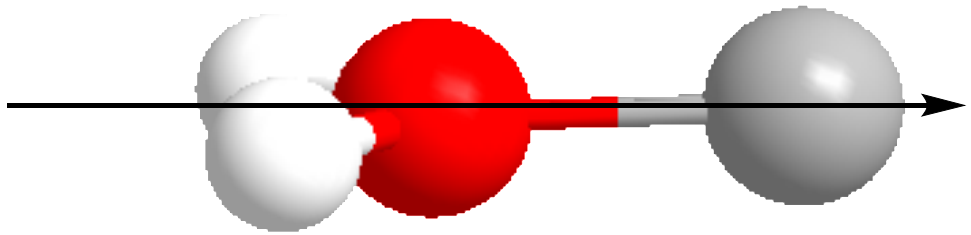
An **alkene** is a hydrocarbon with one or more carbon-carbon double covalent bonds. The simplest alkene is composed of two carbon atoms and is called ethene (shown below). Each carbon is bonded to two hydrogen atoms, in addition to the double bond between them.

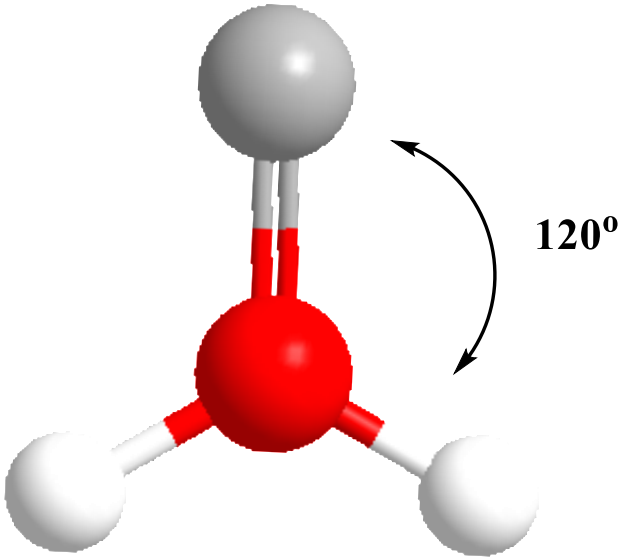


Hydrocarbons

Alkene

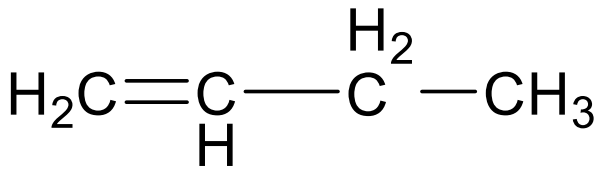
- The hybridization of each carbon atom is sp^2 with trigonal planar geometry. All the atoms of the molecule lay in one plane. The general formula for alkenes with one double bond is C_nH_{2n}

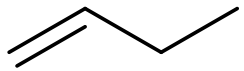




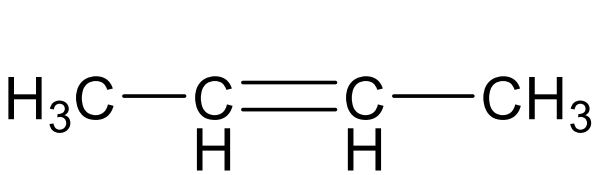
Hydrocarbons

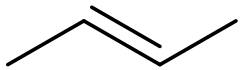
- An **unsaturated hydrocarbon** is a hydrocarbon that contains less than the maximum number of hydrogen atoms that can possibly bond with the number of carbon atoms present.
- The location of the carbon-carbon double bond can vary. The 4-carbon alkene generic name is butene. Since the double bond can be located in more than one place, we have for example 1-butene and 2-butene:





