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Chapter 1: General

-Study of the carbon atom and these bonds.

-Functions and nomenclature of organic compounds: Ordinary, trivial, usual and systematic IUPAC nomenclature.

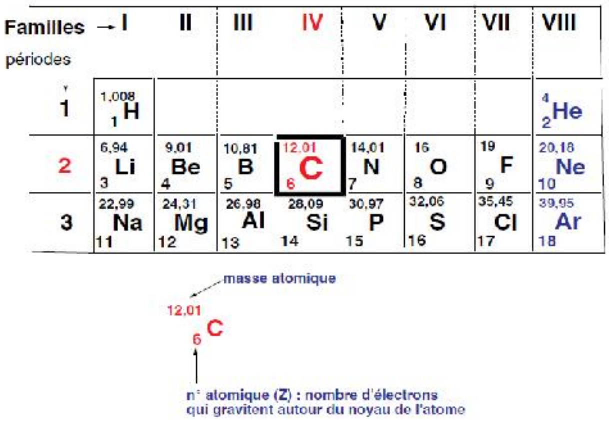
I.1/ Study of the carbon atom and these bonds

- Organic chemistry is the chemistry of compounds, natural or synthetic, made up of carbon atoms except carbon monoxide (CO), carbon dioxide (CO2), carbonates and bicarbonates (Ex: NaCO3, NaHCO, etc.), cyanides (KCN, Na2CN3), disulfide (CS2) and carbides (CaC2) which are inorganic compounds.
- These compounds also include other elements, we find in particular hydrogen, we then have hydrocarbons (composed of C and H), and heteroatoms: oxygen, nitrogen, phosphorus, sulfur, halogens or metals. The sequence of carbon atoms constitutes the carbon skeleton of the molecule. This chemistry therefore concerns an infinite number of areas: proteins, sugars, fats, oil, plastics, organometallics, etc.

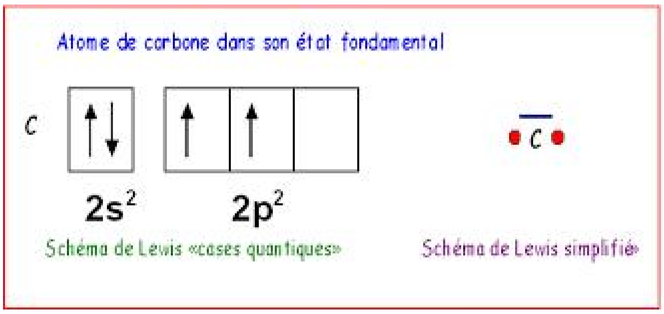
I.1.1/ The carbon atom

The element "carbon" is located in the middle of the second period of the "*Mendeleiev*" table between boron (B) and nitrogen (N).

Carbon belongs to the 4th family of elements. Its atomic number, (Z) is 6 and its electronic configuration is: 1 s^2 2 s^2 2p^2

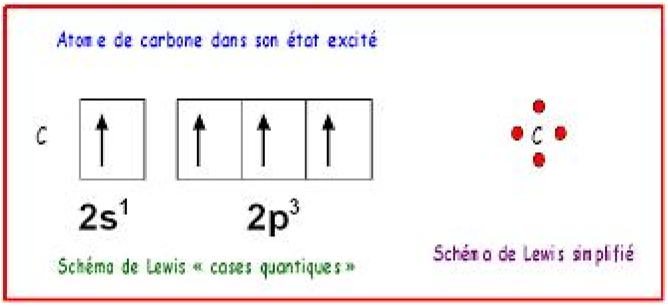


Familles → / périodes ↓	I	II	III	IV	V	VI	VII	VIII
1	1,008 H 1							4 He 2
2	6,94 Li 3	9,01 Be 4	10,81 B 5	12.01 C 6	14,01 N 7	16 O 8	19 F 9	20,18 Ne 10
3	22,99 Na 11	24,31 Mg 12	26,98 Al 13	28,09 Si 14	30,97 P 15	32,06 S 16	35,45 Cl 17	39,95 Ar 18



The compounds formed by carbon in the valence state 2 are unstable because the octet rule is not respected (the incomplete peripheral layer: 6 é instead of 8 é).

In organic compounds, carbon forms 4 bonds (valence = 4), this explained by the migration of an electron from the 2s subshell to the 2p subshell:



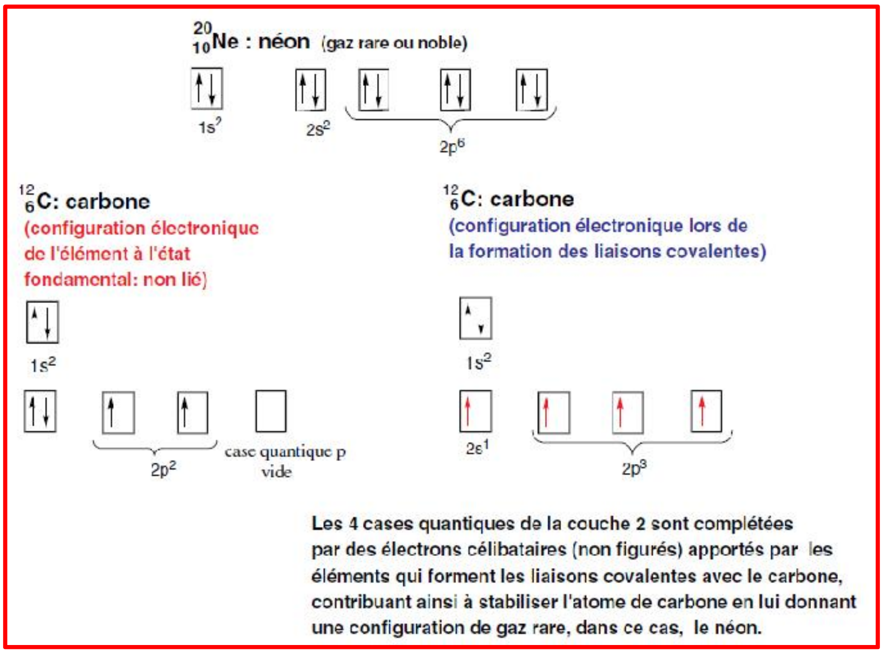
I.1.2/ Chemical bonds

A molecule is the assembly of two or more atoms, there are three types of strong bonds, which unite the atoms:

