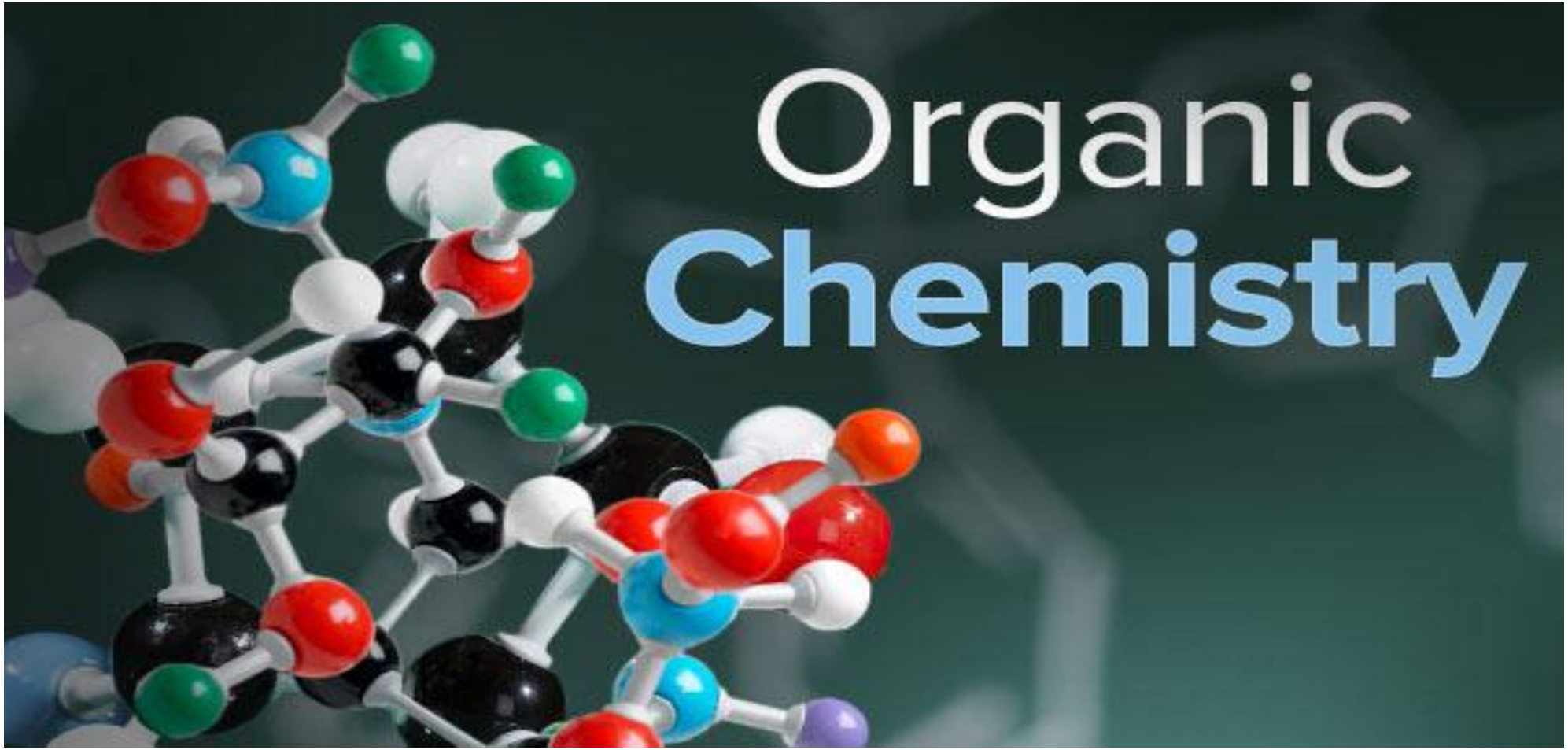
الكلية	العلوم
القسم	الكيمياء
المادة باللغة الانجليزية	Organic Chemistry
المادة باللغة العربية	الكيمياء العضوية
المرحلة الدراسية	الاولى
اسم التدريسي	محمد عدنان عبد منديل
عنوان المحاضرة باللغة الانجليزية	The principal of Organic Chemistry
عنوان المحاضرة باللغة العربية	مبادي الكيمياء العضوية
رقم المحاضرة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



Organic Chemistry 1st level

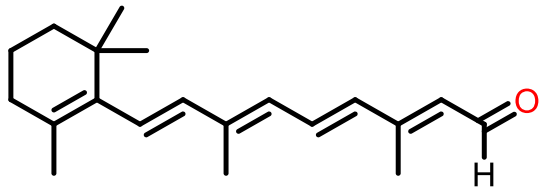
Organic Chemistry 1st level

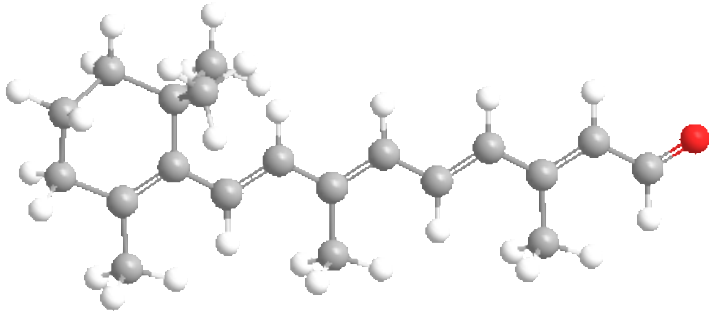
Overview

- A level 1 course, 8-12 lectures part of basic and core organic 1st year chemistry
- Aims: to learn the basic concept of organic chemistry associated with the most common reactions of use to organic chemists, and to understand (roles) which allowing the design of new chemistry reaction. This will prepare you for the next levels of studying.
- Scope: both traditional (from 1800s onwards) and contemporary (up to 2021 developments)
- Course given by *Mohammed Adnan Abid* (Uni of Anbar, College of Science, Chemistry Dept).
- Core course materials are 'Clayden' (1st and 2nd ed.) and 'Moodle'; learning objectives at end of each lecture.

