Pharmaceutical Organic Chemistry-1

Chapter-1: Introduction

Organic Chemistry: Definition

- The word **Organic** can be a biological or chemical term, in biology it means anything that is living or has lived. The opposite is Non-Organic.
- **Organic Chemistry** is unique in that it deals with vast numbers of substances, both natural and synthetic.

The clothes, the petroleum products, the paper, rubber, wood, plastics, paint, cosmetics, insecticides, and drugs

- But, from the chemical makeup of organic compounds, it was recognized that one constituent common to all was ***the element carbon***.
- **Organic chemistry** is defined as ***the study of carbon/hydrogen-containing compounds and their derivatives.***

The Uniqueness of Carbon

موجود في مجموعة رابعة

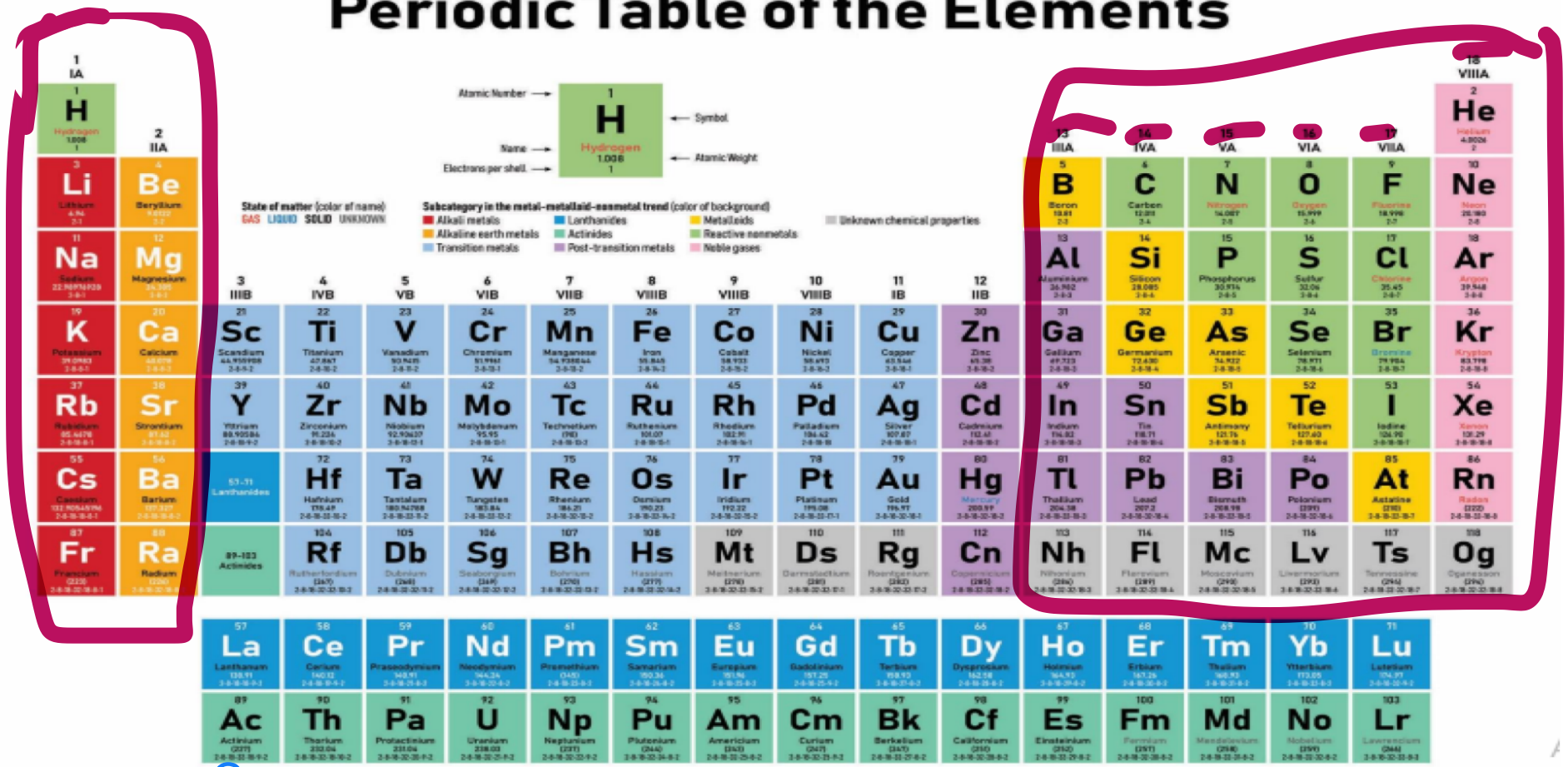
- What is unique about the element ***carbon***?
- Why does it form so many compounds?

The answers lie in

- The **structure** of the ***carbon*** atom. بنية ذرة
- The **position** of ***carbon*** in the periodic table. موقع

- These factors enable it to form strong bonds with
  - other carbon atoms
  - and with other elements (hydrogen, oxygen, nitrogen, halogens,…etc).
- Each **organic compound** has its own characteristic set of physical and chemical properties which depend on the ***structure of the molecule***. تعتمد

Periodic Table of the Elements



- Organic compounds are compounds containing carbon

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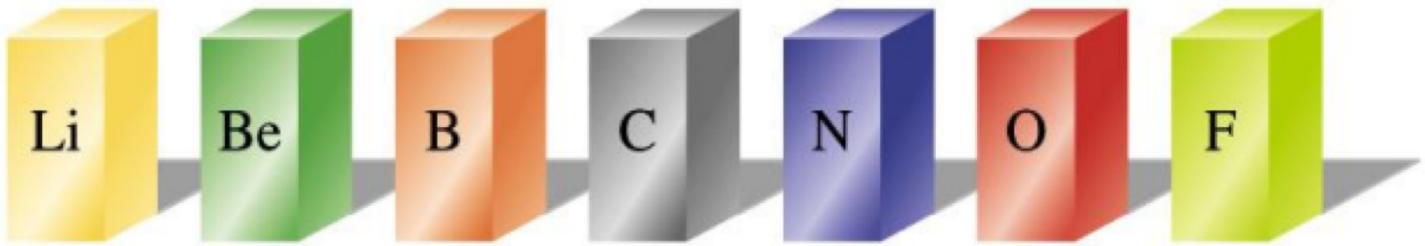


the second row of the periodic table

- Atoms to the left of carbon give up electrons.
- Atoms to the right of carbon accept electrons.
- Carbon shares electrons.

Atomic Structure

يسار بتفقد الالكترونات
عشان هيك شحنتها موجبة

الكربون تشاركي ب
تبعته atom

- **Atoms consist of three main particles: neutrons (have no charge), protons (positively charged) and electrons (negatively charged).**

موجبة — سالبة — ما لها شحنة

  - **Neutrons and protons are found in the nucleus.** داخل نواة
  - **Electrons are found outside the nucleus.** خارج

كلما بعدت عن نواة زادت طاقة

Electrons are distributed around the nucleus in successive *shells* (*principal energy levels*).