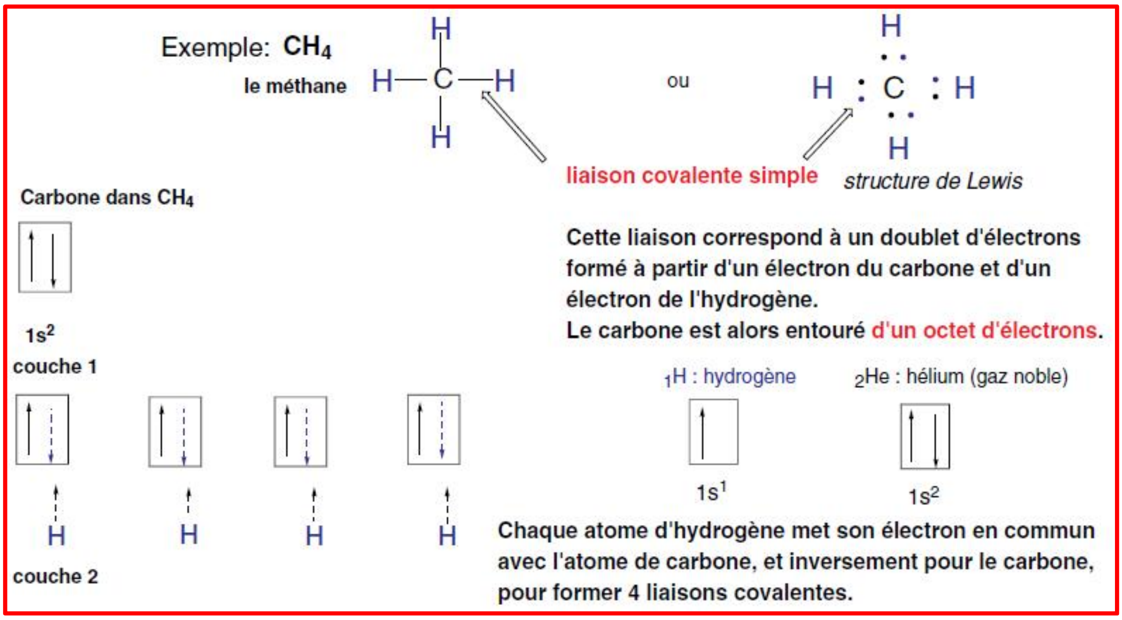
- Ionic bond: The ionic or heteropolar bond is formed between ions of opposite sign, example: CH3 COO-,Na+
- Metallic bond: it is a bond that connects a carbon and a metal, example: C-Zn; C-Mg; C-Pb
- Covalent bond: results from a sharing of two or more electrons between two atoms. These electrons are most often single, example: C-H
  The covalent bond can be Single (d bond) (C-C) or multiple (л bond) either double bond like CH2=CH2, or triple bond like CH=CH

I.1.3/ valence of elements:

The sequence of atoms is done based on the valency of each element, of which, the valence of a chemical element is the maximum number of chemical bonds that it can form.



Les 4 cases quantiques de la couche 2 sont complétées par des électrons célibataires (non figurés) apportés par les éléments qui forment les liaisons covalentes avec le carbone, contribuant ainsi à stabiliser l'atome de carbone en lui donnant une configuration de gaz rare, dans ce cas, le néon.

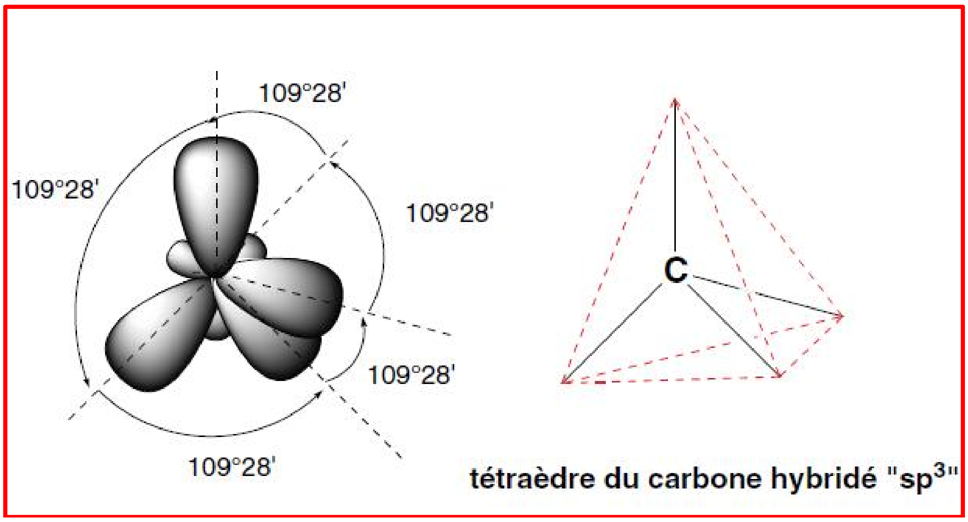


Cette liaison correspond à un doublet d'électrons formé à partir d'un électron du carbone et d'un électron de l'hydrogène.
Le carbone est alors entouré d'un octet d'électrons.

Chaque atome d'hydrogène met son électron en commun avec l'atome de carbone, et inversement pour le carbone, pour former 4 liaisons covalentes.

I.1.4/ sp3 hybridization

In the case where a carbon atom forms 4 single bonds with other atoms, it is in the “sp3” hybridization state. The four axes of symmetry of these hybridized carbon orbitals make equal dihedral angles of 109° 28' between them. The carbon nucleus is at the center of the representation.

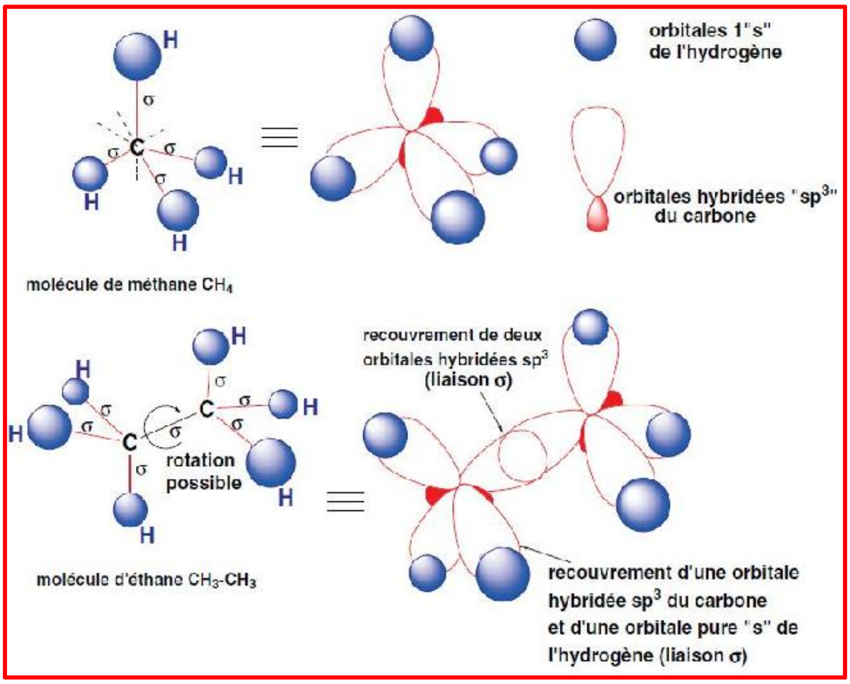


tétraèdre du carbone hybridé "sp^3"

This type of hybridization is that of carbon in methane CH4: 4 equivalent s bonds are formed by covering the 4 hybridized “sp3” orbitals of carbon with the 4 spherical “s” orbitals of 4 hydrogen atoms forming a tetrahedral system.