1-butene

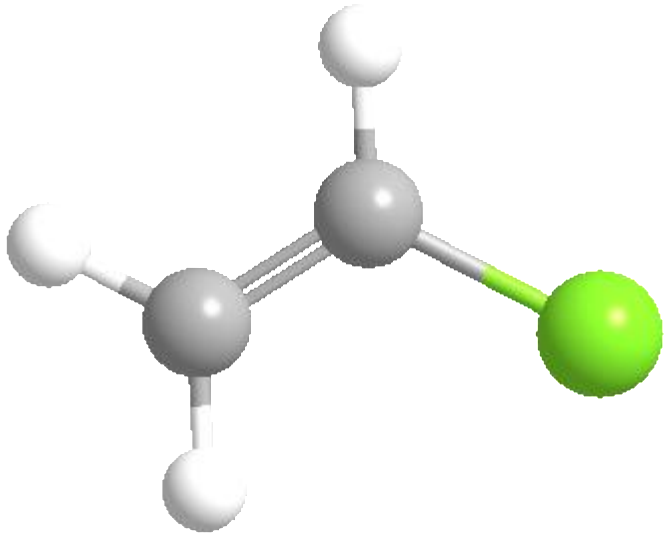




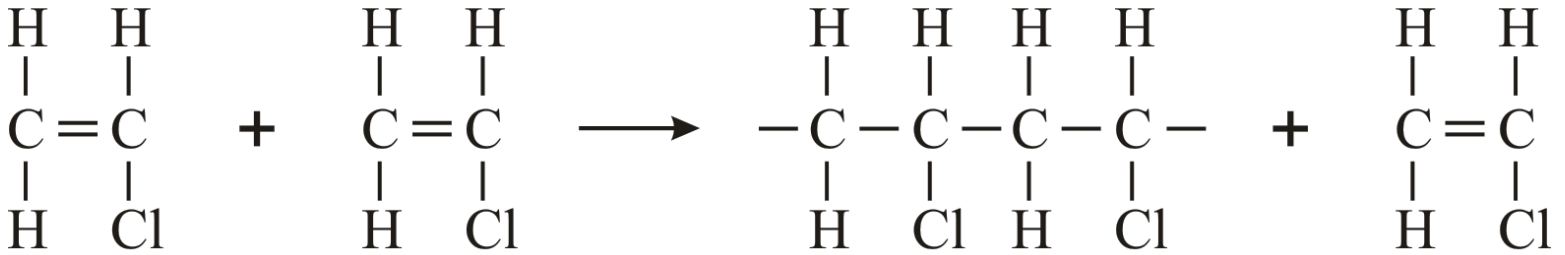
2-butene

Hydrocarbons

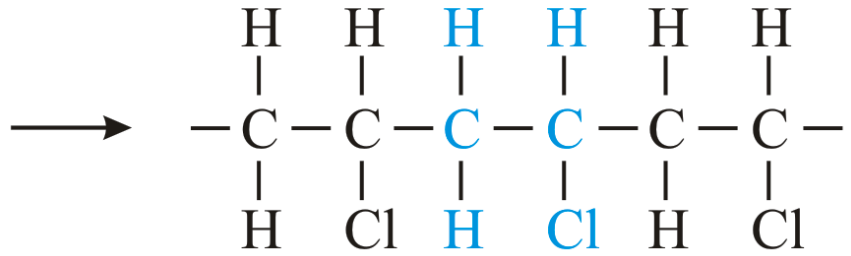
- Polymerization of vinyl chloride gives polyvinyl chloride, or PVC, more than 27 million tons of which is used globally each year to produce pipes, floor tiles, siding for houses, gutters.



Vinyl chloride



vinyl chloride monomers

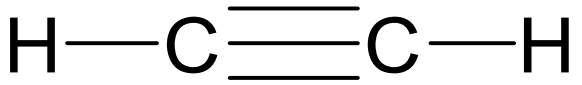


poly(vinyl chloride)

Hydrocarbons

Alkynes

- An **alkyne** is a hydrocarbon with one or more carbon-carbon triple covalent bonds. The simplest alkyne consists of two carbon atoms and is called ethyne (common name: acetylene).