اغلفة متتالية — مستويات طاقة رئيسية

- **Atom is electrically neutral.** متعادلة

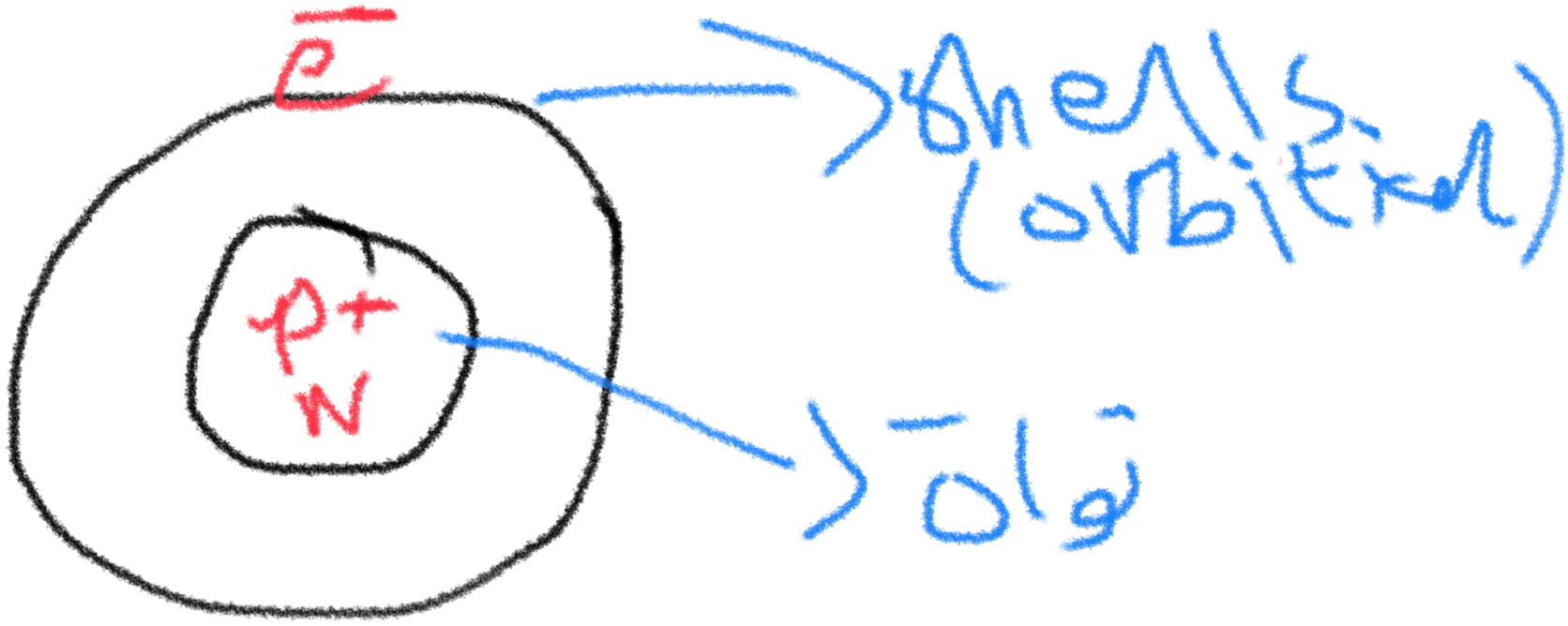
i.e. Number of electrons = Number of protons

- **Atomic number of an element is the number of protons.**

عدد الالكترون في ذرة متعادلة يعني الالكترونات بتكون بتساوي البروتونات

Atoms =nucleous+shells

P+N



* الالكترونات قادرة ع حركة من و الى ذرات

و هون قصدي عن اللكترونات المدار الاخير يعني ابعد واحد عن ذرة

عدد
valence = Grop number
electron

عدد
of shells = Peroid number

شرح كام

smaller number = atomic number

Larg number = mass number

Ex: $^{16}_{8}O$ ⟶ M.N

A.N ⟵

P = A.N = 8

e = 8 لأنها حايدة كهربيا

N = M.N − A.N = 16 − 8 = 8

A.N = 7

M.N = 9

P = 7

e = 7

N = 9 − 7 = 2

$(M_{cp})_{2a} + 2$

10

A. N = 10

M. N = 20 P = 10

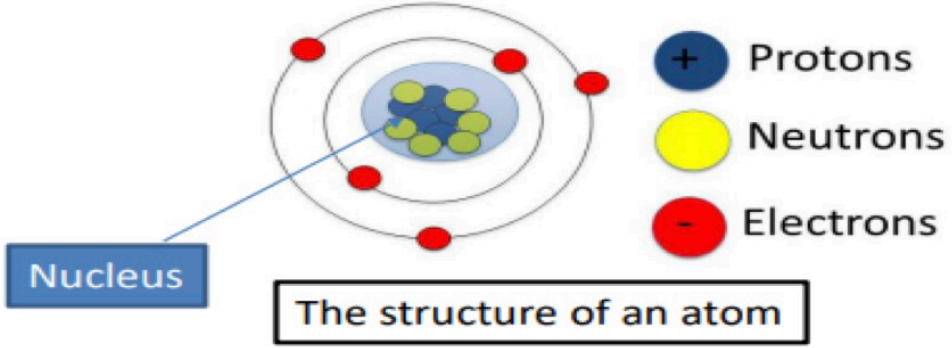
شحنات مختلفة بتتجاذب

Bonding and Isomerism

1.1 How Electrons Are Arranged in Atoms كيفية ترتيب الالكترونات في ذرات

- An atom is: the *smallest particle* of an element that retains all of the chemical properties of that element. اصغر جسيم في العنصر يحتفظ بجميع خصائص كميائية لذلك العنصر

- An atom consists of negatively charged electrons, positively charged protons, and neutral neutrons



The structure of an atom

- **Atomic number**: numbers of protons in its nucleus and it's the number of electrons in the neutral atom.

- **Mass number**: the sum of the protons and neutrons of an atom. (Protons and neutrons are ~1837 times the mass of an e^-)

P + N

- Isotopes have the same atomic number but different mass numbers (^{12}C and ^{13}C)

نظائر عدد كتلي و نيترونات بختلفوا بين isotops

مثال عندي ٢٠ الالكترون كيف رح

مثلا:shells يكونوا موزعين في

shell الاول ٢*١=٢

shell ثاني ٢*٤=٨

Atomic Structure تركيب ذري

تسمى

- **The energy levels are designated by capital letters (*K, L, M, N, ..*) or whole numbers (*n*).** سعة قصوى للغلاف كل مستوى بتحمل عدد
- **The maximum capacity of a shell = $2n^2$ electrons.** محدد من الإلكترون

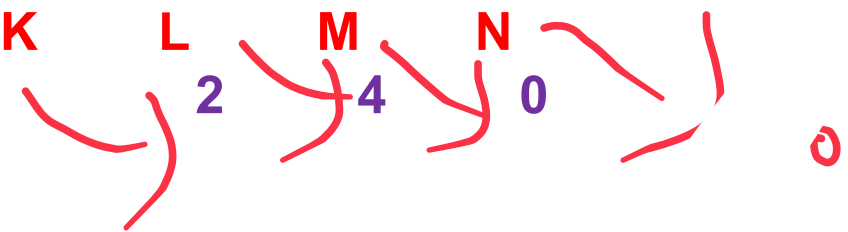
***n* = number of the energy level.**

بدنا نلاحظ احنا بنحكي عن shells هاي اكبر سعة لئلها بس orbetal اكبر سعة لئلها !

- **For example, the element carbon (atomic number 6)**

6 electrons are distributed about the nucleus as

Shell	**K**	**L**	**M**	**N**
Number of electrons	**2**	**4**	**0**	**0**



يعني كل مدار رح يكون فيه ٢الالكترون

Atomic Structure

الالكترون تكافىء

Valance Electrons: Electron-Dot Structures

في المدار الاخير موجودة

- **Valance Electrons** are those electrons located in the ***outermost energy level*** (***the valance shell***).

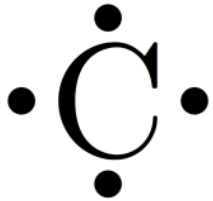
مستوى طاقة خارجية

- **Electron-dot structures**

يمثل رمز عنصر نواة

  - **The symbol of the element represents the core of the atom.**
  - **The valance electrons are shown as dots around the symbol.**

كنقاط حول رمز



Chemical Bonding

هاي بالنسبة للمجموعات في جدول دوري

١.٢.٣بخسر الالكترون

٤بشارك

٥.٦.٧ بكسب

بتفتقر لتفاعل عشان اغلفة تكافؤ ممتلئة بالالكترون

- **In 1916 G.N. Lewis pointed out that:**

The noble gases were stable elements and he described their lack of reactivity to their having their valence shells filled with electrons.