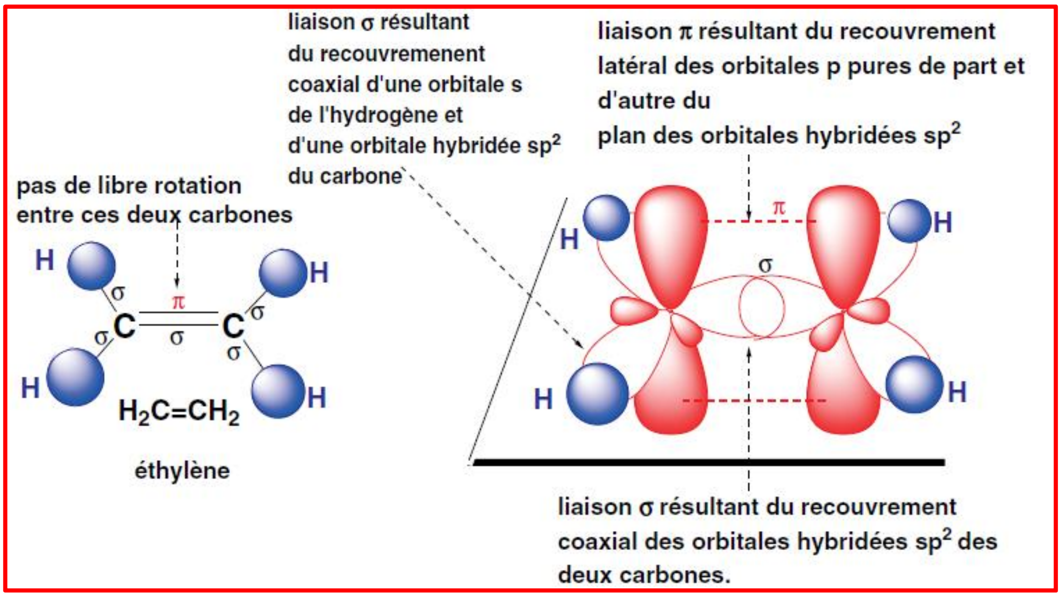
The 4 spherical “s” orbitals of 4 hydrogen atoms forming a tetrahedral system. This hybridization of carbon is found in all alkanes with the general formula C_nH_{2n+2} such as ethane C_2H_6, propane C_3H_8, butane C_4H_{10}, etc.

There is free rotation around single bonds, which allows two adjacent carbon groups to rotate relative to each other.



I.1.5. sp^2 Hybridization

In this type of hybridization of carbon atomic orbitals, only one “p” orbital of layer 2 remains pure. The other 3 orbitals are “sp2” hybridized from the “s” orbital and the two remaining “p” orbitals.
The 3 hybridized “sp2” orbitals are equivalent, their axes of symmetry are coplanar and make angles of 120° between them. The pure “p” orbital is located on either side of this plane, and its axis is perpendicular to it. Double bonds represent regions of the molecule with high electron density.

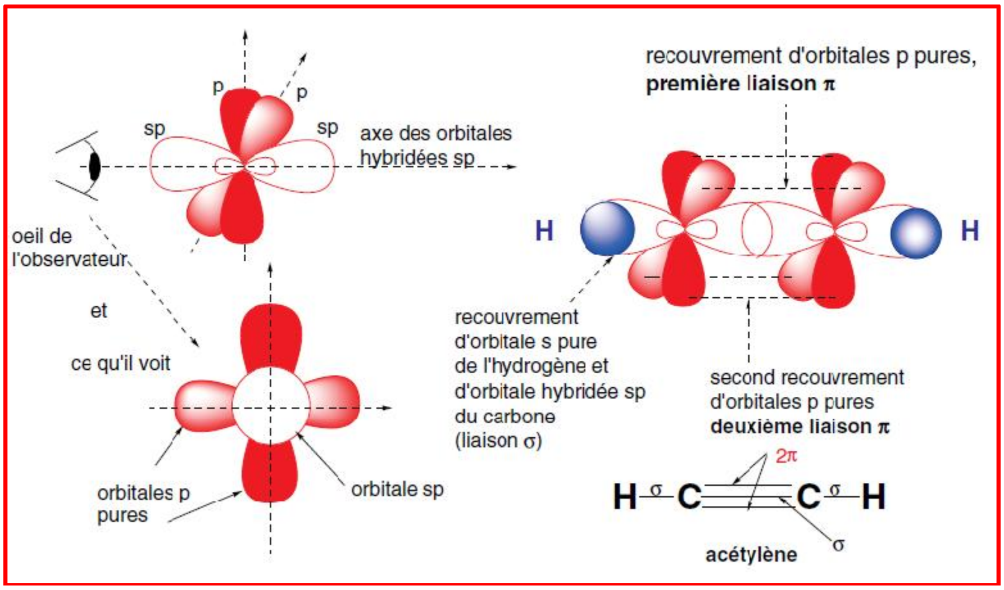


I.1.6. “sp” hybridization

When carbon is in the “sp” hybridization state, two pure p orbitals are accompanied by two equivalent “sp” hybridized orbitals which are formed from the “s” orbital and the third “p” orbital of the layer 2 of carbon.

– The axes of the two “sp” orbitals are collinear.

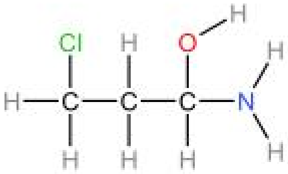
– The axes of the two pure “p” orbitals are perpendicular to each other and to the common axis of the hybridized “sp” orbitals.



I.2. valence of elements:

The sequence of atoms is done on the basis of the valency of each element, of which, the valence of a chemical element is the maximum number of chemical bonds that it can form.
Indeed:
C: tetravalent
N and P: trivalent
O and S: divalent
H, Cl….: monovalent

Exemple :



I.3. Formulas of organic compounds and carbon chain:

I.3.1. Formulas of organic compounds

In organic chemistry; There are 4 ways of writing formulas:

- ✓ Brute formula;
- ✓ Plane structural formula;
- ✓ Semi-developed formula;
- ✓ Simplified formula.

I.3.1.1. Brute formula

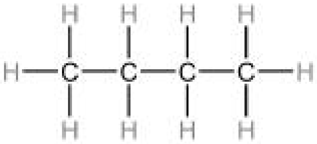
Every organic compound has a crude formula. She tells us only on the number, the nature of atoms that the molecule contains and the degree of unsaturation, is written as follows: $C_xH_yO_zN_tX_w$ (such as X: F, Cl, Br, I). The crude formula is insufficient to define the compound. It does not specify in what sequence the atoms are linked. So the same crude formula corresponds to several so-called isomeric compounds.

Exemple : The brute formula : $C_2H_4O_2$

I.3.1.2. Plane structural formula

In the plane structural formula, all bonds and atoms appear. It gives a more precise idea of the order of arrangement of these atoms in a molecule, but not their real orientation in space.

Exemple:

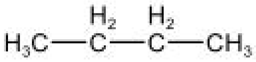


I.3.1.3. Semi-developed formula

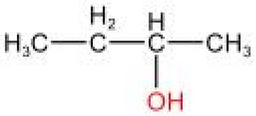
The representation developed therefore quickly becomes heavy and difficult to read as the number of carbon atoms increases.

A first simplification consists of the use of semi-developed formulas, by eliminating connections C-H, O-H and N-H.

Exemple:



$H_3C-\overset{H_2}{C}-\overset{H_2}{C}-CH_3$



$H_3C-\overset{H_2}{C}-\underset{OH}{\overset{H}{C}}-CH_3$

$H_3C-\overset{H_2}{C}-\overset{H_2}{C}-\overset{H_2}{C}-NH_2$

I.3.1.4. Simplified (topological) formula

* When the size of the molecule increases the semi-structural formula becomes bulky and difficult to read. *

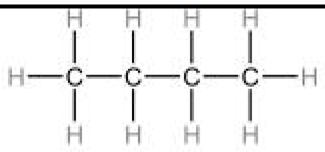
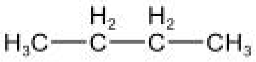
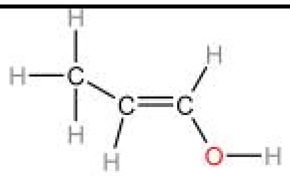
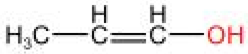
* We therefore agree to represent the skeleton carbon in a simplified and readable manner called simplified formula or topological representation.

