Date:
17/10/2023

لجان الدفعات

Soul Academy

تفريغ عضويه 1

موضوع المحاضرة: Chapter (1)

رقم المحاضرة : (1)

إعداد الصيدلانيه : Gufran Khaseeb

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.

ex: *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.*

organic

Chapter 1 : Introduction

* The organic chemistry it mean : the carbon compounds.

→ the mean elements in organic chemistry is : C, N, O

+ first slide.

The uniqueness of carbon :

1. the structure of carbon atom
2. the position of carbon in the periodic table (group 4)

الجدول الدوري

these factors enable it to form strong bonds with :

a. other carbon atoms

b. with other elements (H, O, N, halogens ,...etc)

→ each organic compound has it's own characteristic set of physical and chemical properites wich depend of the structure of the molecule.

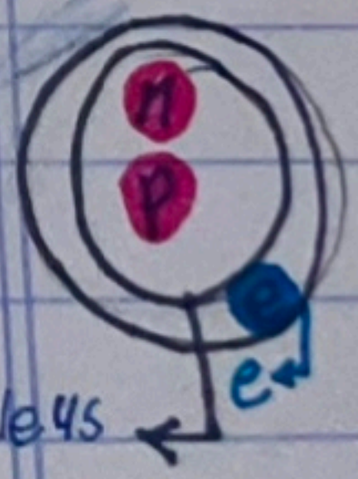
- Li Be B C N O F
- the atoms left of C give up electrons
- the atoms right of C accept electron
- C shares electrons.

* Atoms consist of three main particales (the smallest structure)
  - → neutrons (have no charge) } are found in the nucleus
  - → protons (+) } are found in the nucleus
  - → electrons (−) → found outside of the nucleus. in successive shells (principal energy levels)

رئيسية

→ when th number of electrons = number of protons atoms is electrically neutral

* Atomic number : number of protons and it also the number of electrons when the atom is neutral



(protons and nutrons are ~1837 times the mass of an e^-)

* mass number: the sum of protons and nutrons of an atom

→ Isotops: have the same atomic number but different mass number (^{12}C and ^{13}C)

- the energy levels → capital letters (K, L, M, N)
  → whole numbers (n)
- the maximum capacity of a shell = $2n^2$ (2 electrons) ← number of the energy level

ex: the element C (atomic number) (6)

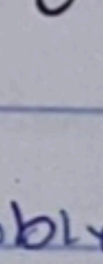
6 electrons are distributed about the nucleus as

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

→ valance electrons: are those electros located in the outermost energy level (the valance shell) and they are involved (مسؤولين) in chimecal reactions.

- electron - dot structure :-

1. the symbol of the element represents the core (جوهر) of the atom.
2. the valance electrons are shown as dots around the symbol



Chemical bonding.

→ the noble gases were stable elements described their lack of reactivity to their having their valance shells filled with electrons.

2 $\bar{e}$ in case of He ← → 8 $\bar{e}$ for other nobel gases

→ in interacting with one anothe atoms can achive a greater degree of stability —by→ rearrangment of the valance electrons

* to acquire the outter-shell structure of the closest noble gas in the perriodic table it when two atoms combin togther in chemical bonding.

reversible (all other Types) ↔ non reversible (covalent bond)

→ Chemical bonging :-

1. Ionic bonds : different elements they form a molecule of compound.

ex: Na + Cl → NaCl
Sodium atom, Chlorine atom, Sodium chloride molecule

→ cations : element at the left of the periodic table give up their valance é and become +ve charged ions.

→ anions : element at the right of the periodic table gain the electrons and become -ve charged ions

(they are oppositely in the periodic table)

* Ionic bond : the electrostatic force of attraction between oppositely charged ions.

ex: $A^{\times}$ + $\cdot\ddot{B}:$ → A^+ + $[\times\cdot\ddot{B}:]^-$
é donor atom, é acceptor atom, cation, anion

[(electrostatic attraction) (Ionic bond)]
$A^+ + [\times\cdot\ddot{B}:] \longrightarrow A^+[\times\cdot\ddot{B}:]^-$

Note:- the majority of ionic compound are inorganic substances

+ slide 12.

2. Covalent bonds : the same element they form a molecule of element

ex: O + O → O_2
oxygen atom, oxygen atom, oxygen molecule

(element that are close to each other in the periodic table attain (اعداد / ترتيب)
the stable noble gas configuration) by sharing valence electrons between them.