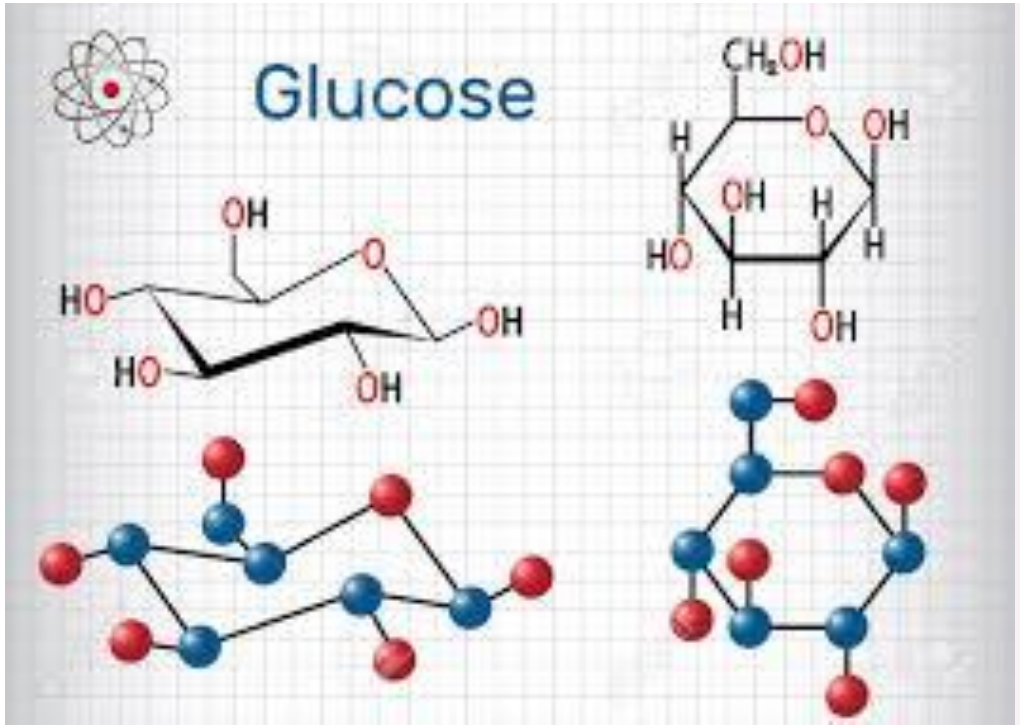
What is the Organic Chemistry?

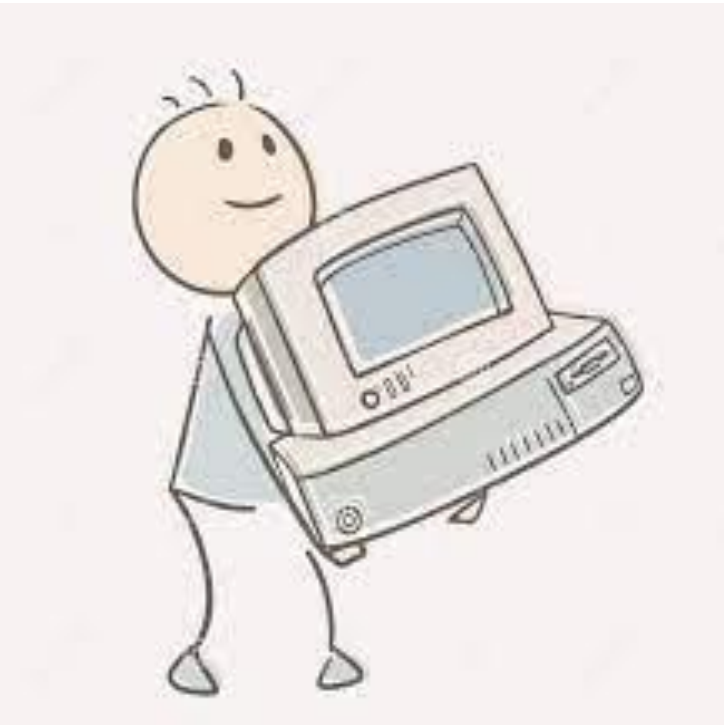
While you are looking to the screen NOW, your eyes are using an organic compound (retinal) to convert visible light into nerve impulses





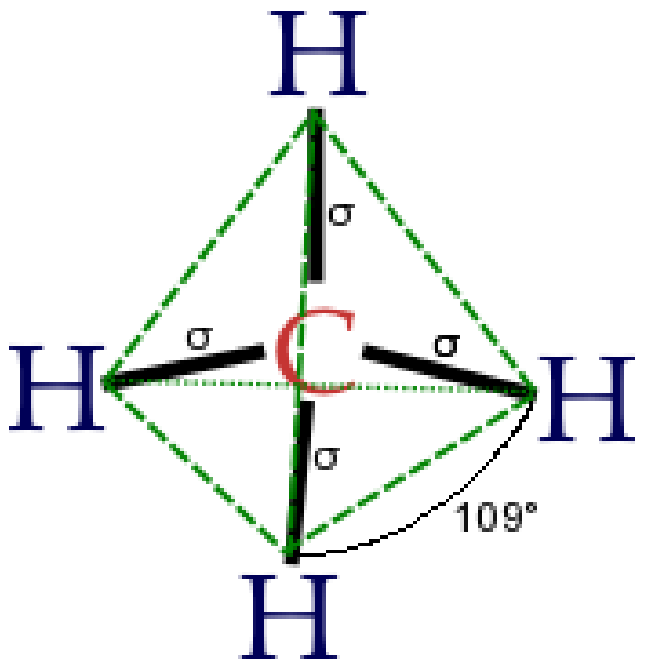
When you picked up *YOUR* computer or mobile phone, your muscles were doing chemical reactions on sugars to give you the energy you needed





Organic chemistry started as the chemistry of **life**, when that was thought to be different from the chemistry in the laboratory. Then it became the *carbon compounds*, especially those found in coal. Now it is both, It is the chemistry of the compounds of carbon along with other elements such as are found in living things and elsewhere…… *To be continued*.