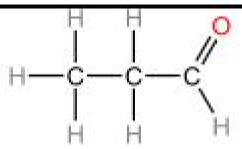
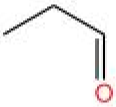
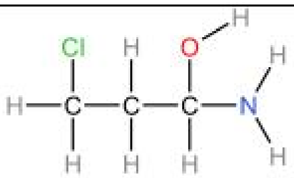
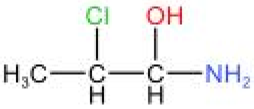
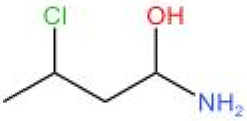
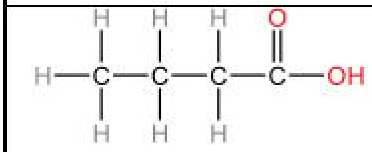
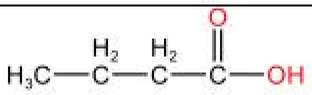
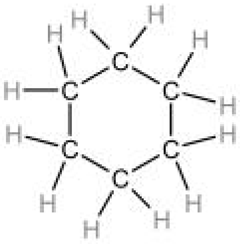
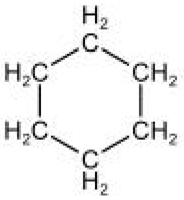
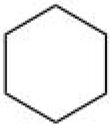
* In this formula, we only look at the carbon skeleton without representing the carbons nor the hydrogens that they can carry.

* On the other hand, we represent the heteroatoms (N, O, S), the hydrogens linked to heteroatoms and halogens (F, Cl, Br, I). Each end and intersection of the skeleton correspond to a carbon.

* In these representations we respect the valence angles.

=> If only one carbon atom is bonded to the heteroatom, it will be represented.

Formule développée plane	Formule semi développée	Formule topologique
	 $H_3C-\overset{H_2}{C}-\overset{H_2}{C}-CH_3$	
	 $H_3C-\overset{H}{C}=\overset{H}{C}-OH$	

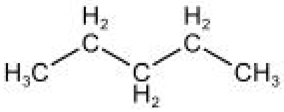
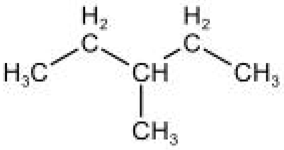
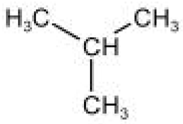
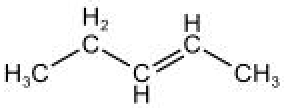
		
		
		
		

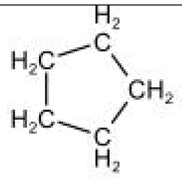
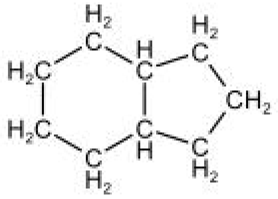
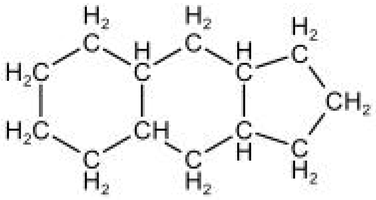
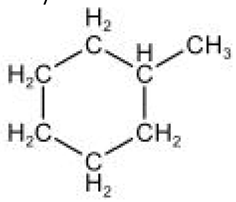
I.4. Carbon chain:

Carbon chain (or carbon skeleton) of an organic molecule is a sequence more or less long of carbon atoms.

I.4.1. Type of carbon chains:

Depending on how the carbon atoms bond together in organic molecules, the different types of carbon chains are:

Linear chain	Chain in which each carbon atom is bonded with two other carbon atoms	
Branched chain	Chain in which minus one of the atoms of carbon is bonded to at least three other carbon atoms	
Saturated chain	Chain in which all connections between carbon atoms are simple connections	
Unsaturated chain	Chain in which minus one of the connections between the atoms of carbon is a bond multiple (double or triple)	
Cyclical chain	Chain of which a portion is “closes” on itself	Monocyle

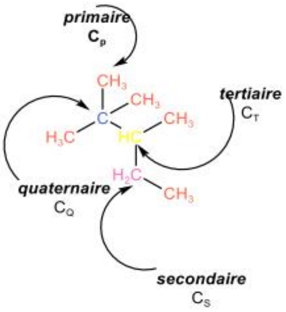
		 Polycycles  bicycle  tricycle branched cycle 

I.4.2. Carbon class:

Depending on whether a carbon atom is linked or to other carbon atoms, we distinguish:

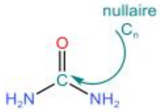
- Primary carbon: it is a carbon atom bonded to a single other atom of carbon.
- Secondary carbon: it is a carbon atom linked to two other atoms of carbon.
- Tertiary carbon: it is a carbon atom bonded to three other carbon atoms.
- Quaternary carbon: it is a carbon atom bonded to four other atoms of carbon.
- Zero carbon: it is a carbon atom not bonded to any other carbon atom.

Exemple :



On peut noter :

- ✓ les **CH_3** sont des **C_P**
- ✓ les **CH2** sont des **C_S**
- ✓ les **CH** sont des **C_T**
- ✓ les **C** sont des **C_Q**



I.4.3. Number of unsaturations (Degree of unsaturation):

The degree of unsaturation of a molecule is the number of rings and bonds multiple that it includes.
Let:
nC be the number of carbon atoms;
nH the number of hydrogen atoms;
nN the number of nitrogen atoms (or another trivalent element like P);
nO the number of oxygen atoms (or another divalent element like S) nX;
the number of carbon atoms (or X: is a halogen)

The number of unsaturation n_I is:

$$n_I = (2n_C - n_H - n_X + n_N + 2)/ 2$$

We notice that:

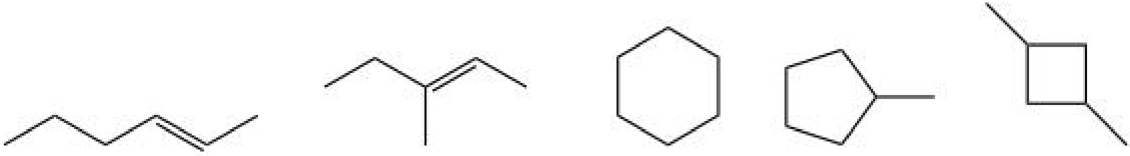
- ✓ The number of oxygen atoms O, or even sulfur atoms S, is not involved in this calculation.
- ✓ A halogen atom F, Cl, Br, I counts as a hydrogen atom.
- ✓ A nitrogen atom, or even phosphorus P.

Exemple:

The number of unsaturation in C_6H_{12} : $n_I = (2*6 - 12 + 2) = 1$
Unsaturation can correspond to:

- ⇨ A double bond
- ⇨ A cycle

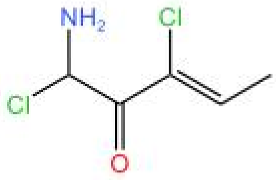
We can give the following structures

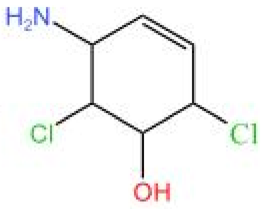


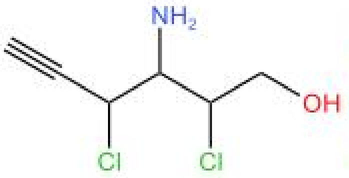
Exemple:

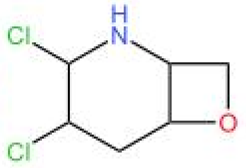
The number of unsaturations in $C_6H_9Cl_2NO$: $n_I = (2 \times 6 - 9 - 2 + 1 + 2)/ 2 = 2$

Two unsaturations can correspond to:
=> - A triple bond
=> - Two double bonds
=> - Two cycles
=> - A double bond and a ring.
We can give the following structures:









I.5. Functions and nomenclature of organic compounds

I.5.1. Introduction

In the early days of organic chemistry, when the number of organic compounds was still restricted, they received particular names, often recalling their origin (eg: "menthol" taken from mint essence...). Then the number of organic compounds increasing very rapidly, it was necessary to establish a language common among all chemists.