  - **2 electrons in case of helium.** مستقر لانو اصلا ما عنده غير ٢ الالكترون
  - **8 electrons for the other noble gases.**

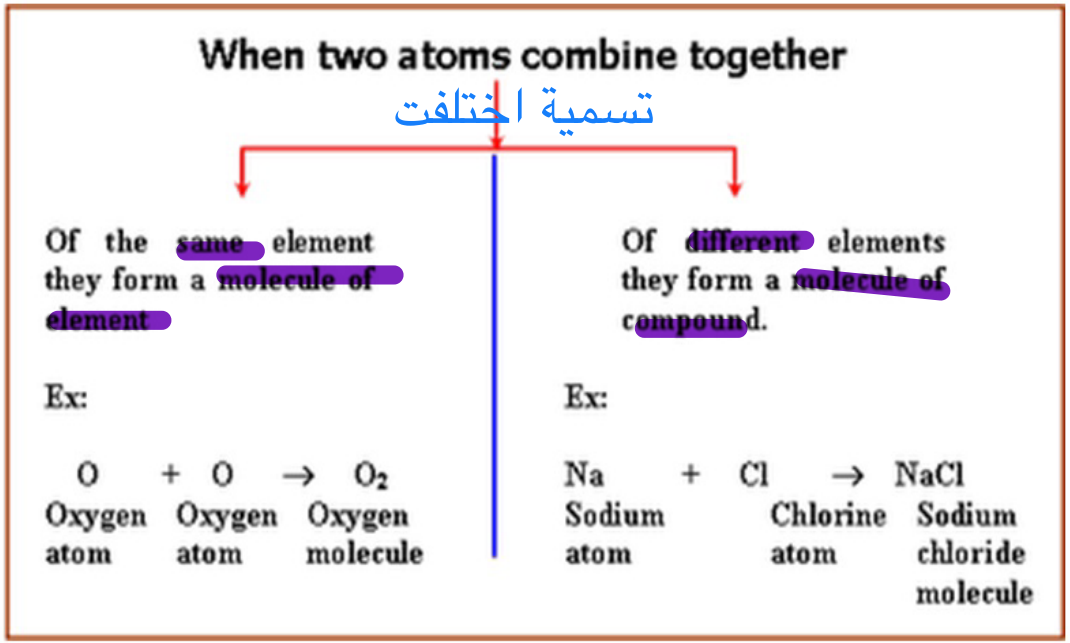
- **According to Lewis,** بس ذرات تتفاعل مع بعضها بتحقق الاستقرار

in interacting with one another atoms can achieve a greater degree of stability

by rearrangement of the valence electrons

to acquire the outer-shell structure of the closest noble gas in the periodic table.

Chemical Bonding



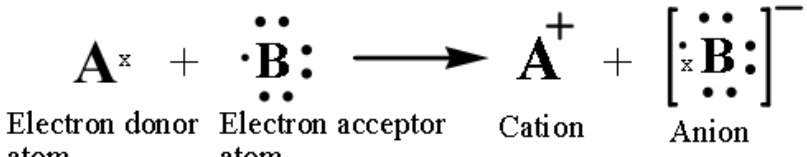
روابط بتزيد
stability
و يقلل طاقة

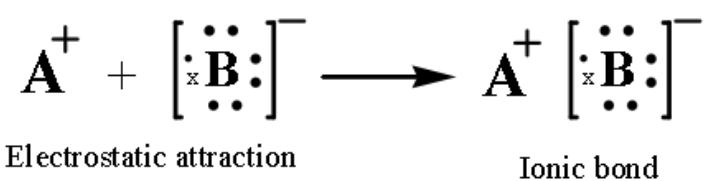
A) Ionic Bonds

جدول دوري

- Elements at the left of the periodic table give up their valance electrons and become *+ve charged ions* (*cations*). فقد الالكترون
- Elements at the right of the periodic table gain the electrons and become *-ve charged ions* (*anions*). كسب الالكترون
- **Ionic bond** كلما كانت مسافة اقل بين ذرتين كلما كانت رابطة اقوى

  The electrostatic force of attraction between oppositely charged ions.





- The majority of ionic compounds are *inorganic substances*.

valence electrons:

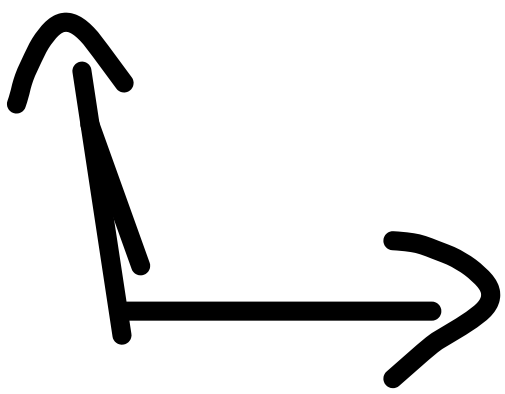
1 → +1
2 → +2
3 → +3

5 → -3
6 → -2
7 → -1

VC →

H B C N O F

P S Br I



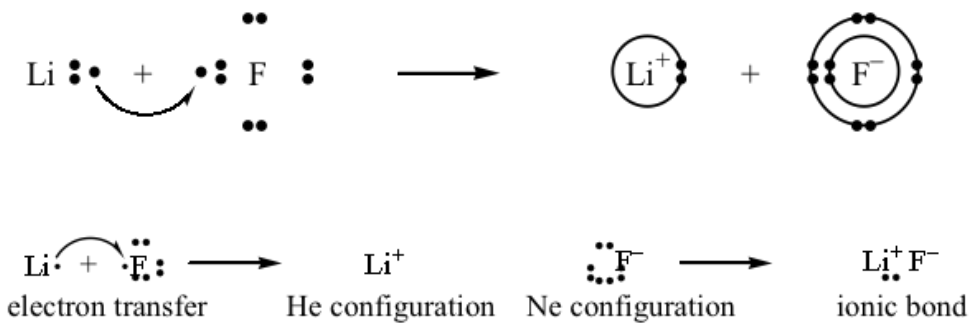
سالبية كهربائية قدرة ع جذب الالكترون

Electronegativity Measures The Ability of An Atom To Attract Electrons

Increasing electronegativity

Decreasing electronegativity

							H
							2.1
F	**O**	**N**	**C**	**B**		**Be**	**Li**
4	3.5	3	2.5	2		1.5	1
Cl	**S**	**P**	**Si**	**Al**		**Mg**	**Na**
3	2.5	2.1	1.8	1.5		1.2	0.9
Br							**K**
2.8							0.8



اقوى رابطة
غالبا بين نفس الذرة بتنشأ

B) Covalent Bonds

- Elements that are close to each other in the periodic table attain the stable noble gas configuration تكوين

by sharing valence electrons between them.

- **Covalent bond**

The chemical bond formed when two atoms share one pair of electrons.

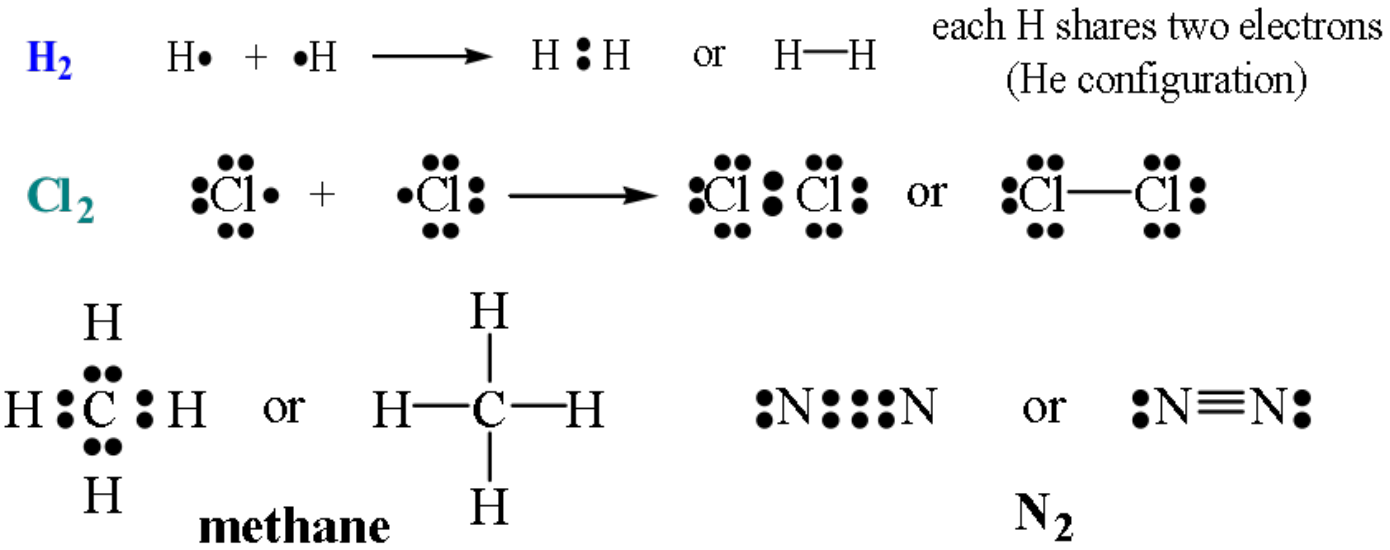
- A shared electron pair between two atoms or single covalent bond, will be represented by a dash (-).