Organic chemistry is the study of the structure, properties, composition, reactions, and preparation of *carbon-containing compounds*, which include not only *hydrocarbons* but also compounds with any number of other elements, including hydrogen (most compounds contain at least one carbon–hydrogen bond), nitrogen, oxygen, halogens, phosphorus, silicon, and sulfur. This branch of chemistry was originally limited to compounds produced by living organisms but has been broadened to include human-made substances such as plastics.



Methane, CH_4; the line-angle structural formula shows four carbon-hydrogen single bonds (σ, in black), and the typical 3D shape of tetrahedral molecules, with ~109° interior bond angles (in dashed-green).

Introduction to Organic Chemistry

- We will talk about hydrocarbons in details later on!!

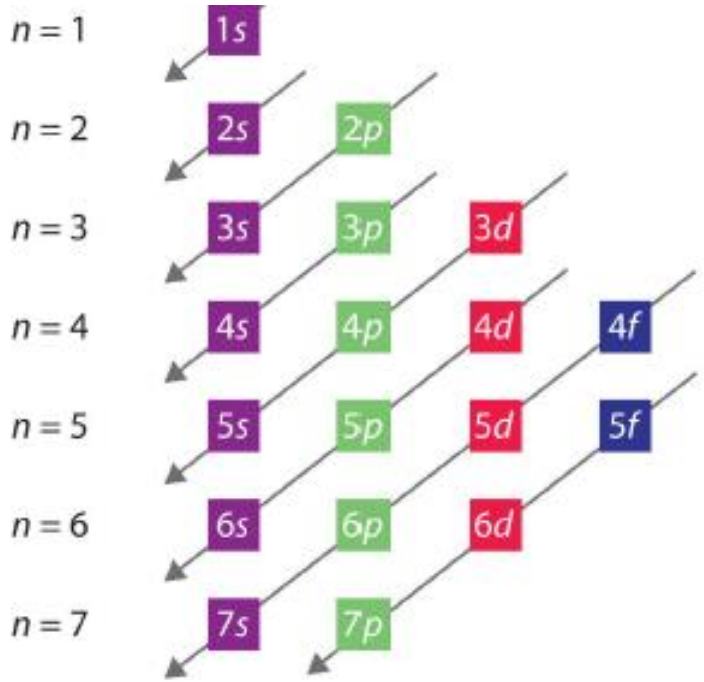
- **Structure and bonding:**

At the end, you will be able to define, and use in context, the key terms below:

- bond strength
- covalent bond
- ionic bond
- Lewis structure
- lone-pair electron
- non-bonding electron

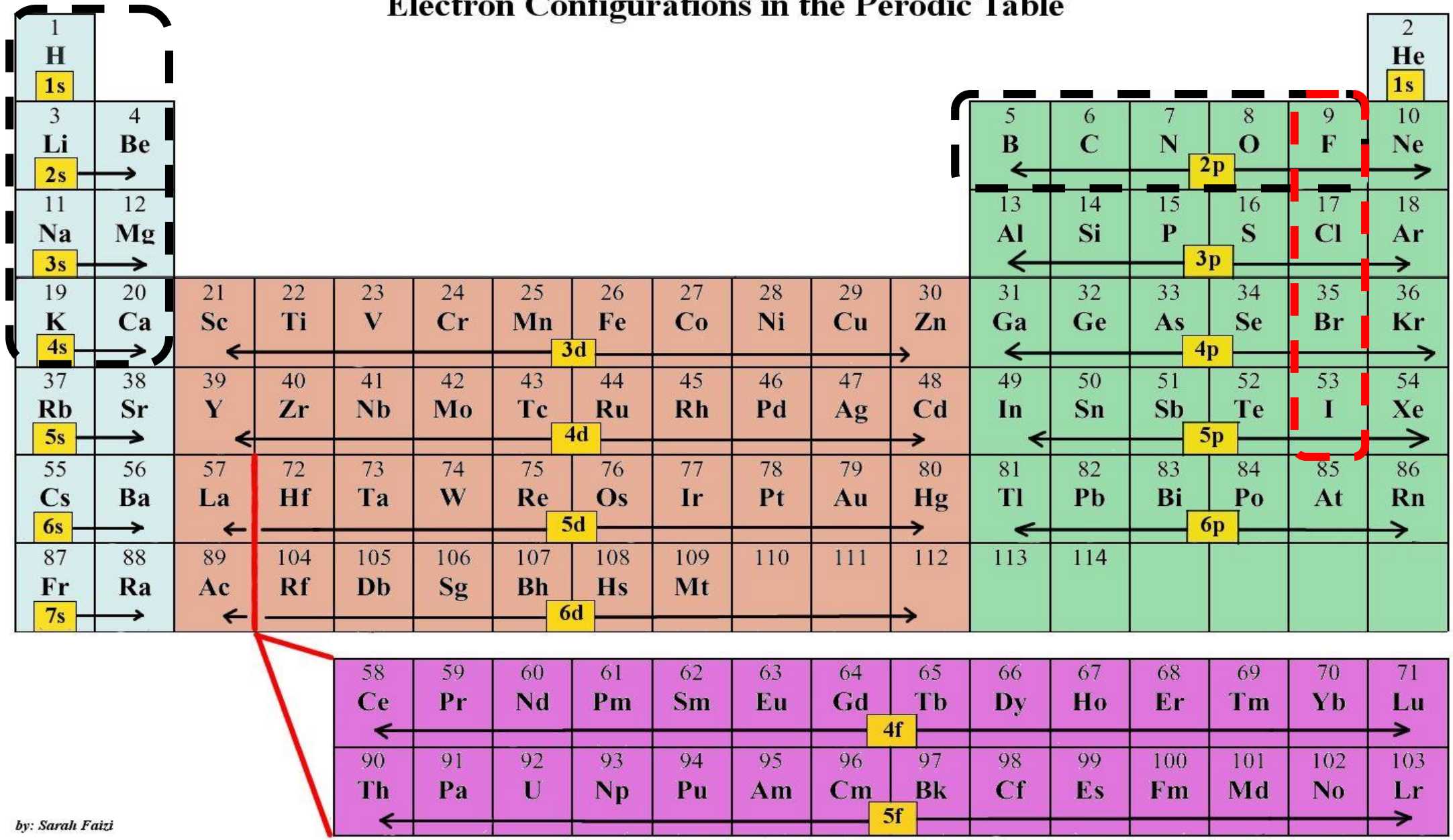
Introduction to Organic Chemistry

To draw Lewis structures successfully, you need to know the number of valence electrons present in each of the atoms involved. *Memorize* the number of valence electrons possessed by each of the elements commonly encountered in organic chemistry: C, H, O, N, S, P and the halogens.