In general, there are three recognized nomenclatures in chemistry; to know:

- Common nomenclature (Usual, Codex): commonly used, e.g.: the name of $CHCl$ is Chloroform, and that of $CH\equiv CH$ is acetylene.
- Registered nomenclature (trivial): used in industry (Neomecyne, Paracetamol, etc.).
- Systematic nomenclature: scientifically it is the official nomenclature of chemical compounds. It is known by the name "IUPAC nomenclature ". The rules of this nomenclature are established by an international body, IUPAC: International Union of Pure and Applied Chemistry.

I.5.2. General Principle

The name assigned to a molecule is constructed by the assembly, in an order and according to strictly determined rules of writing, elements translating each of its particularities. We first establish the name of the main carbon chain, which constitutes the basis of the compound name. Then, we add prefixes and/or suffixes, as well as numerical indices, indicating the number and position of atoms or groups of atoms on the main chain.

The name of a compound is in the form: ***Prefix*** + ***Main chain*** + ***Suffix***

Prefix: corresponds to the substituents;

Suffix: corresponds to the family of the compound deduced from its main function;

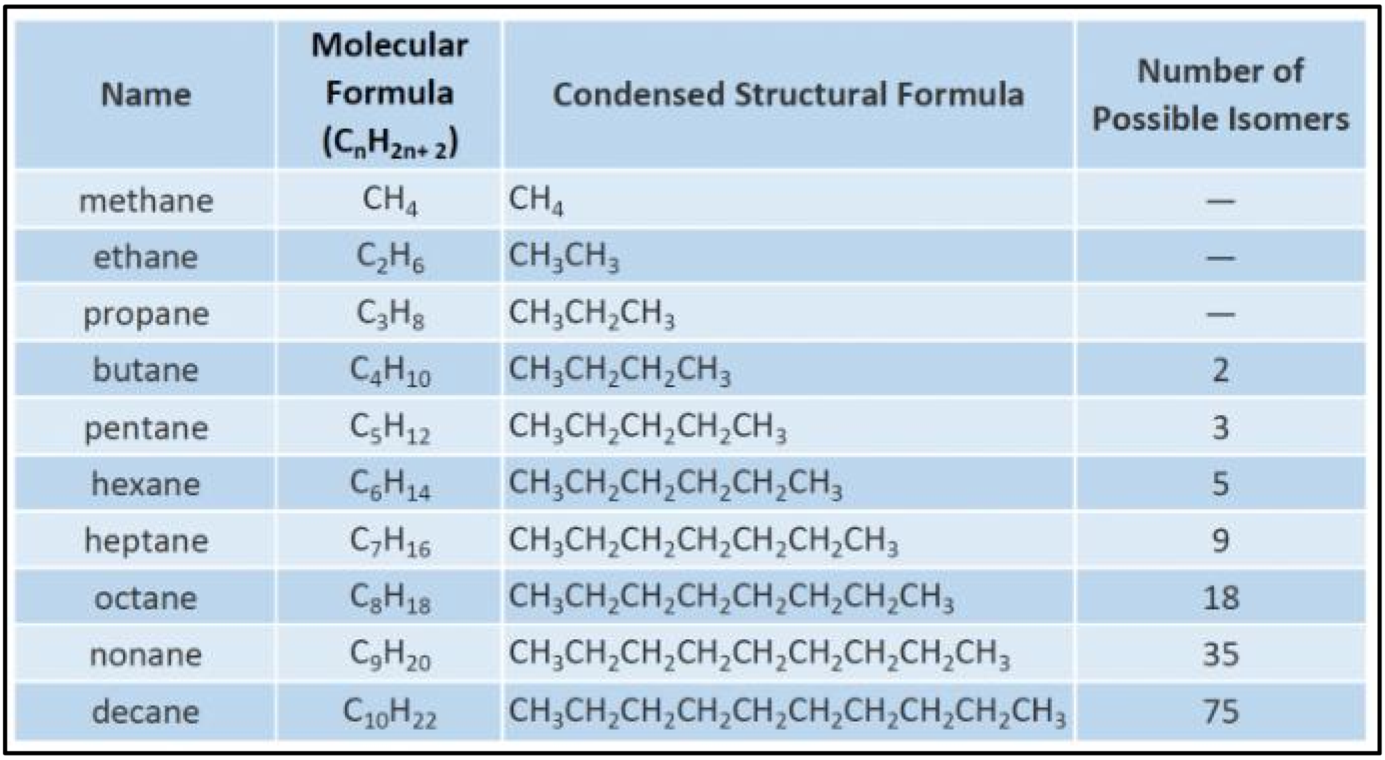
1 C	2 C	3 C	4 C	5 C	6 C	7 C	8 C	9 C	10 C
Meth	Eth	Prop	But	Pent	Hex	Hept	Oct	Non	Dec

I.5.3. Nomenclature of saturated hydrocarbons

I.5.3.1. Alkane nomenclature

Alkanes are saturated hydrocarbons of the form C_nH_{2n+2}. The name of an alkane includes the number of carbon atoms present in the chain followed by the ending –ane.

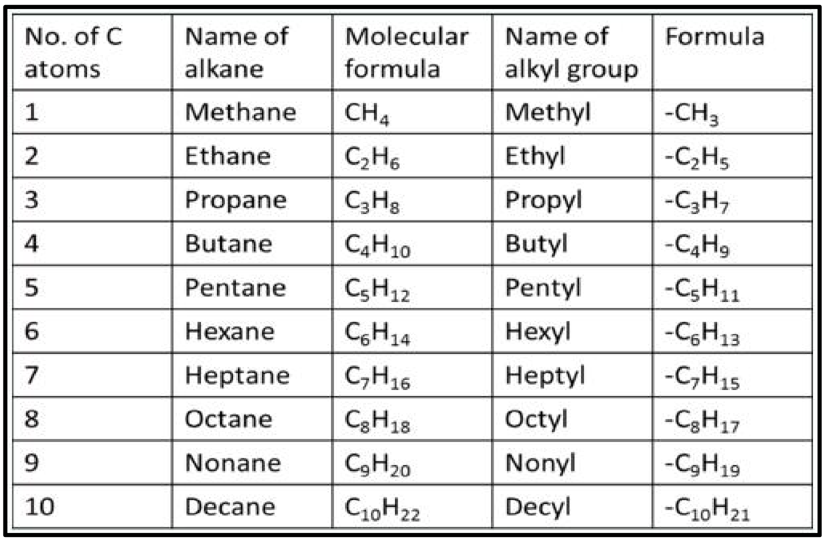
The names of the first 10 linear alkanes are given in Table 1.



