College of Environmental Sciences

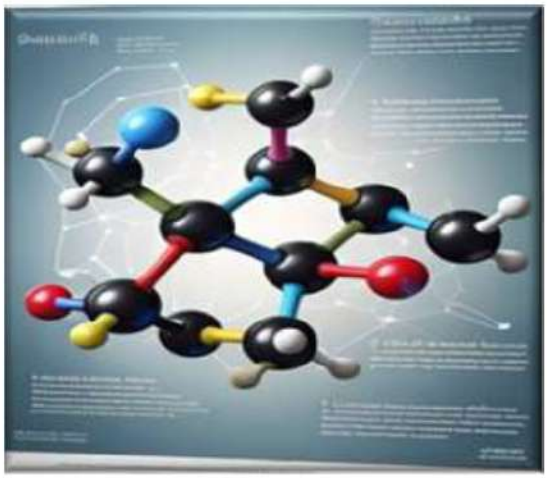
Department of Environmental Health

1st Class

First Lecture

Organic Chemistry

By: Dr. Liqa'a Saeed



Compound & Metals

Organic compounds contain mainly carbon, hydrogen, and oxygen, in addition to some other elements such as nitrogen, halogen, sulfur, and phosphorus. There is a group of special organic compounds called organometallic compounds, and these contain a metallic element in their composition.

Hydrocarbons

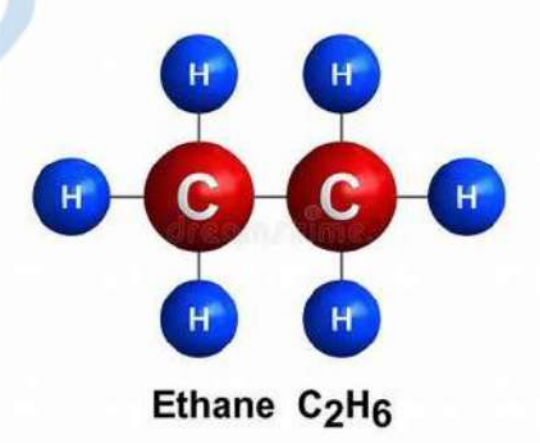
Introduction

Hydrocarbons are chemical compounds that contain only carbon (C) and hydrogen (H), bonded together in different forms, as we will see later. It is possible to initially divide hydrocarbons into two main categories:

aliphatic hydrocarbons and aromatic hydrocarbons.

***Aliphatic* hydrocarbons** It includes straight-chain, branched, and cyclic compounds. Aliphatic hydrocarbons can be divided into two groups, according to the type of carbon-carbon bonds they contain. These two groups are:

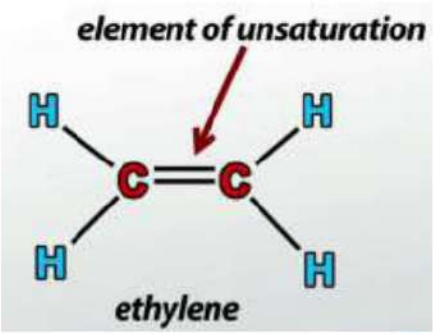
1. ***Saturated alpha hydrocarbons:*** are organic compounds that contain only single bonds between carbon-carbon atoms and are called ***alkanes***, such as Ethane CH_3-CH_3.



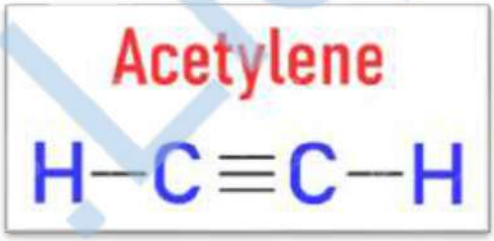
Ethane C_2H_6

2. *UnSaturated alpha hydrocarbons:* which are compounds that contain multiple bonds (more than one) between carbon atoms, including:

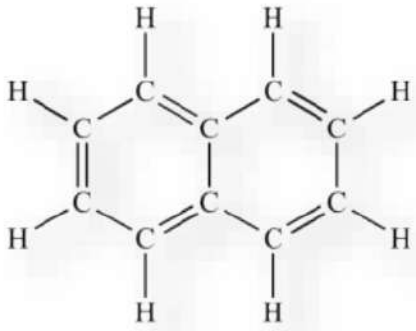
Alkenes are compounds that contain carbon-carbon double bonds (C=C), such as ethylene, as shown in the following figure:



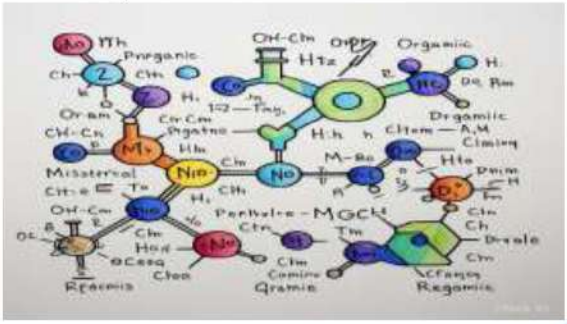
Alkynes are compounds that contain at least one carbon-carbon triple bond (C≡C), and compounds that contain more than one multiple bond, Whether the compound is open-chain or cyclic, an example of this group is acetylene.

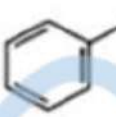


Aromatic hydrocarbons include benzene and its derivatives, polycyclic hydrocarbons benzene (C_6H_6) and naphthalene $C_{10}H_8$, as shown in the following figure.