Most of these concepts will be studied in inorganic chemistry.

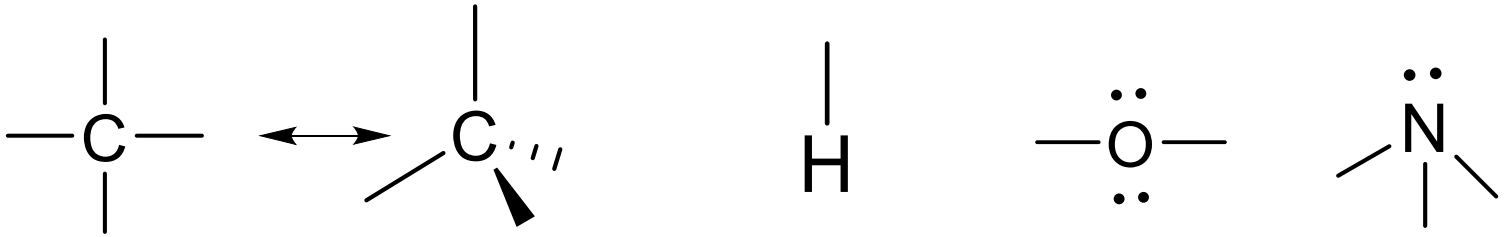
Electron Configurations in the Perodic Table



by: Sarah Faizi

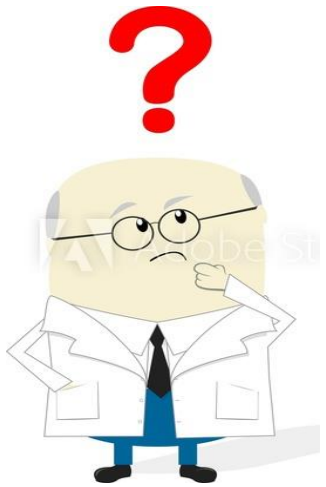
Introduction to Organic Chemistry

- *Note:* When drawing any organic structure, you must remember that a neutral carbon atom will almost always have four bonds.
- Similarly, hydrogen always has one bond; neutral oxygen atoms have two bonds; and neutral nitrogen atoms have three bonds. By committing these simple rules to memory, you can avoid making unnecessary mistakes later in the course.



Introduction to Organic Chemistry

- Why are some substances chemically bonded molecules and others are an association of ions???!!!



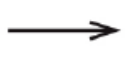
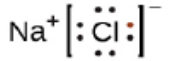
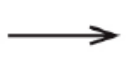
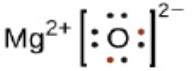
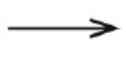
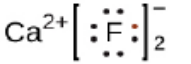
- The answer to this question depends upon the *electronic structures of the atoms* and *nature of the chemical forces* within the compounds.

Introduction to Organic Chemistry

FOR THIS:

Chemical bonds are typically classified into **three** main types: **ionic bonds**, **covalent bonds**, and **metallic bonds**:

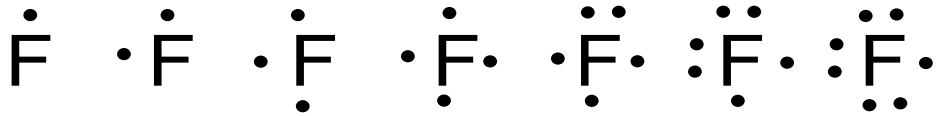
1. **Ionic bonds** results from electrostatic forces that exist between ions of opposite charge. These bonds typically involve a metal with a nonmetal.

Metal		Nonmetal		Ionic Compound
	+			
sodium atom		chlorine atom		sodium chloride (sodium ion and chloride ion)
	+			
magnesium atom		oxygen atom		magnesium oxide (magnesium ion and oxide ion)
	+			
calcium atom		fluorine atoms		calcium fluoride (calcium ion and two fluoride ions)

Introduction to Organic Chemistry

Lewis Dot symbols

To write an element's Lewis dot symbol, we place dots representing its valence electrons, one at a time, around the element's chemical symbol. Up to four dots are placed above, below, to the left, and to the right of the symbol (in any order, as long as elements with four or fewer valence electrons have no more than one dot in each position). The next dots, for elements with more than four valence electrons, are again distributed one at a time, each paired with one of the first four. Fluorine, for example, with the electron configuration $1s^2\ 2s^2\ 2p^5$, has seven valence electrons, so its Lewis dot symbol is constructed as follows:



Introduction to Organic Chemistry

Group	1	2	13	14	15	16	17	18
Electron Configuration	$[He]2s^1$	$[He]2s^2$	$[He]2s^22p^1$	$[He]2s^22p^2$	$[He]2s^22p^3$	$[He]2s^22p^4$	$[He]2s^22p^5$	$[He]2s^22p^6$
Lewis Dot Symbol	Li ·	·Be·	· B ·	· C ·	· N·	:O ·	: F ·	:Ne:

Lewis used the unpaired dots to predict the number of bonds that an element will form in a compound. Consider the symbol for nitrogen in Figure above, the Lewis dot symbol explains why nitrogen, with three unpaired valence electrons, tends to form compounds in which it shares the unpaired electrons to form three bonds. Boron, which also has three unpaired valence electrons in its Lewis dot symbol, also tends to form compounds with three bonds, whereas carbon, with four unpaired valence electrons in its Lewis dot symbol, tends to share all of its unpaired valence electrons by forming compounds in which it has four bonds. Lewis symbols are a tool to help draw structures.