Name	Molecular Formula (C_nH_{2n+2})	Condensed Structural Formula	Number of Possible Isomers
methane	CH_4	CH_4	—
ethane	C_2H_6	CH_3CH_3	—
propane	C_3H_8	$CH_3CH_2CH_3$	—
butane	C_4H_{10}	$CH_3CH_2CH_2CH_3$	2
pentane	C_5H_{12}	$CH_3CH_2CH_2CH_2CH_3$	3
hexane	C_6H_{14}	$CH_3CH_2CH_2CH_2CH_2CH_3$	5
heptane	C_7H_{16}	$CH_3CH_2CH_2CH_2CH_2CH_2CH_3$	9
octane	C_8H_{18}	$CH_3CH_2CH_2CH_2CH_2CH_2CH_2CH_3$	18
nonane	C_9H_{20}	$CH_3CH_2CH_2CH_2CH_2CH_2CH_2CH_2CH_3$	35
decane	$C_{10}H_{22}$	$CH_3CH_2CH_2CH_2CH_2CH_2CH_2CH_2CH_2CH_3$	75

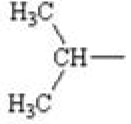
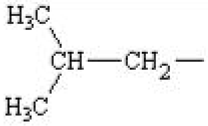
I.5.3.2. Nomenclature of alkyl groups

Alkyl groups result from the removal of a hydrogen from an alkane. They are named by replacing the ending -ane with -yle. Table 2 presents some branched alkyl groups with common names.



No. of C atoms	Name of alkane	Molecular formula	Name of alkyl group	Formula
1	Methane	CH_4	Methyl	$-CH_3$
2	Ethane	C_2H_6	Ethyl	$-C_2H_5$
3	Propane	C_3H_8	Propyl	$-C_3H_7$
4	Butane	C_4H_{10}	Butyl	$-C_4H_9$
5	Pentane	C_5H_{12}	Pentyl	$-C_5H_{11}$
6	Hexane	C_6H_{14}	Hexyl	$-C_6H_{13}$
7	Heptane	C_7H_{16}	Heptyl	$-C_7H_{15}$
8	Octane	C_8H_{18}	Octyl	$-C_8H_{17}$
9	Nonane	C_9H_{20}	Nonyl	$-C_9H_{19}$
10	Decane	$C_{10}H_{22}$	Decyl	$-C_{10}H_{21}$

e.g.

	Isopropyle	1-méthyléthyle	Propane
	Isobutyle	2-méthylpropyle	2-méthylpropane (isobutane)

- ➢ A primary carbon is a carbon bonded only to 1 other carbon atom; hydrogen atoms attached to such carbon are called hydrogens primary and an alkyl group originating from the removal of a primary hydrogen is also said to be primary.
- ➢ A secondary carbon is attached to 2 other carbon atoms and a carbon tertiary is 3. Their hydrogens and alkyl groups are described as the same respectively.
- ➢ A carbon carrying 4 alkyl groups is called quaternary carbon.
- ➢ The carbon of methane (CH_4) is said to be unary, as is the hydrogen fixed to it in methane derivatives.

I.5.3.3. Nomenclature of branched alkanes

For the first three alkanes, there is only one possible structure. From n=4, the structures corresponding to alkanes can be linear or branched (containing branches or ramifications).

IUPAC Rule No. 1.

- Identify and name the longest chain that can be found within the molecule.
- If a molecule has two or more chains of equal length, we chooses the chain with the greatest number of substituents.

IUPAC Rule No. 2.

- Name all carbon groups grafted onto the longest chain as alkyl substituents.
- If the chain of the substituent is itself branched, the same rule applies: we first search for the longest string then we name all the annexes, and the carbon linked to the main chain is numbered 1.

IUPAC Rule No. 3.

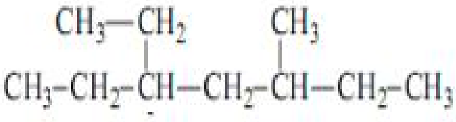
- Number the carbons of the longest chain starting at the end closest to a substituent.
- If two substituents are equidistant from both ends of the main chain, the alphabet is used to decide the direction of numbering of the main chain. The substituent to be stated first is considered to be attached to the carbon with the lowest number.
- If there are more than 2 substituents, the main chain is numbered in the direction which provides the smallest digit at the level of the first difference between the two possible numbering modes (principle of difference at the first level).

IUPAC Rule No. 4.

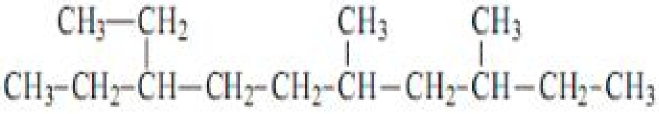
- Write the name of the alkane by first arranging all the substituents in alphabetical order (each preceded, using a hyphen, by the number of the carbon atom to which it is attached), then by appending the name of the main channel.
- When a molecule contains the same substituent in several copies, the name is preceded by a prefix such as di, tri, tetra, penta, etc. The position indices of these identical substituents are indicated as a

sequence of numbers preceding the name of the substituting and these numbers are separated by commas (the prefixes di, tri, tetra, etc., are not taken into account in the alphabetical arrangement).

Example: Give the systematic name of the following branched alkanes:



$CH_3-CH_2-\overset{\overset{\displaystyle CH_3-CH_2}{|}}{CH}-CH_2-\overset{\overset{\displaystyle CH_3}{|}}{CH}-CH_2-CH_3$



$CH_3-CH_2-\overset{\overset{\displaystyle CH_3-CH_2}{|}}{CH}-CH_2-CH_2-\overset{\overset{\displaystyle CH_3}{|}}{CH}-CH_2-\overset{\overset{\displaystyle CH_3}{|}}{CH}-CH_2-CH_3$

I.5.3.4. Nomenclature of halogenoalkanes

The halogen denoted X (F, Cl, Br and I) is considered to be a substituent attached to the alkane skeleton. These compounds are named in harmony with the rules that apply to the nomenclature of alkanes. Halogenated alkanes whose symbol is RX are called haloalkane. (R: alkyl chain)

Example: $Br-CH_2-CH_3$ … Bromoethane

Bromo: prefix which designates bromine (Brome)

I.5.3.5. Nomenclature of organometallic compounds

Organometallic compounds contain one or more carbon-metal bonds.

- If they have the R-MX form (M: metal; X: halogen), they are “alkyl metal halides”.

Exemple: CH_3-CH_2-MgI … Ethylmagnesium iodide (Iodure - diéthylmagnésium).

- If they are of the form R-M-R they are alkyl metals, named according to the model below.

Exemple: $CH_3-Cd-CH_3$ … Dimethyle cademium.

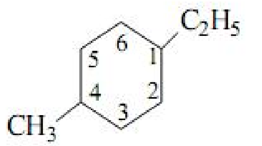
I.5.3.6. Cycloalkanes (cyclic hydrocarbons)

We construct a cycloalkane with the general formula C_nH_{2n} by removing two atoms of hydrogen terminals of a linear alkane and by making a bond between the extreme carbons.

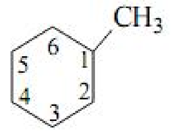
The naming system for members of this class of compound is quite simple: the name of the alkane is preceded by the prefix -cyclo.

- ⇨ The nomenclature of a substituted cyclic alkane involves numbering the individual carbons of the ring only.
- ⇨ In monosubstituted rings, the carbon to which the substituent is attached is considered carbon #1.
- ⇨ For compounds polysubstituted, care must be taken to obtain the lowest possible numbering sequence.
- ⇨ When two possibilities present themselves, the alphabetical order of the substituents is decisive.