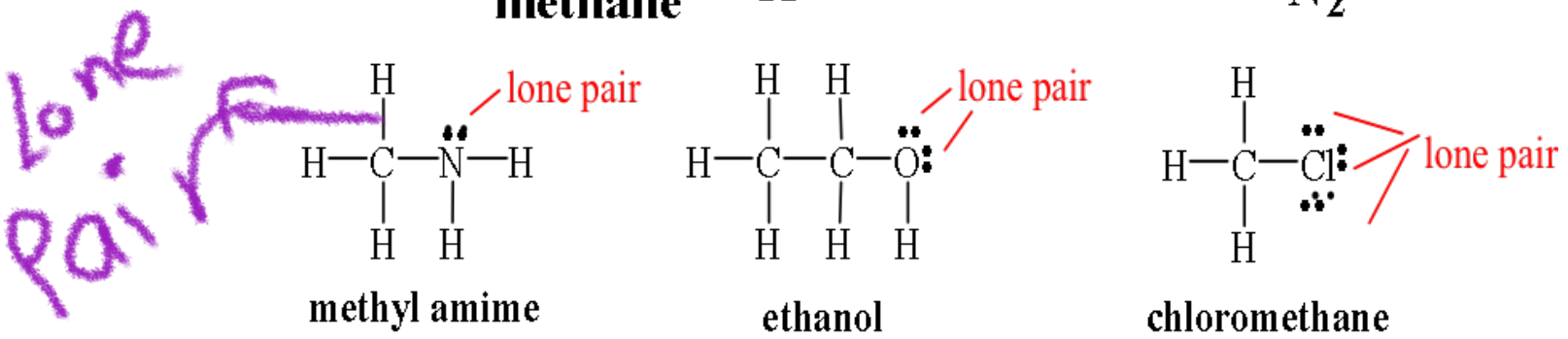
معظم ذرات بتصل الى استقرار اذا عندها v e =٨

B) Covalent Bonds

Examples

عشان يكون مستقر زي غاز نبيل





حفظ

نلاحظ من موقع ، مهم عشان بنحتاجه في
حل المسألة

مجموعة 7	٦	٥	٤

F ، Cl ، Br	2	3	4
1 رابطة			

B) Covalent Bonds

عشان لا تروح الالكترونات الى ذرة محبة للالكترون اكثر من ذرة الاخرى يلي عاملة معها رابطة ، زي اكسجين و كربون

- In molecules that consist of **two like atoms**;

  the bonding electrons are shared equally (both atoms have the same electronegativity).

- When **two unlike atoms**;

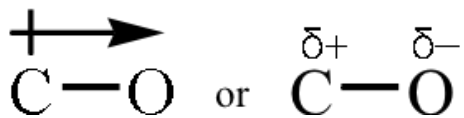
  the bonding electrons are no longer shared equally (shared unequally).

A) Polar Covalent Bond

A bond, in which an electron pair is shared unequally.

➤ **The more electronegative atom assumes a partial negative charge and the less electronegative atom assumes a partial positive charge.**

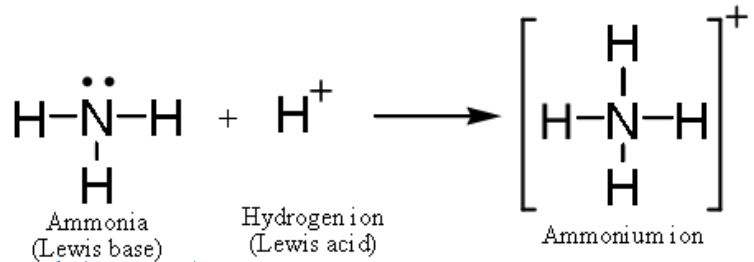
اقل سالبية كهربائية



زوج من الالكترون من نفس الذرة

B) Coordinate Covalent Bonds

- There are molecules in which one atom supplies both electrons to another atom in the formation of a covalent bond.
- For example;



- **Lewis base** يلي شاركت الالكترون
  The species that furnishes the electron pair to form a coordinate covalent bond. يوفر
- **Lewis acid** يلي قبلت الالكترون
  The species that accepts the electron pair to complete its valance shell.

- Electrons are located in atomic orbitals (S, P, d, f).

Orbital جزء من shell

- Orbitals tell us the energy of the electron and the volume of space around the nucleus where an electron is most likely to be found.

- Orbitals are grouped in shells .

Each orbital can hold a maximum of $2e^-$ and the two electrons have opposite spin

Table 1.1 Distribution of Electrons in the First Four Shells That Surround the Nucleus

	First shell	Second shell	Third shell	Fourth shell
Atomic orbitals	*s*	*s*, *p*	*s*, *p*, *d*	*s*, *p*, *d*, *f*
Number of atomic orbitals	1	1, 3	1, 3, 5	1, 3, 5, 7
Maximum number of electrons	2	8	18	32

Valence electrons (VE) are located in the outermost shell. They are involved in chemical reactions.

VE = Group number

		VE	Lewis symbol of atom
Examples:	^{1}H: $1s^1$	1	H·
	^{8}O: $1S^2\ 2S^2\ 2P^4$	6	·· :O: ··
	^{6}C: $1s^2\ 2s^2\ 2p^2$		

Table 1.3 Valence Electrons of the First 18 Elements

Group	I	II	III	IV	V	VI	VII	VIII
	H·							He:
	Li·	Be·	·B·	·C·	·N:	·O:	:F:	:Ne:
	Na·	Mg·	·Al·	·Si·	·P:	·S:	:Cl:	:Ar:

How Many Bonds to an Atom? Covalence Number عدد تساهمي

The number of covalent bonds that an atom can form with other atoms.

i.e. *the covalence number* *is equal to the number of electrons needed to fill its valance shell.* عدد تساهمي =عدد الالكترون في غلاف تكافؤ

Element	Number of valence electrons	Number of electrons in filled valence shell	Covalence number
H	1	2	1
C	4	8	4
N	5	8	3
O	6	8	2
F, Cl, Br, I	7	8	1

Number of v e

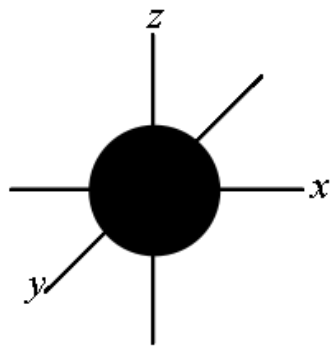
Covalencenumber

Shapes of Organic Molecules: Orbital Picture of Covalent Bonds

Atomic Orbitals

- **An atomic orbital** ***represents a specific region in space in which an electron is most likely to be found.***
- **Atomic orbitals are designated in the order in which they are filled by the letters *s, p, d,* and *f*.**
  - **Examples:** ***K shell has only one 1s orbital.***