Introduction to Organic Chemistry

I encourage all of you to read **the Octet Rule**

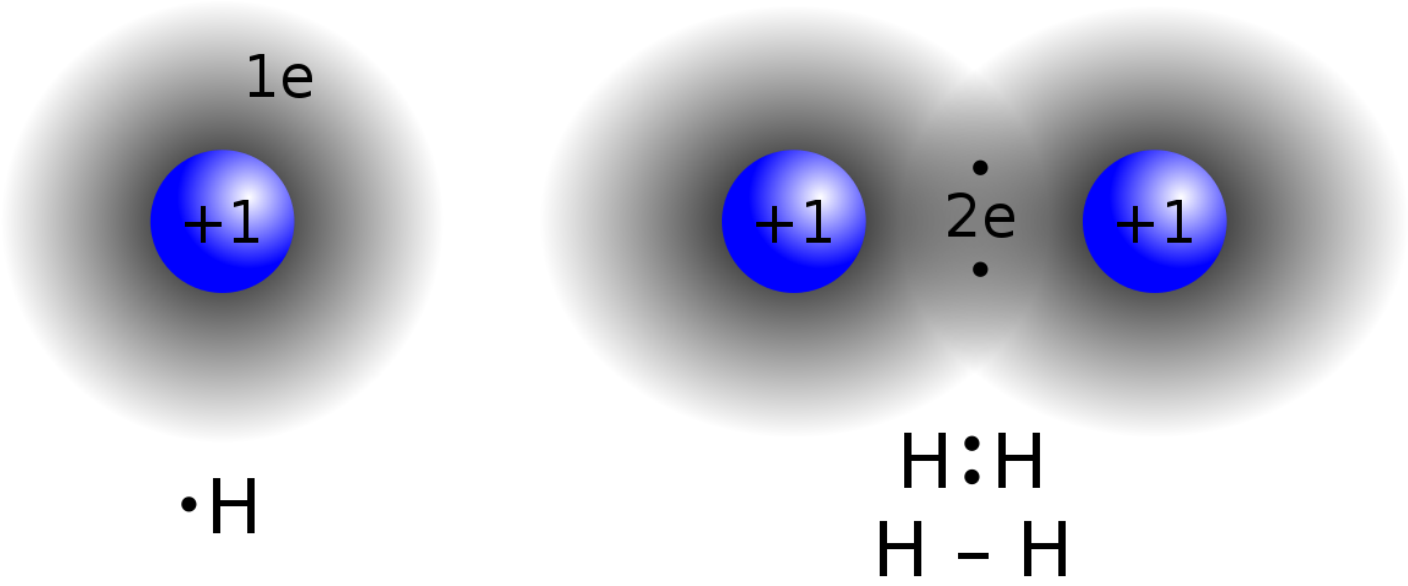
AND

The main differences between **Covalent** and **Ionic** bond

Introduction to Organic Chemistry

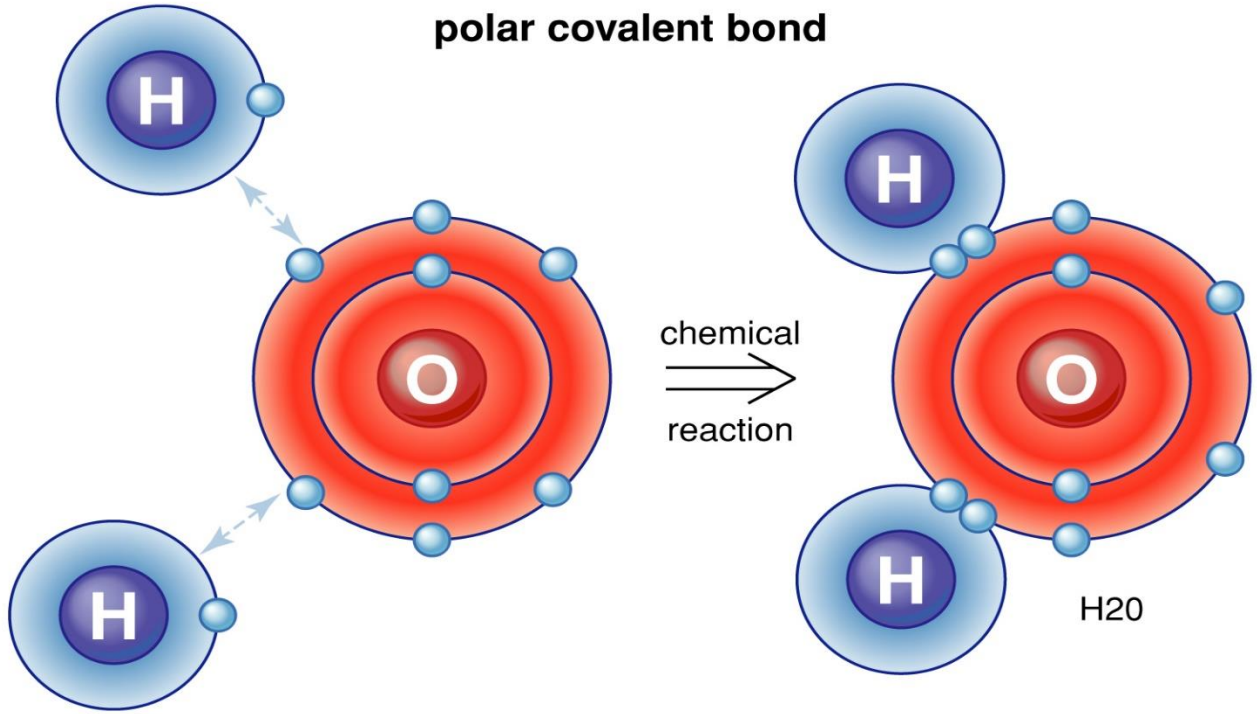
2. **Covalent bonds** result from **the sharing of electrons between two atoms**. The bonds typically involve one nonmetallic element with another.

- When two atoms of the same element form a covalent bond are the shared electrons actually shared equally between the atoms, *e.x.* H_2, $O_2$and CH_4.



Introduction to Organic Chemistry

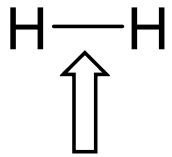
- When atoms of different elements share electrons through covalent bonding, the electron will be drawn more toward the atom with the higher electronegativity resulting in a polar covalent bond such as H_2O.