- The ethyne molecule is linear, with sp hybridization for each carbon atom. The general formula of alkynes with one triple bond is C_nH_{2n-2}. Alkynes are also unsaturated hydrocarbons.

Hydrocarbons

To sum

- An alkane is a hydrocarbon with one carbon-carbon covalent bonds with general formula C_nH_{2n+2}.
- An alkene is a hydrocarbon with one or more carbon-carbon double covalent bonds with general formula C_nH_{2n}.
- An alkyne is a hydrocarbon with one or more carbon-carbon triple covalent bonds with general formula C_nH_{2n-2}.
- An unsaturated hydrocarbon is a hydrocarbon that contains less than the maximum number of hydrogen atoms that can possibly bond with the number of carbon atoms present.

Hydrocarbons

Nomenclature of hydrocarbons (Alkanes)

After the classification of alkanes, the new approach has been developed to name them according to a global system. This system has been agreed upon by chemists, known as the systematic nomenclature.

Systematic name: is known as abbreviated as IUPAC, which is present the first letters of the words International Union of Pure and Applied Chemistry.

Hydrocarbons

Nomenclature of hydrocarbons

saturated hydrocarbons(Alkanes)

In order to name organic compounds you must first memorize a few basic names. These names are listed within the discussion of naming alkanes. In general, the base part of the name reflects the **number** of carbons in what you have assigned to be the **parent chain**. The **suffix** of the name reflects the type(s) of functional group(s) present on (or within) the parent chain. Other groups which are attached to the parent chain are called **substituents**.

Hydrocarbons

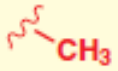
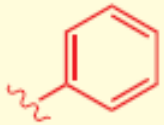
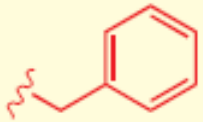
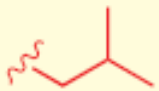
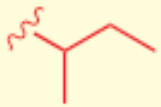
- The names of the straight chain saturated hydrocarbons for up to a 10 carbon chain are shown below. The names of the substituents formed by the removal of one hydrogen from the end of the chain is obtained by changing the suffix -**ane** to -**yl**.

$$\underset{\textbf{alkane}}{C_nH_{2n+2}} \xrightarrow{-H} \underset{\textbf{alkyl}}{C_nH_{2n+1}}$$

Number of Carbons	Name
1	**meth**ane
2	**eth**ane
3	**prop**ane
4	**but**ane
5	**pent**ane
6	**hex**ane
7	**hept**ane
8	**oct**ane
9	**non**ane
10	**dec**ane

Hydrocarbons

There are a few common branched substituents which you should memorize. These are shown below.

R	alkyl		***t*-Bu**	*tert*-butyl	
Me	methyl		**Ar**	aryl	any aromatic ring
Et	ethyl		**Ph**	phenyl	
Pr (*n*-Pr)	propyl		**Bn**	benzyl	
Bu (*n*-Bu)	butyl		**Ac**	acetyl	
***i*-Pr**	isopropyl			vinyl	
***i*-Bu**	isobutyl			allyl	
s-Bu	*sec*-butyl		**X**	halide	F, Cl, Br or I

Hydrocarbons

- Here is a simple list of rules to follow. Some examples are given at the end of the list:

1. Identify the longest carbon chain. This chain is called the parent chain.
2. Identify all of the substituents (groups appending from the parent chain).
3. Number the carbons of the parent chain from the end that gives the substituents the lowest numbers. When comparing a series of numbers, the series that is the "lowest" is the one which contains the lowest number at the occasion of the first difference. If two or more side chains are in equivalent positions, assign the lowest number to the one which will come first in the name.

Hydrocarbons

4. If the same substituent occurs more than once, the location of each point on which the substituent occurs is given. In addition, the number of times the substituent group occurs is indicated by a prefix (di, tri, tetra, etc.).
5. If there are two or more different substituents they are listed in alphabetical order using the base name (ignore the prefixes). The only prefix which **is** used when putting the substituents in alphabetical order is **iso** as in isopropyl or isobutyl. The prefixes sec- and tert- are not used in determining alphabetical order except when compared with each other.