    L shell has one 2s and three 2p ($2p_x$, $2p_y$ and $2p_z$). كروية
  - **An *s* orbital is spherically shaped electron cloud with the atom's nucleus and its center.**



s orbital

Mine energy shell → Subshell → Orbitals → Electrons

لازم كل orbital
يحتوي ع الالكترونين ك
حد اقصى

S → one orbital → 2

P → Three // → 3*2=6

D → Five // → 5*2=10

F → seven // → 7*2=14

* اذا فرعي هيلع سي اذا حكا رئيسي
يعني كم الالكترون في هستري رئيسي
ثانيا م

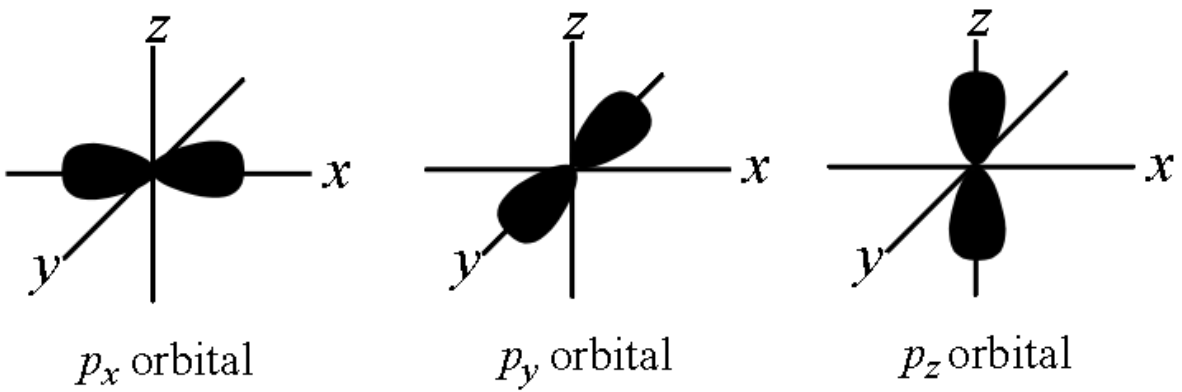
S+P

2+6=8

Shapes of Organic Molecules: Orbital Picture of Covalent Bond

Atomic Orbitals

- A *p* orbital is a dumbbell-shaped electron cloud with the nucleus between the two lobes.
- Each *p* orbital is oriented along one of three perpendicular coordinate axes (in the *x, y,* or *z* direction).

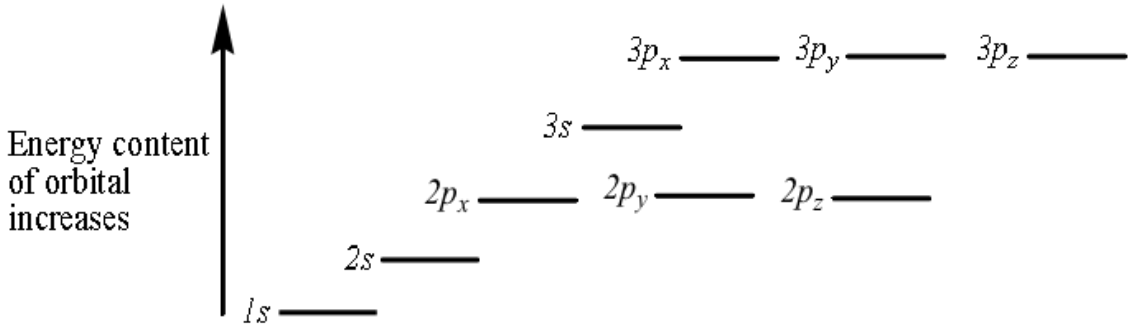


p_x orbital p_y orbital p_z orbital

Shapes of Organic Molecules: Orbital Picture of Covalent Bond

Atomic Orbitals

- An energy level diagram of atomic orbitals.

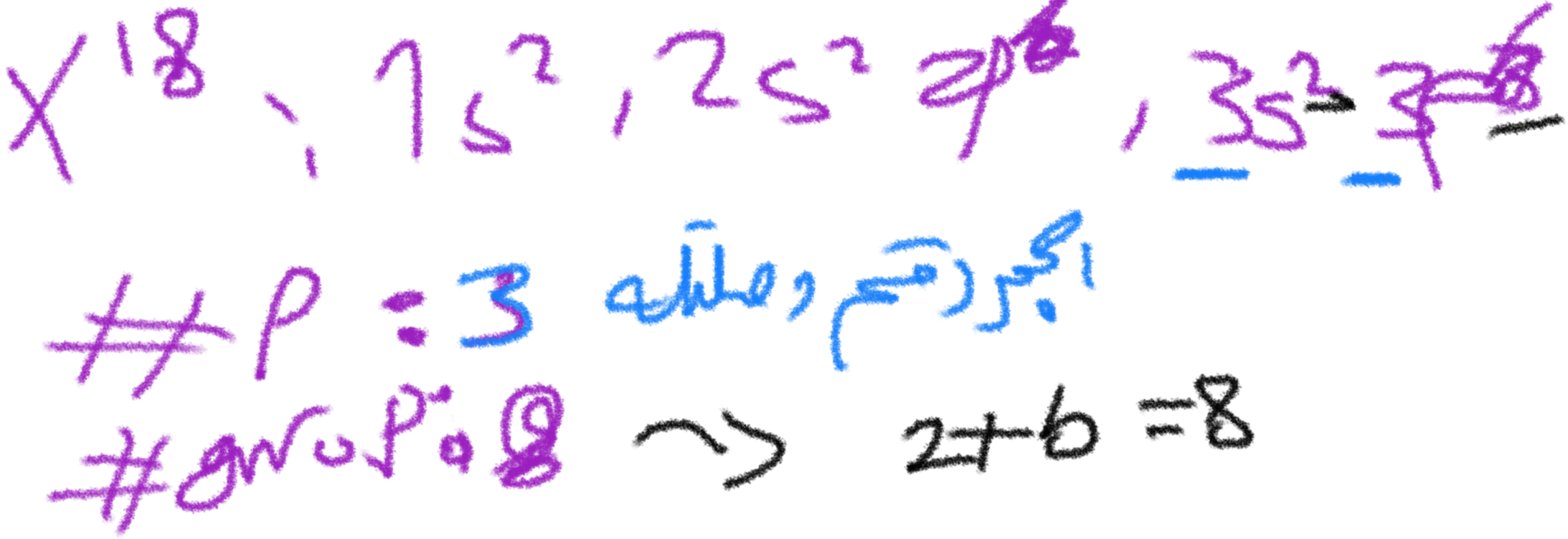


- When filling the atomic orbitals, keep in mind that

(1) An atomic orbital contain no more 2 electrons.

(2) Electrons fill orbitals of lower energy first. بنبلش في مدار اقل طاقة

(3) No orbital is filled by 2 electrons until all the orbitals of equal energy have at least one electron. بنوزع واحد واحد بعدين بنخليهم اثنين



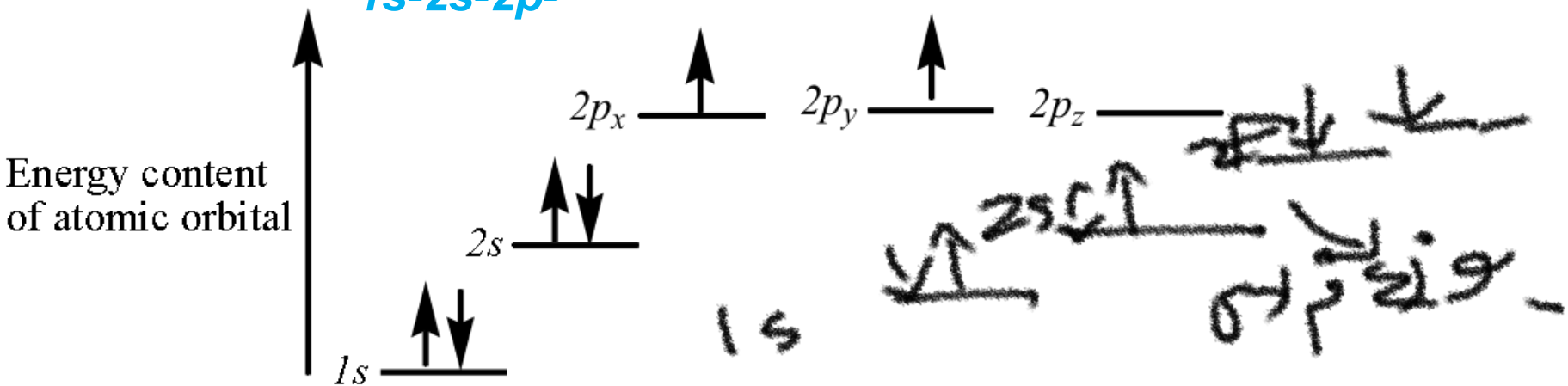
مجموعة ثامنة صف ٣

هذا عشان اعرف موقعها في جدول

Shapes of Organic Molecules: Orbital Picture of Covalent Bond

Atomic Orbitals

- The electronic configuration of carbon (atomic number 6) can be represented as $1s^2 2s^2 sp^1{}_x 2p^1{}_y$ or $1s^2 2s^2 2p^2$