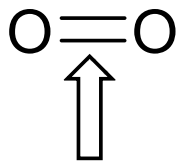
Introduction to Organic Chemistry

We have three types of covalent bond

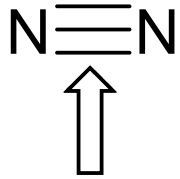
1. Single bond (σ)



2. Doubled Bond (σ, π)

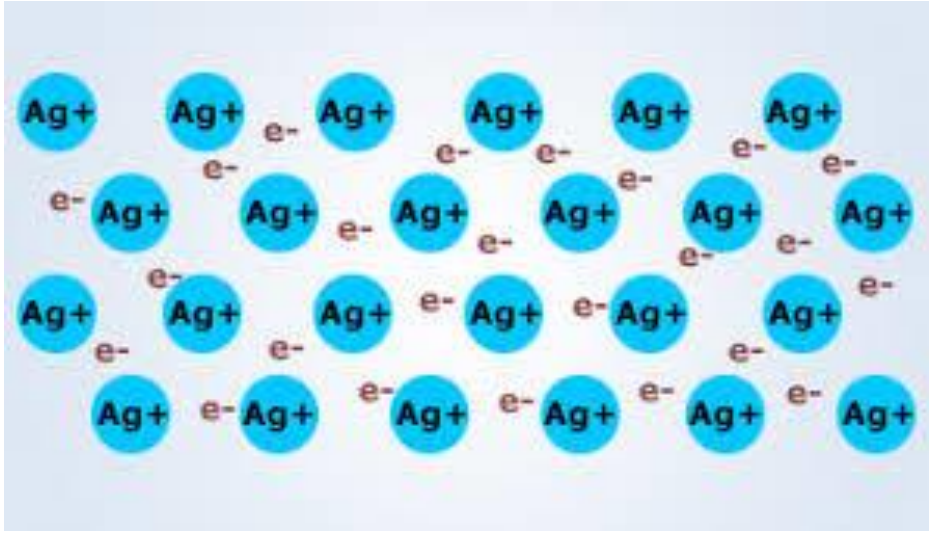


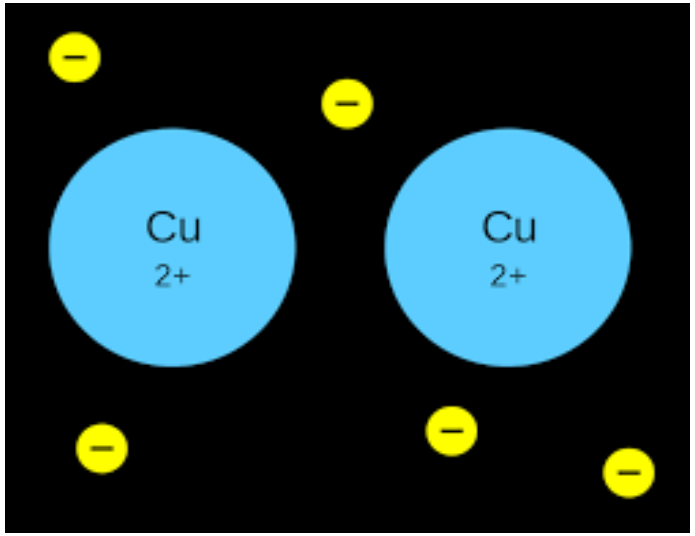
3. Triple Bond (π, σ, π)



Introduction to Organic Chemistry

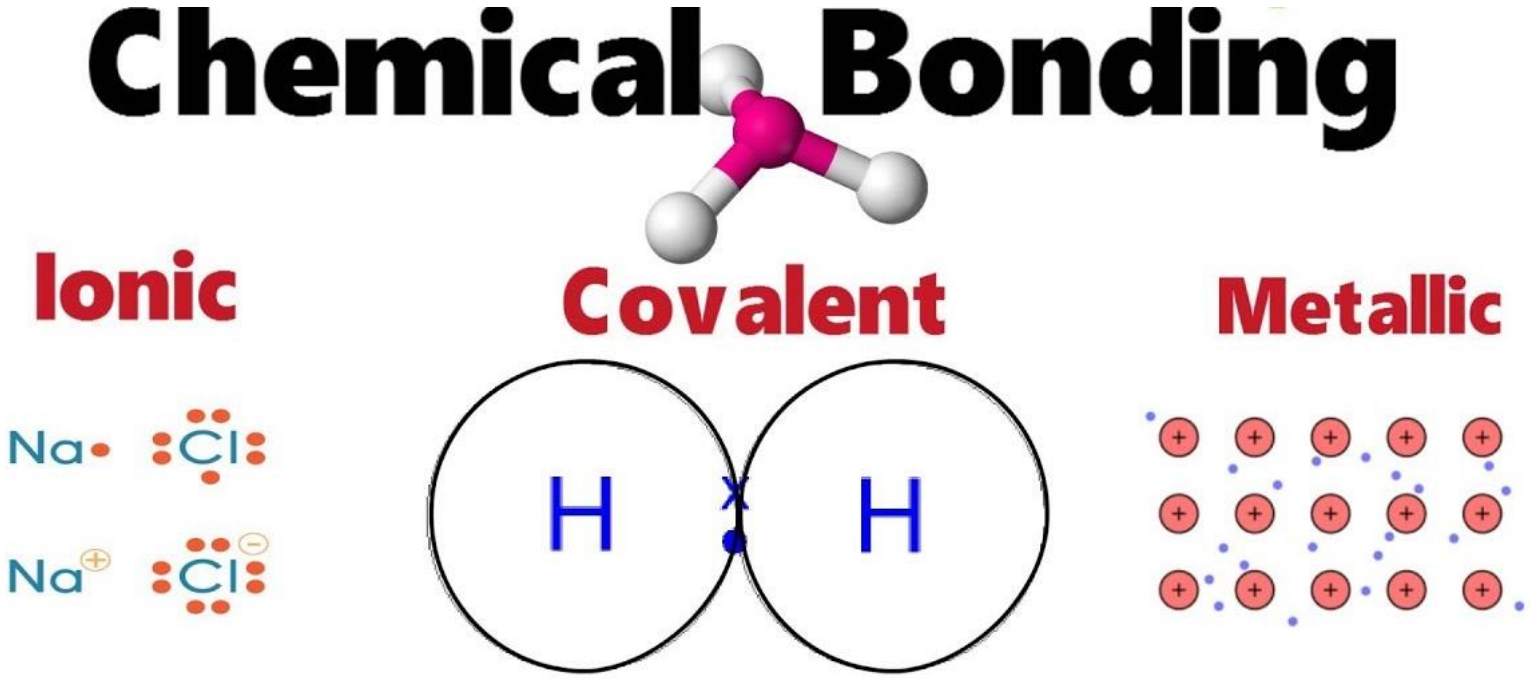
3. **Metallic bonds** are found in solid metals (copper, iron, aluminum) with each metal atom bonded to several neighboring metal atoms and the bonding electrons are free to move throughout the 3-dimensional structure. This type is ***NOT*** important in this course