Hydrocarbons

6. If chains of equal length are competing for selection as the parent chain, then the choice goes in series to:
   a) the chain which has the greatest number of side chains.
   b) the chain whose substituents have the lowest- numbers.
   c) the chain having the greatest number of carbon atoms in the smaller side chain.
   d)the chain having the least branched side chains.
7. A cyclic (ring) hydrocarbon is designated by the prefix **cyclo-** which appears directly in front of the base name.

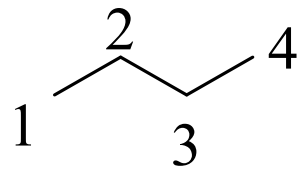
Hydrocarbons

- When the alkyl group attached to carbon atom which attaches to one carbon atom, it is call primary carbon and it presents as (1^o).
- When the alkyl group attached to carbon atom which attaches to two carbon atoms, it is call secondary (sec) carbon and it presents as (2^o).
- When the alkyl group attached to carbon atom which attaches to three carbon atoms, it is call tertiary (tert) carbon and it presents as (3^o). Also, the quaternary (4^o).

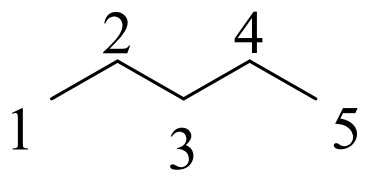
Hydrocarbons

Some examples of alkanes nomenclature

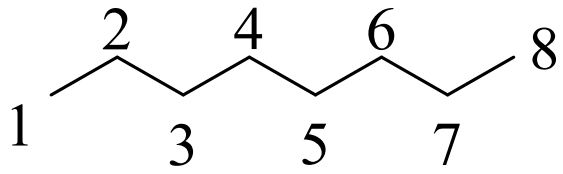
- Identify the longest carbon chain, this chain is called the parent chain, any others are called alkyl groups.
-