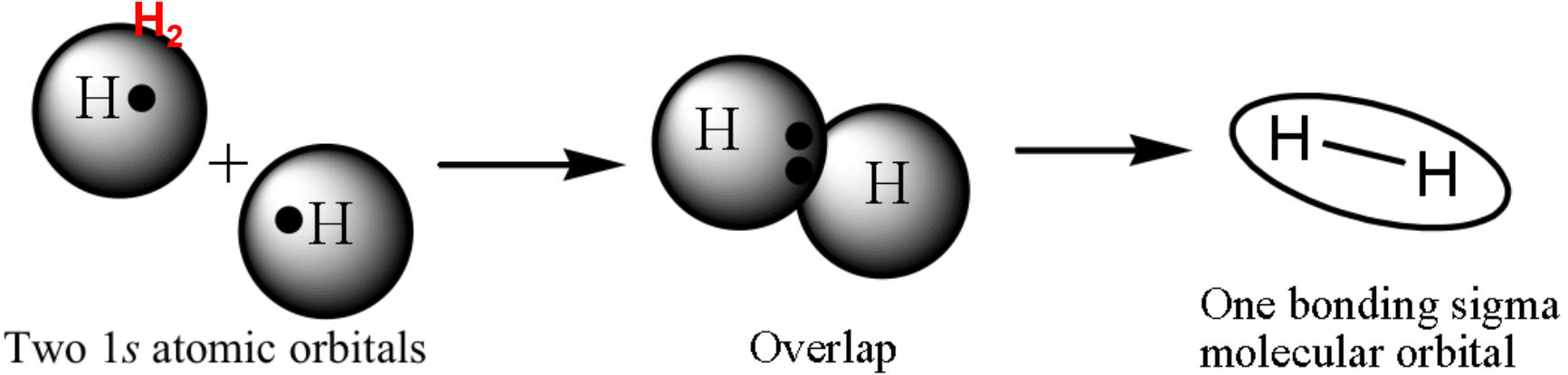
Energy level diagram for carbon.

Shapes of Organic Molecules: Orbital Picture of Covalent Bond

Molecular Orbitals

- A covalent bond consists of the overlap between two atomic orbitals to form a molecular orbital.
- Example:

Molecular orbital of H_2



Shapes of Organic Molecules: Orbital Picture of Covalent Bond

Molecular Orbitals

- **Sigma bonds (σ bonds)** can be formed from احادية
  - The overlap of two *s* atomic orbitals.
  - The end-on overlap of two *p* atomic orbitals.
  - The overlap of two an *s* atomic orbital with a *p* atomic orbital.
- **pi bonds (π bonds)** can be formed from the side-side overlap between two *p* atomic orbitals. ثنائية

كلما كانت طاقة رابطة اعلى كلما بحتاج طاقة اعلى لكسرها و كلما كانت رابطة اقصر

Bond Energy and Bond Length

- **A molecule is more stable than the isolated constituent atoms.**

  This stability is apparent in the release of energy during the formation of the molecular bond.

- **Heat of formation (bond energy)** طاقة يلي بتنتج بس اكون رابطة بين اثنتين

  The amount of energy released when a bond is formed.

- **Bond dissociation energy** طاقة يلي بحتاجها عشان اكسر رابطة

  The amount of energy that must be absorbed to break a bond.

- **Bond length**

  The distance between nuclei in the molecular structure.

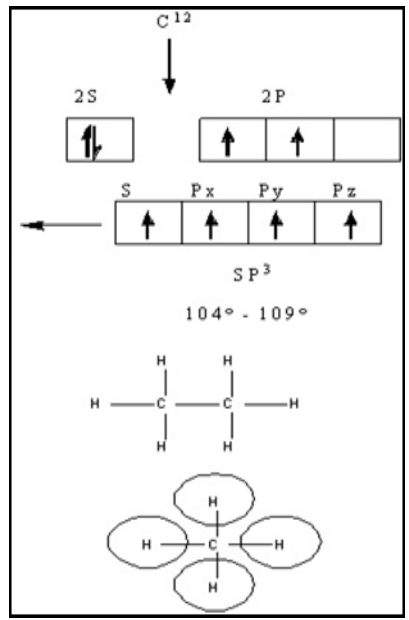
تهجين

وصف لحالة ذرة في مركب

Hybridization (Alkanes sp^3)

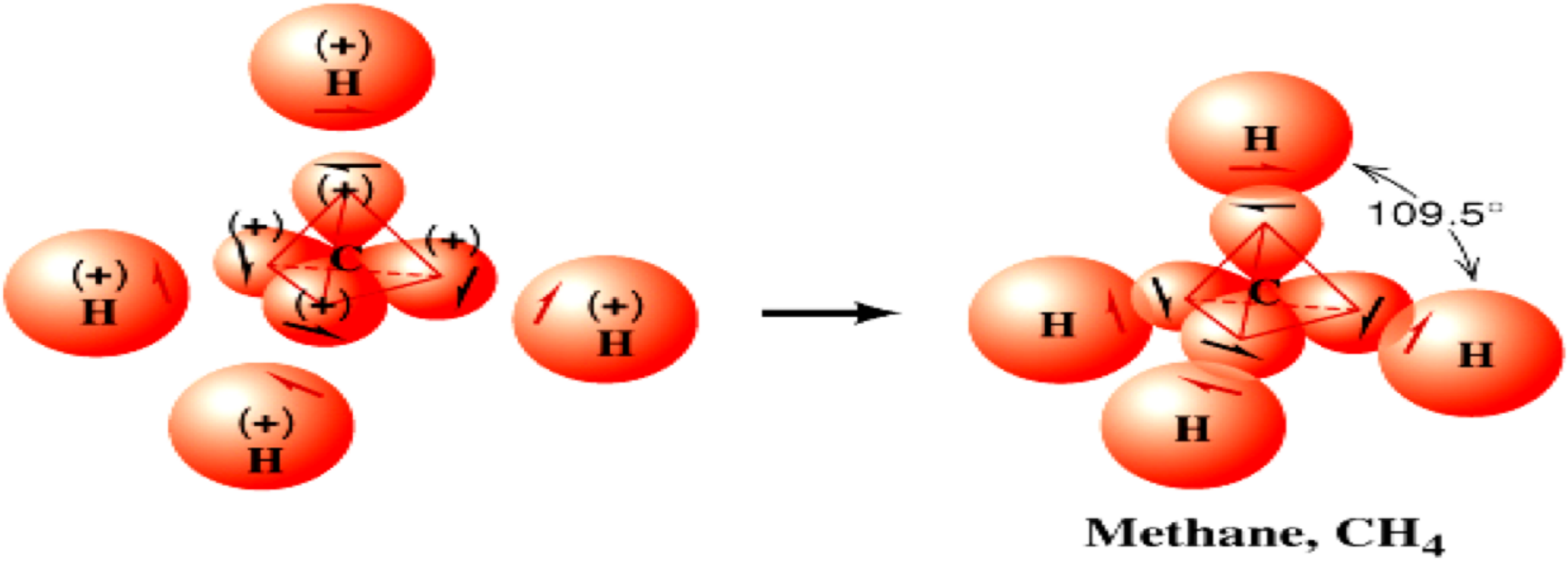
احادية رابطة

- In the case of **alkanes sp^3**, the three *2p* orbitals of the carbon atom are combined with its *2s* orbital to form four new orbitals called "**sp^3**" hybrid orbitals.
- Four hybrid orbitals were required since there are four atoms attached to the central carbon atom.
- These new orbitals will have an energy slightly above the *2s* orbital and below the *2p* orbitals as shown in the following illustration. مدارات جديدة طاقة اعلى من ٢s و اقل من ٢ p
- Notice that no change occurred with the *1s* orbital. ما تغير ١s
- **Regular tetrahedron with all H-C-H bond angles of 109.5º.**