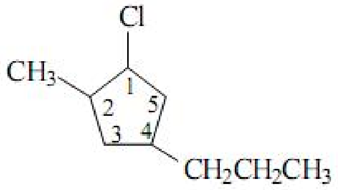
Exemple :



1-éthyl-4-méthylcyclohéxane



1-méthylcyclohéxane



1-chloro-2-méthyl-4-propylcyclopentane

Noticed:

Disubstituted cycloalkanes where the two substituents are carried by two different carbons present two possibilities:

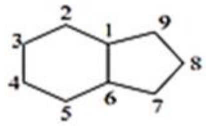
*The two substituents are on the same side of the ring. Prefix: Cis

* The two substituents are on either side of the ring. Prefix: Trans

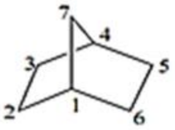
I.5.3.7. Nomenclature of bridged bicyclic systems

- ⇨ Bridged bicyclic carbon compounds take the name of the linear alkane of same number of carbons preceded by the prefix bicyclo.
- ⇨ After this prefix, we put between brackets the number of carbon atoms of each of the three bridges, we number the atoms of the compound by giving the number 1 to a bridgehead and we continue the numbering starting with the longest chain leading to the other head of bridge.
- ⇨ We continue by numbering the middle chain returning to the first head of bridge then we finish with the shortest.

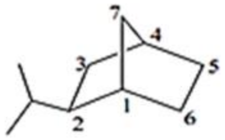
Exemple:



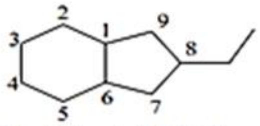
Bicyclo[4,3,0]nonane



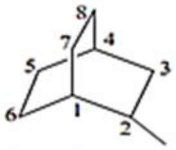
Bicyclo[2,2,1]heptane



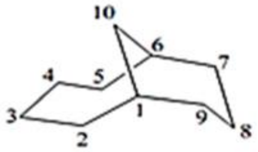
2-isopropylbicyclo[2,2,1]heptane



8-éthylbicyclo[4,3,0]nonane



2-méthylbicyclo[2,2,2]octane

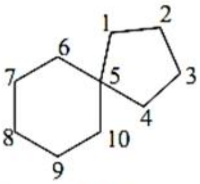


Bicyclo[4,3,1]décane

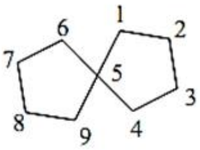
I.5.3.8. Nomenclature of spyranic compounds

Bicyclic derivatives linked by a carbon are called spiranic compounds, their name consists of a prefix spiro followed by a bracket containing two numbers indicating the size of the two cycles. The atoms of a saturated hydrocarbon monospiranic are numbered consecutively starting from a cyclic atom immediately adjacent to the spiranic carbon atom, by first numbering the smallest cycle, then the spiranic atom, and finally the second cycle.

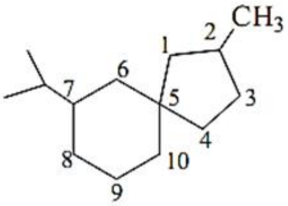
Exemples :



Spiro[4,5]décane



Spiro[4,4]nonane



7-isopropyl-2-méthylspiro[4,5]déca

I.5.4. Unsaturated hydrocarbons

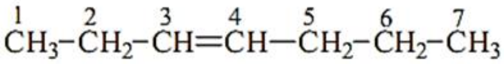
I.5.4.1. Acyclic (non-cyclic) hydrocarbons

An unsaturated hydrocarbon is a hydrocarbon that contains multiple bonds (double or triple). We distinguish two main families:

=> Alkene with general formula C_nH_{2n} containing a C=C double bond. They are named as follows: Prefix (indicating the number of carbons) + ending "ene".

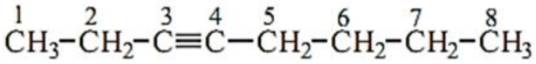
=> Alkyne with general formula C_nH_{2n-2} containing a C=C triple bond. They are named as follows: Prefix (indicating the number of carbons) + ending "yne".

Exemples :



$\overset{1}{C}H_3-\overset{2}{C}H_2-\overset{3}{C}H=\overset{4}{C}H-\overset{5}{C}H_2-\overset{6}{C}H_2-\overset{7}{C}H_3$

hept-3-ène



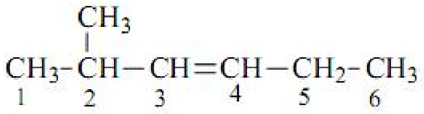
$\overset{1}{C}H_3-\overset{2}{C}H_2-\overset{3}{C}\equiv\overset{4}{C}-\overset{5}{C}H_2-\overset{6}{C}H_2-\overset{7}{C}H_2-\overset{8}{C}H_3$

oct-3-yne

The rules for nomenclature of linear and branched alkenes and alkynes are:

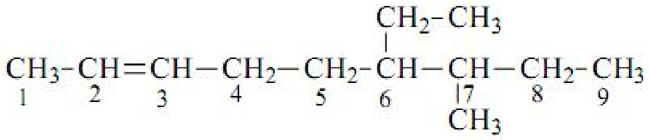
- The main chain is the longest that contains the multiple links;
- Dialing starts from the nearest end of the multilink;
- If the hydrocarbon chain is symmetrical, the said main chain must be numbered in the direction, which gives the first substituent, encountered the smallest possible index.

Exemple:



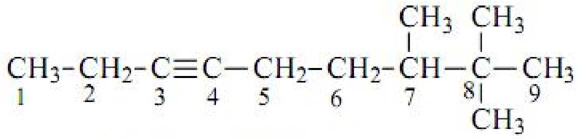
$\underset{1}{CH_3}-\underset{2}{\overset{CH_3}{\overset{|}{CH}}}-\underset{3}{CH}=\underset{4}{CH}-\underset{5}{CH_2}-\underset{6}{CH_3}$

2-méthylhéx-3-ène



$\underset{1}{CH_3}-\underset{2}{CH}=\underset{3}{CH}-\underset{4}{CH_2}-\underset{5}{CH_2}-\underset{6}{\overset{CH_2-CH_3}{\overset{|}{CH}}}-\underset{\underset{CH_3}{|7}}{CH}-\underset{8}{CH_2}-\underset{9}{CH_3}$

6-éthyl-7-méthylnon-2-ène



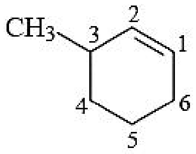
$\underset{1}{CH_3}-\underset{2}{CH_2}-\underset{3}{C}\equiv\underset{4}{C}-\underset{5}{CH_2}-\underset{6}{CH_2}-\underset{7}{\overset{CH_3}{\overset{|}{CH}}}-\underset{\underset{CH_3}{8|}}{\overset{CH_3}{\overset{|}{C}}}-\underset{9}{CH_3}$

7,8,8-triméthylnon-3-yne

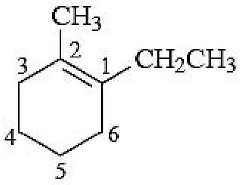
I.5.4.2. Unsaturated cyclic hydrocarbons

In cycloalkanes, carbons 1 and 2 are the ones that attach the double bond. In the case of the existence of the substituents, the numbering is done so as to give the indices 1 and 2 to the carbons of the double bond, and to the substituents the indices more possible and in the case of the choice take into account the alphabetical order of the substituents.