Introduction to Organic Chemistry

To summaries



Introduction to Organic Chemistry

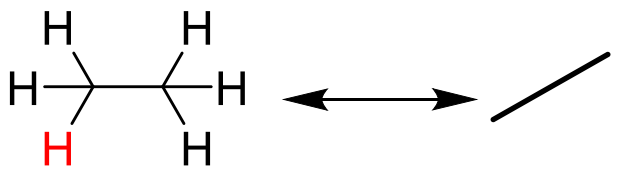
❖ Functional Group

What is the functional group?

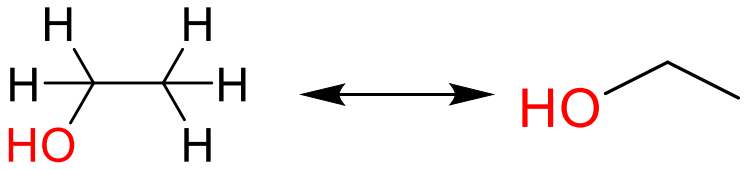
It refers to specific atoms bonded in a certain arrangement that give a compound certain physical and chemical properties. In other way, it is a specific group of atoms or bonds within a compound that is responsible for the characteristic chemical reactions of that compound.

Introduction to Organic Chemistry

The difference between **ethanol** and **ethane** is the functional group, the OH or hydroxyl group. We know that these chemical properties (being able to react with acids, bases, and oxidizing agents) are properties of the hydroxyl group and not just of ethanol because other compounds containing OH groups (in other words, other alcohols) have similar properties, whatever their hydrocarbon frameworks.