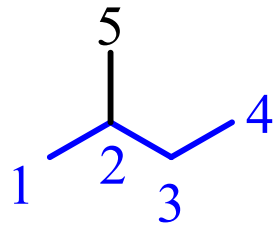
n-butane

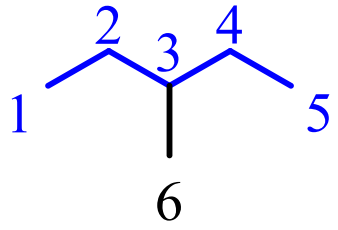


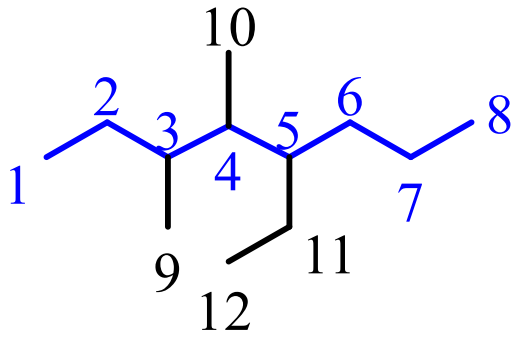
n-pentane



n-octane

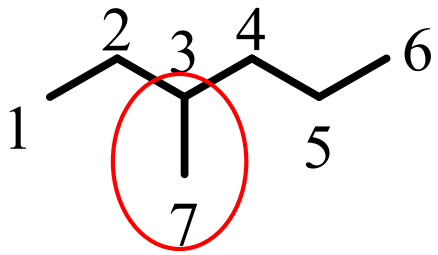




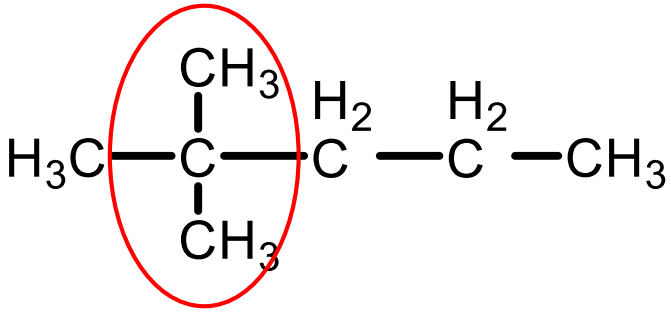


Hydrocarbons

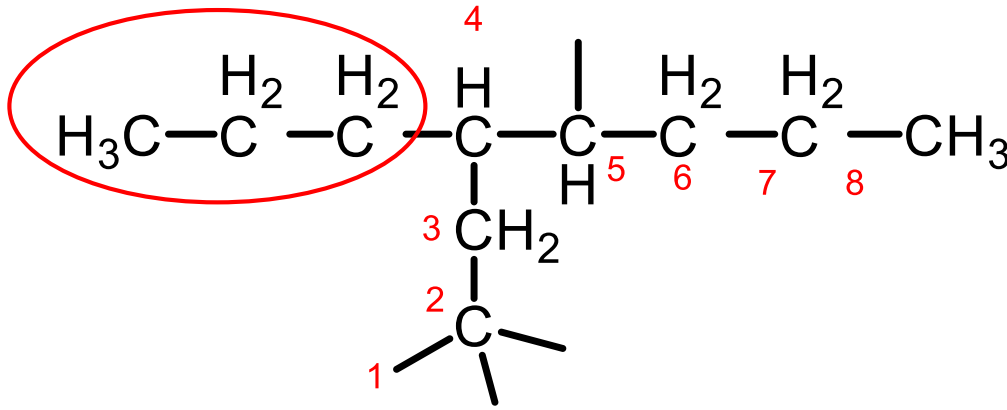
- Examples



3-methylhexane

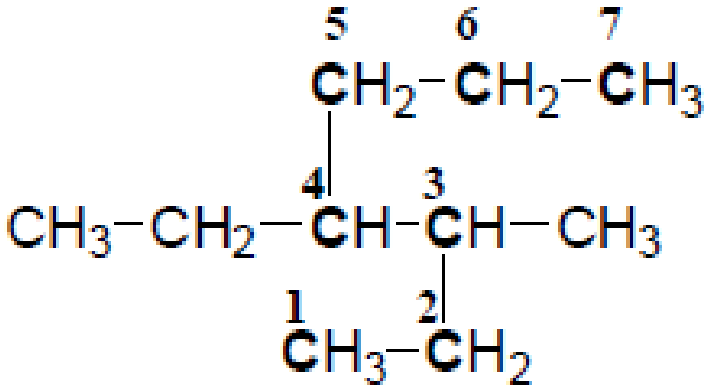


2,2-dimethylpentane

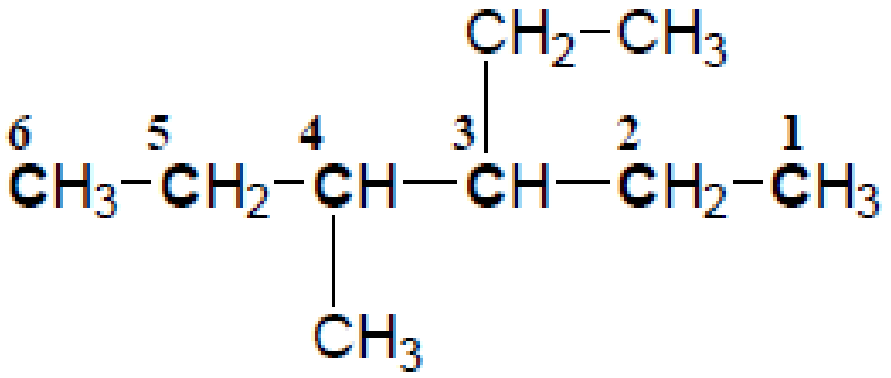


2,2,5-trimethyl-4-propyloctane

Hydrocarbons



4-Ethyl-3-methyl heptane



3-Ethyl- 4-methyl hexane

To be continued…….