Methane

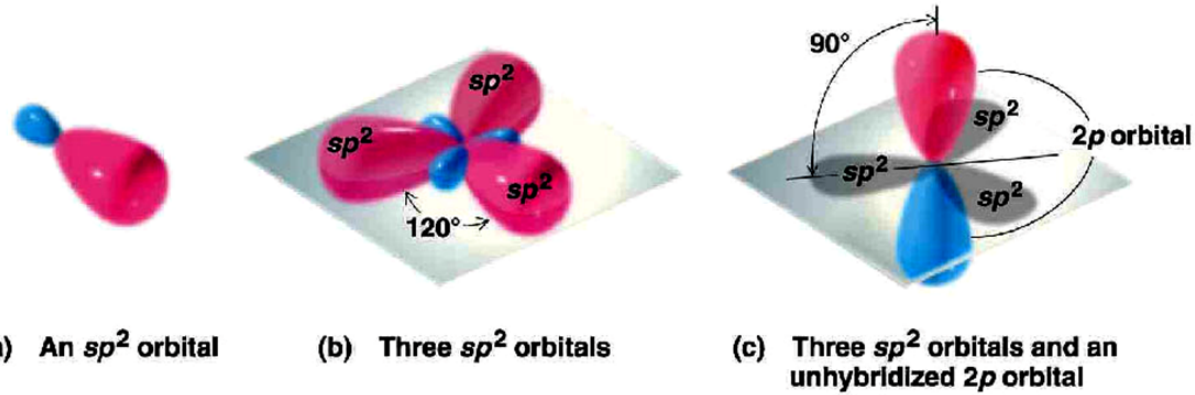
Hybridization (Alkanes *sp*³



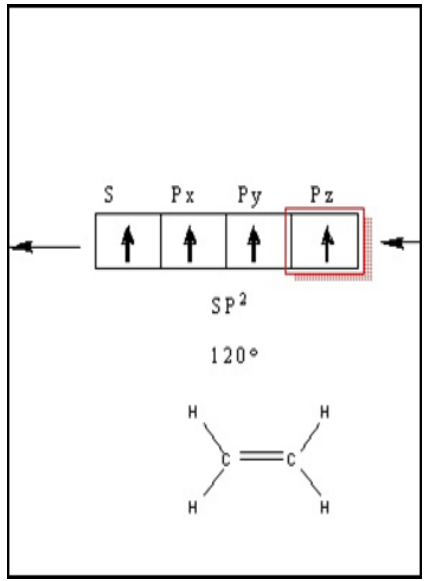
Hybridization (Alkenes sp^2)

رابطتين

- In the case of **alkenes sp^2**, the *2s* orbital is combined with only two of the *2p* orbitals (*since we only need three hybrid orbitals for the three groups. thinking of groups as atoms and non-bonding pairs*) forming three hybrid orbitals called sp^2 hybrid orbitals.
- The other *p*-orbital remains unhybridized and is at right angles to the trigonal planar arrangement of the hybrid orbitals.
- **The trigonal planar** arrangement has **bond angles of**



(a) An sp^2 orbital (b) Three sp^2 orbitals (c) Three sp^2 orbitals and an unhybridized 2*p* orbital

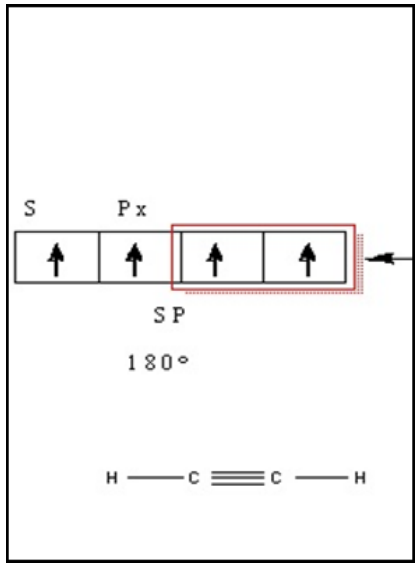


Ethene *(Ethylene)*

رابطة ثلاثية

Hybridization (Alkynes *sp*)

- In the case of **alkynes *sp***, the *2s* orbital is combined with only one of the *2p* orbitals to yield two *sp* hybrid orbitals.
- The two hybrid orbitals will be arranged as far apart as possible from each other with the result being a linear arrangement.
- The two unhybridized *p*-orbitals stay in their respective positions (at right angles to each other) and perpendicular to the **linear** molecule **(180°).**



Ethyne *(Acetylene)*

sp^3	رابطة احادية	75% P 25% S	109.5	Tetrahedral
sp^2	رابطة ثنائية	67% P 33% S	120	Planer
sp	رابطة ثلاثية و ٢ رابطة ثنائية	50% S 50% P	180	Linear

كلما زادت نسبة pكلما زادت طاقة

سبحان الله

الحمدلله

لا إله إلا الله

الله أكبر

Formal Charge

Formal Charge: is the net charge on each atoms of the molecule or ion. (which contain a covalent bond only)

How to calculate the Formal Charge (FC):

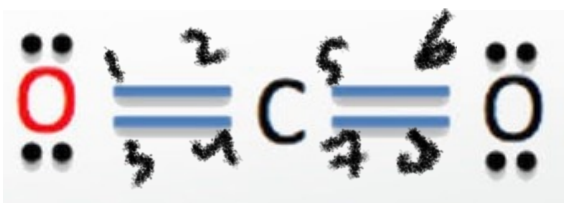
$$FC = \begin{array}{c}\text{Valence } e^- \\ \text{in Free Atom}\end{array} - \left(\begin{array}{c}\text{Total} \\ \text{Nonbonding } e^-\end{array} + \frac{\text{Total Bonding } e^-}{2} \right)$$

في مدار الاخير

Example: calculate the formal charge of CO2

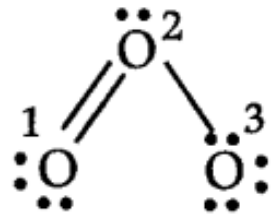
FC for O= 6-(4+4/2)=0

FC for C= 4-(0 + 8/2)= 0



Example:

Lewis structure of O_3 is

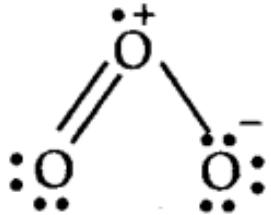


Formal charge on O(1) $= 6 - \left(4 + \frac{4}{2}\right) = 0$

Formal charge on O(2) $= 6 - \left(2 + \frac{6}{2}\right) = +1$

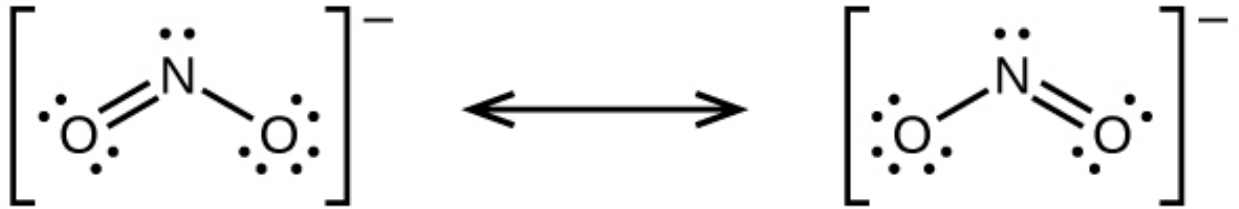
Formal charge on O(3) $= 6 - \left(6 + \frac{2}{2}\right) = -1$

Hence we represent O_3 along with formal charges as follows.