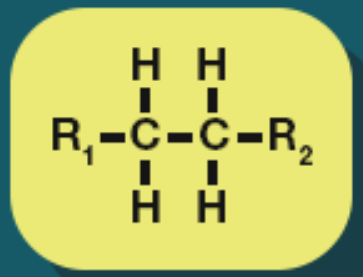


Ethane



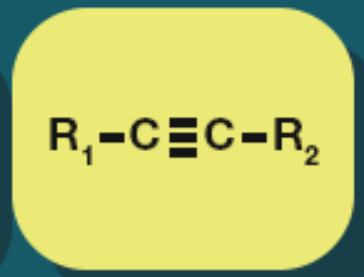
Ethanol

FUNCTIONAL GROUPS



ALKANE

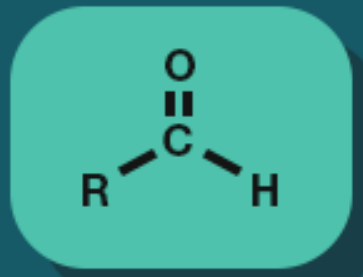
ALKENE



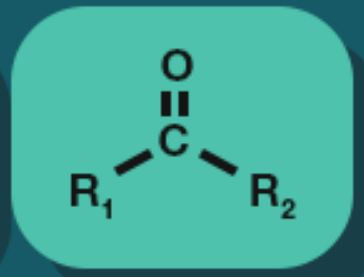
ALKYNE

ARENE

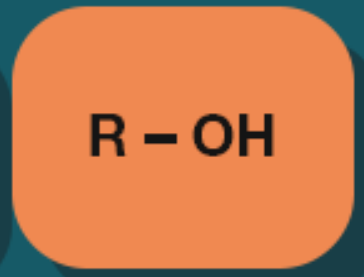
HALOALKANE



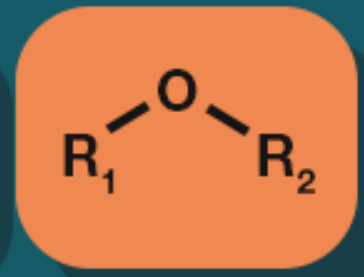
ALDEHYDE



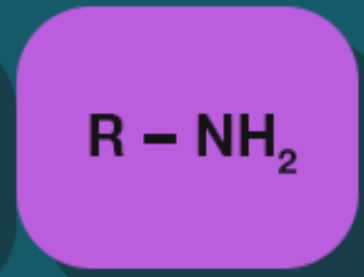
KETONE



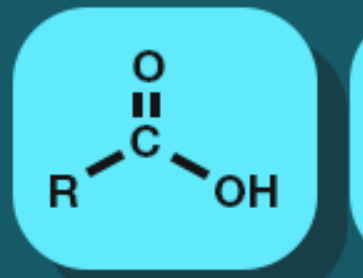
ALCOHOL



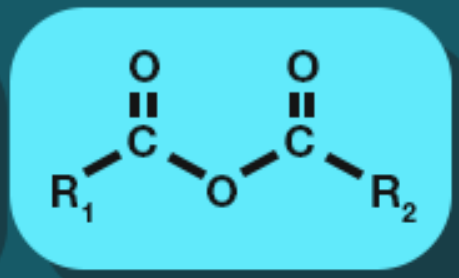
ETHER



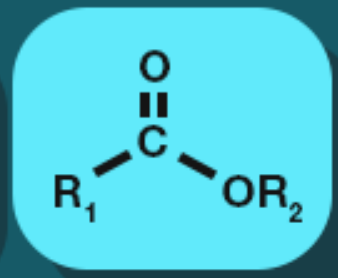
AMINE



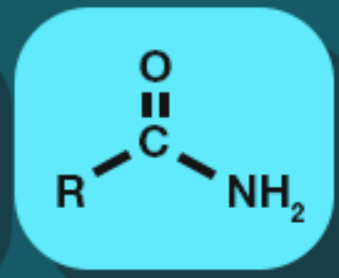
CARBOXYLIC ACID



ACID ANHYDRIDE



ESTER



AMIDE

ACYL HALIDE

HYDROCARBONS

AROMATICS

OTHER HETEROATOMICS

SIMPLE OXYGEN HETEROATOMICS

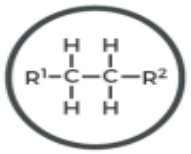
CARBONYL COMPOUNDS

CARBOXYLIC ACIDS AND DERIVATIVES

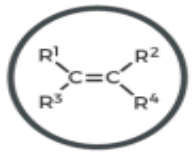
FUNCTIONAL GROUPS IN ORGANIC CHEMISTRY

Functional groups are the characteristic groups in organic molecules that give them their reactivity. In the formulae below, R represents the rest of the molecule and X represents any halogen atom.

Hydrocarbons | Halogen-containing groups | Oxygen-containing groups | Nitrogen-containing groups | Sulfur-containing groups | Phosphorus-containing groups

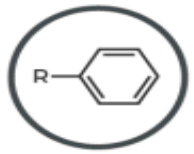


ALKANE
Naming: -ane
e.g. ethane



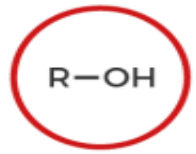
ALKENE
Naming: -ene
e.g. ethene

ALKYNE
Naming: -yne
e.g. ethyne

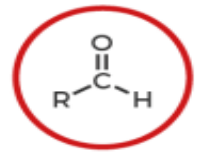


ARENE
Naming: -yl benzene
e.g. ethyl benzene

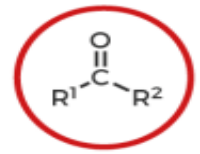
HALOALKANE
Naming: halo-
e.g. chloroethane



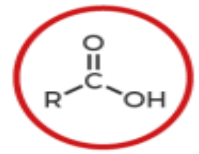
ALCOHOL
Naming: -ol
e.g. ethanol



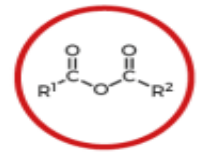
ALDEHYDE
Naming: -al
e.g. ethanal



KETONE
Naming: -one
e.g. propanone

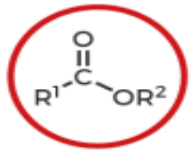


CARBOXYLIC ACID
Naming: -oic acid
e.g. ethanoic acid

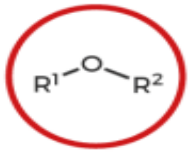


ACID ANHYDRIDE
Naming: -oic anhydride
e.g. ethanoic anhydride

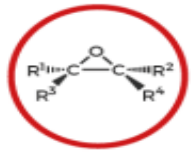
ACYL HALIDE
Naming: -oyl halide
e.g. ethanoyl chloride



ESTER
Naming: -yl -oate
e.g. ethyl ethanoate



ETHER
Naming: -oxy -ane
e.g. methoxyethane



EPOXIDE
Naming: -ene oxide
e.g. ethene oxide

AMINE
Naming: -amine
e.g. ethanamine

AMIDE
Naming: -amide
e.g. ethanamide

NITRATE
Naming: -yl nitrate
e.g. ethyl nitrate

NITRITE
Naming: -yl nitrite
e.g. ethyl nitrite

NITRILE
Naming: -nitrile
e.g. ethanenitrile

NITRO
Naming: nitro-
e.g. nitromethane

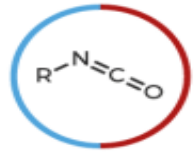
NITROSO
Naming: nitroso-
e.g. nitrosoethane

IMINE
Naming: -imine
e.g. ethanimine

IMIDE
Naming: -imide
e.g. succinimide

AZIDE
Naming: -yl azide
e.g. phenylazide

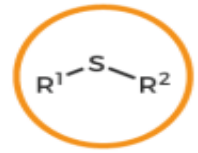
CYANATE
Naming: -yl cyanate
e.g. methyl cyanate



ISOCYANATE
Naming: -yl isocyanate
e.g. methyl isocyanate

AZO COMPOUND
Naming: azo-
e.g. azoethane

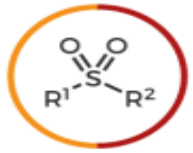
THIOL
Naming: -thiol
e.g. methanethiol



SULFIDE
Naming: sulfide
e.g. dimethyl sulfide

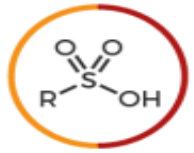
DISULFIDE
Naming: disulfide
e.g. dimethyl disulfide

SULFOXIDE
Naming: sulfoxide
e.g. dimethyl sulfoxide

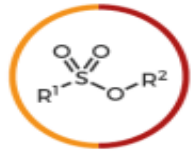


SULFONE
Naming: sulfone
e.g. dimethyl sulfone

SULFINIC ACID
Naming: -sulfinic acid
e.g. benzenesulfinic acid



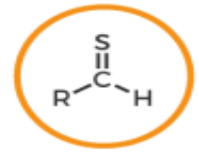
SULFONIC ACID
Naming: -sulfonic acid
e.g. benzenesulfonic acid



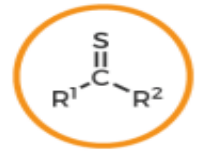
SULFONATE ESTER
Naming: -yl sulfonate
e.g. methylmethanesulfonate

THIOCYANATE
Naming: thiocyanate
e.g. ethyl thiocyanate

ISOTHIOCYANATE
Naming: isothiocyanate
e.g. ethyl isothiocyanate



THIAL
Naming: -thial
e.g. ethanethial



THIOKETONE
Naming: -thione
e.g. propanethione

PHOSPHINE
Naming: phosphane
e.g. methylphosphane

Thank you for attention