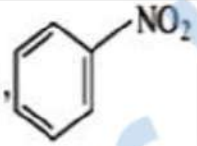


Functional Group: The term active group refers to an atom or group of atoms present in the structure of a compound molecule



أمثلة	اسم المجموعة الفعالة	الصيغة البنائية للمجموعة الفعالة
$H_2C=CH_2$	الألكينات	$C=C$
	المركبات الأروماتية (المركبات العطرية)	
$H-C\equiv C-H$	الألكاينات	$-C\equiv C-$
CH_3I , 	الهاليدات العضوية	$-\overset{X}{\underset{\vert}{C}}-$ (X = I, Br, Cl , F)
CH_3CH_2OH	الكحولات	$-\overset{\vert}{C}-OH$
CH_3-O-CH_3	الإيثرات	$-\overset{\vert}{C}-O-\overset{\vert}{C}-$
$CH_3-\overset{O}{\overset{\Vert}{C}}-H$	الألدهيدات	$-\overset{O}{\overset{\Vert}{C}}-H$
$CH_3-\overset{O}{\overset{\Vert}{C}}-CH_3$	الكيتونات	$-\overset{\vert}{C}-\overset{O}{\overset{\Vert}{C}}-\overset{\vert}{C}-$

$H-\overset{\overset{O}{\|}}{C}-OH$	الأحماض الكربوكسيلية	$-\overset{\overset{O}{\|}}{C}-OH$
$CH_3-\overset{\overset{O}{\|}}{C}-OCH_3$	مشتقات الأحماض الكربوكسيلية	$-\overset{\overset{O}{\|}}{C}-Y$ $(Y = Cl, OR, NR_2, \ldots)$
$CH_3NH_2, \overset{\overset{CH_3}{\|}}{CH_3}NH$	الأمينات	$-\overset{\|}{C}-\overset{\|}{N}-$
CH_3CN	النيتريلات	$-\overset{\|}{C}-C\equiv N$

CH_3NO_2, 	مركبات نيترو	$-\overset{\|}{\underset{\|}{C}}-\overset{\overset{O}{\|}}{N}-O-$
CH_3SH	الثيولات	$-\overset{\|}{C}-SH$

Alkanes (paraffins)

Saturated hydrocarbon compounds consisting of carbon and hydrogen. They are poisonous with paraffins because they are inactive against strong acids such as HCI, HNO_3 and strong bases such as NaOH, KOH. These compounds are found in nature, especially in crude oil. The carbon atoms in them are of the SP^3 type and all their compounds contain single covalent bonds and their general formula is R-H. (the alkyl radical is attached to a hydrogen atom) and follows the general law C_nH_{2n+2}.

Physical Properties

Alkanes containing 1-4 carbon atoms are gases under normal conditions and are composed of 5-17 liquids, while those consisting of more than 18 carbon atoms exist in the form of solids, meaning that an increase in the carbon percentage is accompanied by an appropriate change in boiling and melting points, density and viscosity.

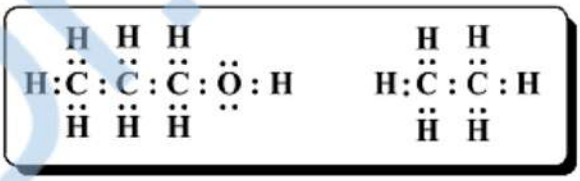
Alkanes are considered non-polar molecules because they do not contain polarized covalent bonds because they contain only carbon and hydrogen atoms. Alkanes molecules are connected to each other by weak Vander Waals forces.

Methods of writing organic compounds

There is more than one way to express organic compounds, including the following:

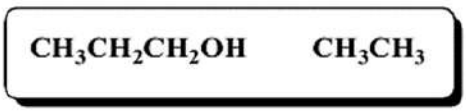
Dot structure formula

This method includes placing all valence electrons around all atoms. Bonding is also expressed in this way by placing two electrons connecting the two atoms. The use of this method is rare because it is a troublesome and slow method and requires its use long time.



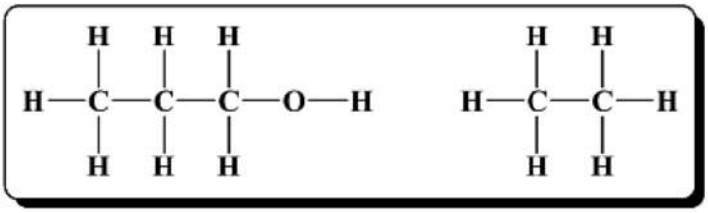
Condensed Formula

This method is considered the most widely used method for expressing the formulas of organic compounds. It is characterized by its simplicity and speed of writing organic structures, where the carbon atom is written, then the hydrogen atoms, followed by their number, without bonds or dots indicating bonds or valence electrons.



Kekule Formula

This method involves writing the atoms that make up the compound and writing the bonds that connect these atoms in the form of lines.



linear Formula

This method is considered the simplest and fastest method used in writing structural formulas, as it only shows the carbon structure of the molecule and deletes the hydrogen atoms and the bonds that connect them to the carbon atoms, but they are considered present. As for atoms other than carbon and hydrogen, such as (P, S, CI, O, N), they are written. In some mechanical reactions, we need to put some atoms Hydrogen or free electronic pairs of atoms to clarify how the reactions proceed. In this case, there is no objection to placing them after ensuring their precise location.