Formal Charg

Example:



$O_1 = 6 - \left(4 + \frac{4}{2}\right) = 0$

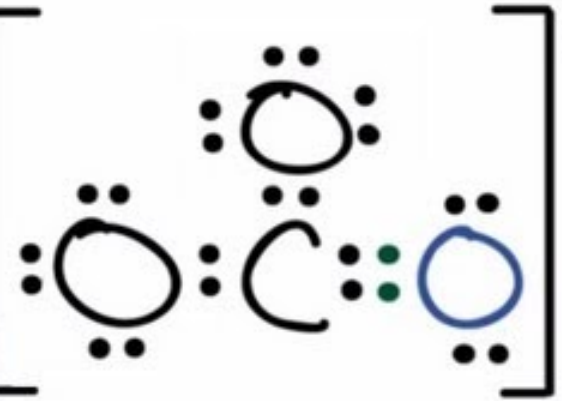
$N = 5 - \left(2 + \frac{6}{2}\right) = 0$

$O_2 = 6 - \left(6 + \frac{2}{2}\right) = -1$

Formal Charg

Example:

CO_3^{2-}



Formal Charge	=	Valence Electrons	-	NonBonding Val Electrons	-	Bonding Electrons / 2		
C	=	4	-	0	-	8/2	=	0
O	=	6	-	6	-	2/2	=	-1
O	=	6	-	4	-	4/2	=	0

structures:

Ex) CO_2

① # ve = 6 + 4 + 6 = 16

② Draw: بحط ذرة اقل كهروسلبية بنص

O — C — O

③ # ve − ①bond

16 − 4 = 12

④ بعبي ذرات بالالكترون وابدأ من الاكثر كهروسلبية

⑤ اذا ve خلصوا بحل مشكل ذرات يصيروا عندهم 8 بلجي استعمال روابط ثنائية وثلاثية

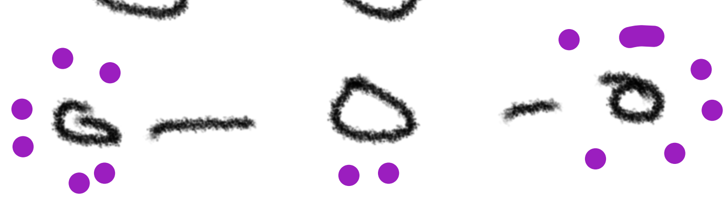
6) F.C زي ما تعلمنا نحسبها

O_3

1) ve = 18

② O — O — O

3) 18 − 4 = 14

4) 

5) 

$(CO_3)^{-2}$

1) # Ve = 18 + 6 = 24

2)

3)

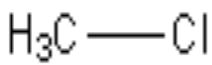
لا حول و لا قوة إلا بالله

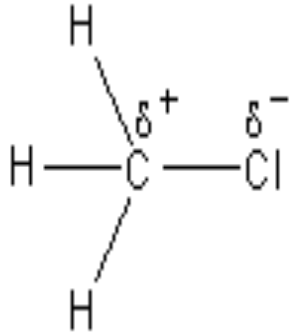
Inductive Effect

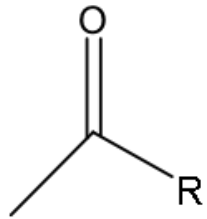
- **Inductive effect** can be defined as ***the permanent displacement of electrons forming a covalent bond (sigma σ bonds) towards the more electronegative element or group*.**
- **The inductive effect is represented by the symbol, the arrow pointing towards the more electronegative element or group of elements.**

(+ I) effect if the substituent electron-donating

(- I) effect if the substituent electron-withdrawing







Electron-donating substituents (+I): -CH_3, -C_2H_5,….

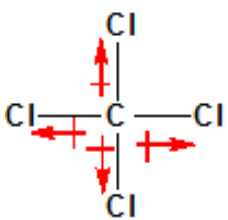
Electron-withdrawing substituents (-I): -NO_2, -CN, -SO_3H, COOH, COOR, NH_2, OH, OCH_3

Bond Polarity and Dipole Moment (μ)

من موجب لسالب
استقطاب لحظي

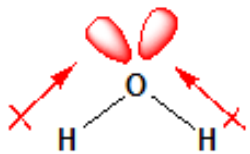
- **Dipole moment** (depends on the inductive effect).
- A bond with the electrons shared equally between two atoms is called a **nonpolar bond** like in Cl-Cl and C-C bond in ethane.
- A bond with the electrons shared unequally between two different elements is called a **polar bond**.
- The **bond polarity** is measured by its dipole moment (μ).
- **Dipole moment (μ)** defined to be the amount of charge separation (+δ and –δ) multiplied by the bond length.

CCl_4



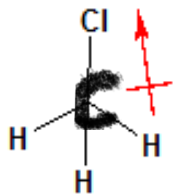
μ = zero

H_2O



μ ≠ zero

CH_3Cl



μ ≠ zero

DM :

ارتجا 1 → δ+ → δ-

$\overset{+}{\longrightarrow}$

2C — F^4 (2)

3S — F^4 (1)

$\overset{+}{\longrightarrow}$

polar bond — هذا حكم

اذا شلي

polar compound

1) polar bond

2) اتجاه

خلينا فهم

$\overset{-\delta}{O} = \overset{+\delta}{C} = \overset{-\delta}{O}$ non polar

$\overset{+}{\longleftarrow}$ $\overset{+}{\longrightarrow}$

مش حفظ و لا إشي منها

Classification According to Functional Group

A functional group is an arrangement of atoms with distinctive **physical** and **chemical** properties.

Table 1.6 The Main Functional Groups

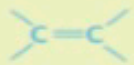
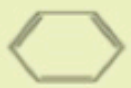
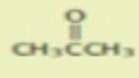
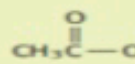
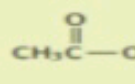
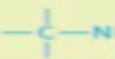
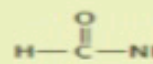
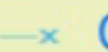
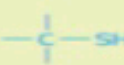
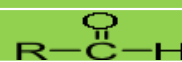
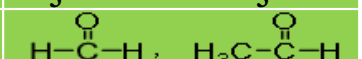
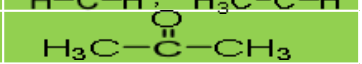
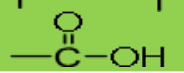
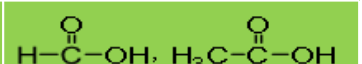
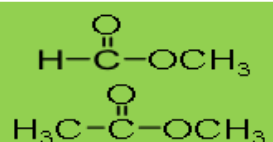
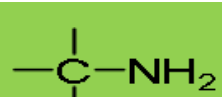
	Structure	Class of compound	Specific example	Common name of the specific example
A. Functional groups that are a part of the molecular framework		alkane	$CH_3—CH_3$	ethane, a component of natural gas
H,c		alkene	$CH_2=CH_2$	ethylene, used to make polyethylene
		alkyne	$HC\equiv CH$	acetylene, used in welwelding
		arene		benzene, raw material for polystyrene and phenol
B. Functional groups containing oxygen				
1. With carbon–oxygen single bonds فيها O		alcohol	CH_3CH_2OH	ethyl alcohol, found in beer, wines, and liquors
		ether	$CH_3CH_2OCH_2CH_3$	diethyl ether, once a common anesthetic

Table 1.6 continued

	Structure	Class of compound	Specific example	Common name of the specific example
*2. With carbon–oxygen double bonds**		aldehyde	$CH_2=O$	formaldehyde, used to preserve biological specimens
		ketone		acetone, a solvent for varnish and rubber cement
3. With single and double carbon–oxygen bonds		carboxylic acid		acetic acid, a component of vinegar
		ester		ethyl acetate, a solvent for nail polish and model airplane glue
*C. Functional groups containing nitrogen***		primary amine	$CH_3CH_2NH_2$	ethylamine, smells like ammonia
		nitrile	$CH_2=CH—C\equiv N$	acrylonitrile, raw material for making Orlon
D. Functional group with oxygen and nitrogen		primary amide		formamide, a softener for paper
E. Functional group with halogen	 Cl	alkyl or aryl halide	CH_3Cl	methyl chloride, refrigerant and local anesthetic
F. Functional groups containing sulfur†		thiol (also called mercaptan)	CH_3SH	methanethiol, has the odor of rotten cabbage
		thioether (also called sulfide)	$(CH_2=CHCH_2)_2S$	diallyl sulfide, has the odor of garlic

Functional Groups

Functional Group is a reactive portion of an organic molecule, an atom, or a group of atoms that confers on the whole molecule its characteristic properties.

Class	General formula	Functional group	Specific
Alkane	RH	C – C (single bond)	$H_3C - CH_3$
Alkene	$R - CH = CH_2$	C = C (double bond)	$H_2C = CH_2$
Alkyne		 (triple bond)	
Alkyl halide	RX	-X (X = F, Cl, Br, I)	H_3C - Cl
Alcohol	R – OH	-OH	H_3C - OH
Ether	R – O –R’	- C- O – C -	$H_3C - O - CH_3$
Aldehyde			
Ketone			
Carboxylic acid			
Ester			
Amine	$R - NH_2$		$H_3C - NH_2$