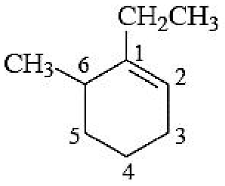
Exemple:



3-méthylcyclohexène



1-éthyl-2-méthylcyclohexène



1-éthyl-6-méthylcyclohexène

I.5.4.3. Unsaturated hydrocarbons with many multiple bonds:

In this case, the main chain is the one that contains the greatest number of multiple links overall (doubles and triples). If several possibilities present, the following criteria are used in the order given.

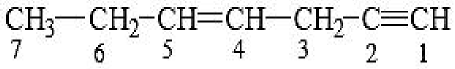
=> The greatest number of carbon atoms;

=> Highest number of double bonds;

=> Largest number of substituents cited as prefixes.

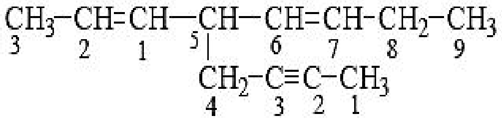
The numbering is done in such a way as to give the lowest possible indices to the multiple connections overall. If a choice remains, the double bond is priority than the triple.

Exemple:



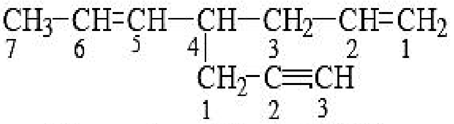
$CH_3-CH_2-CH=CH-CH_2-C\equiv CH$

hept-4-én-1-yne



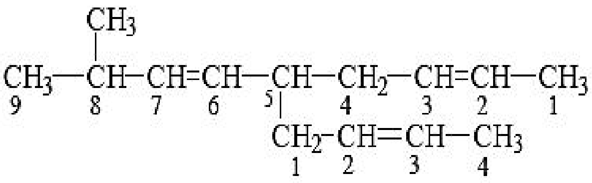
$CH_3-CH=CH-CH(CH_2-C\equiv C-CH_3)-CH=CH-CH_2-CH_3$

5-[prop-1-ényl]non-6-én-2-yne



$CH_3-CH=CH-CH(CH_2-C\equiv CH)-CH_2-CH=CH_2$

4-[prop-2-ynyl]hepta-1,5-diène



$CH_3-CH(CH_3)-CH=CH-CH(CH_2-CH=CH-CH_3)-CH_2-CH=CH-CH_3$

5-[but-2-ényl]-8-méthylnona-2,6-diène

I.5.5. Monofunctional organic compounds

A monofunctional organic compound is a saturated or unsaturated hydrocarbon containing a heteroatomic organic function.

Table 3 gives the name and formula of some common organic functions. The general rules for nomenclature of these compounds are:

=> The main string is the longest that contains the function;

=> The index assigned to the carbon, which carries the function, is as low as possible;

=> The nature of the function is indicated by a suffix after the name of the unit fundamental structural.

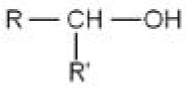
I.5.5.1. Oxygen compounds

I.5.5.1.1. Alcohols

An alcohol is an organic compound that has a hydroxyl group (-OH) attached to one of these carbon atoms (R-OH). The name of the alcohol derives from that of the corresponding alkane by replacing the ending "-ane" with "-ol". There are three types alcohol:

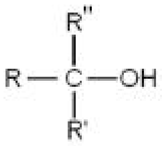
$R-CH_2-OH$

Alcool primaire



$R-CH(R')-OH$

Alcool secondaire



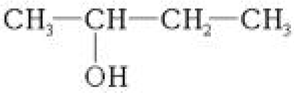
$R-C(R')(R'')-OH$

Alcool tertiaire

Exemple :

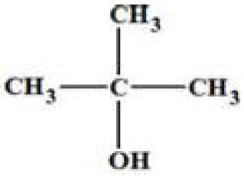
CH_3-CH_2-OH

Ethan-1-ol



$CH_3-CH(OH)-CH_2-CH_3$

butan-2-ol



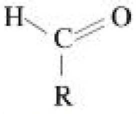
$(CH_3)_3C-OH$

2-méthylpropan-2-ol

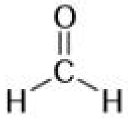
I.5.5.1.2. Aldehydes

Aldehyde is an organic compound that has a carbonyl group (C=O), carried by a primary carbon of the carbon chain. The name of the aldehyde derives from that of the corresponding alkane by replacing the suffix "-ane" with "-al".

Exemple:



structure de l'aldehyde

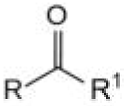


méthanal (ou formaldehyde)

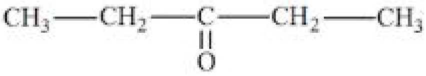
I.5.5.1.3. Ketones

A ketone has a carbonyl group (C=O) linked to a secondary carbon atom. The name of a ketone derives from that of the corresponding alkane in replacing the suffix "-ane" with "-one".

Exemple:



structure des cétone



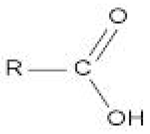
$CH_3-CH_2-C(=O)-CH_2-CH_3$

butan-3-one

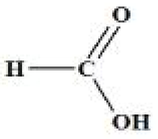
I.5.5.1.4. Carboxylic acids

A carboxylic acid contains a carboxyl group (COOH) located at the end of the carbon chain. The name of the carboxylic acid derives from that of the alkane corresponding by replacing the suffix "-ane" with "-oeic". It is always preceded by the term acid.

<u>*Exemple:*</u>



Acides carboxylique

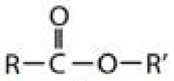


Acide méthanoïque

I.5.5.1.5. Esters

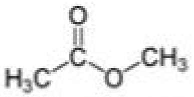
A carboxylic ester is designated by R-COO-R'. The name is that of the group alkanoate (derived from the name of the alkyl R-C=O) + from + the name of the group R'.

<u>*Exemple:*</u>



$R-\overset{O}{\overset{\|}{C}}-O-R'$

Structure d'un ester

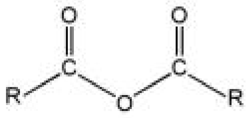


éthanoate de méthyle

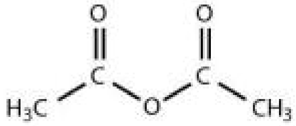
I.5.5.1.6. Acid anhydrides

An acid anhydride is composed of the two groups (R-C=O) and (O=C-R') linked by an oxygen atom. The name derives from the corresponding acid by replacing the term "acid" by "anhydride".

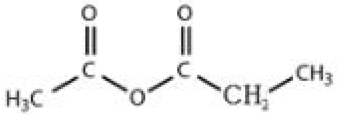
<u>*Exemple:*</u>



Anhydride d'acide



anhydride éthanoïque



anhydride éthanoique propanoïque

I.5.5.1.7. Ether-oxides (or Ethers)

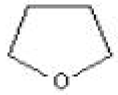
An ether-oxide corresponds to the formula R–O–R (symmetrical ethers), or R–O–R' (mixed ethers). In the case of acyclic ethers: we use as a suffix the name of the shortest alkyl and the other chain prefixed with alkoxyalkane type.

- ⇨ For cyclic ethers, we use the name that a cyclic alkane would have if the oxygen of the ether was replaced by a carbon, and the prefix "oxa" was added.
- ⇨ For a cyclic ether with 3 carbon atoms and 1 oxygen atom: oxacyclobutane. For a cyclic ether with 5 carbon atoms and 1 atom of oxygen: oxacyclohexane.

<u>*Exemple:*</u>

CH_3-CH_2-O-CH_2-CH_3

Ethoxyéthane (ou éther)



oxacyclopentane