* covalent bond : the chimecal bond formed when two atoms share one pair of electrons

→ A shared electrons pair between two atoms or single covelent bond will be represented by dash (—)

(the effect of electronegativity in the ionic bonds)

the electronegtivity measures the ability of an atom to attract electrons :-

note: the reason why ionic bond form faster in elements than other (the electronegativity)

Increasing electronagtivity →

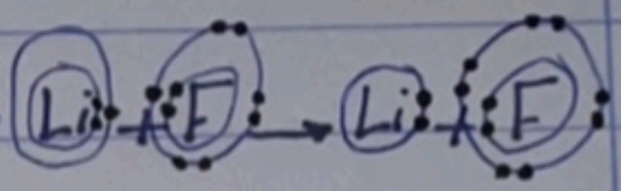
2.1 H O 3.5 F 4

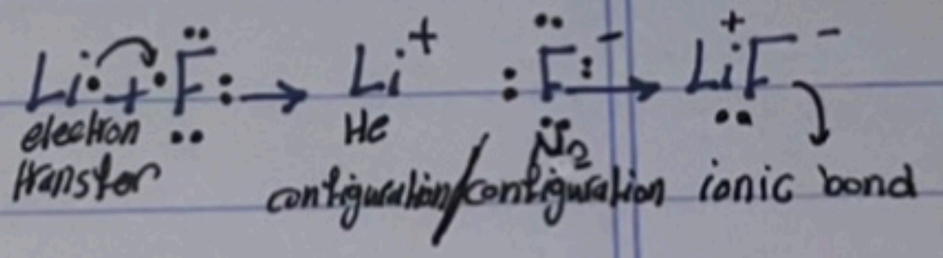
1 Li

0.9 Na

↓ decreasing electronagtivity

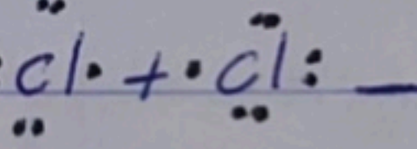
the reason ↘ size of atoms ↑ ∝ the control of nucleus ↓ over elements

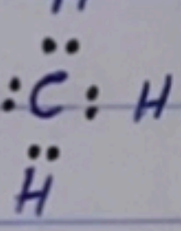
ex: 



* covalent bonds examples:

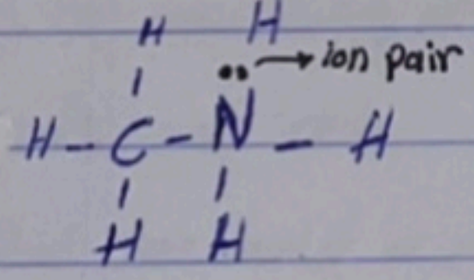
① H_2 : $H\cdot + \cdot H \rightarrow H:H$ or H—H (each H shares two electrons (He configuration)

② Cl_2 : 

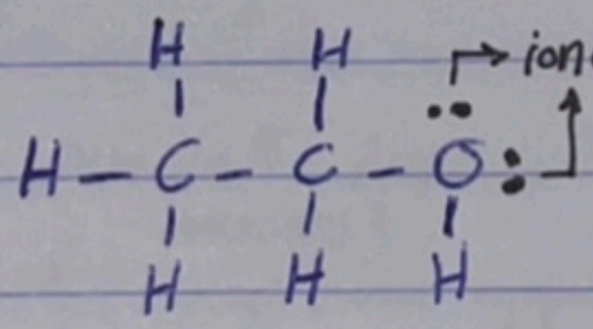
③ 

methane

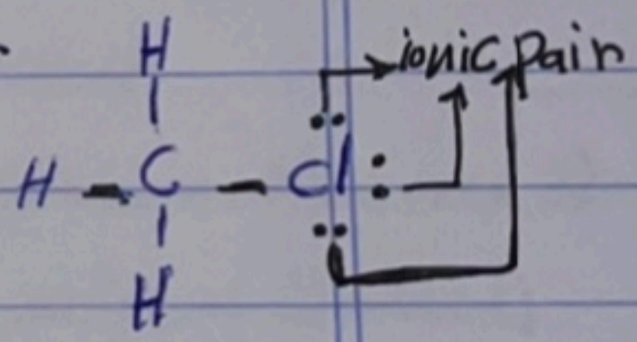
④ $:N:::N$ or $N\equiv N$ (N_2)



methyl amime



ethanol



in covalent bonds:

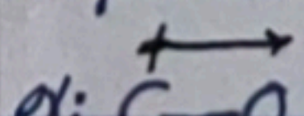
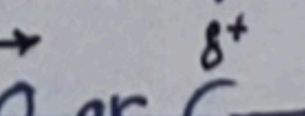
a. molecules that consist of two like atoms :-

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

b. molecules that consist of two unlike atoms :-

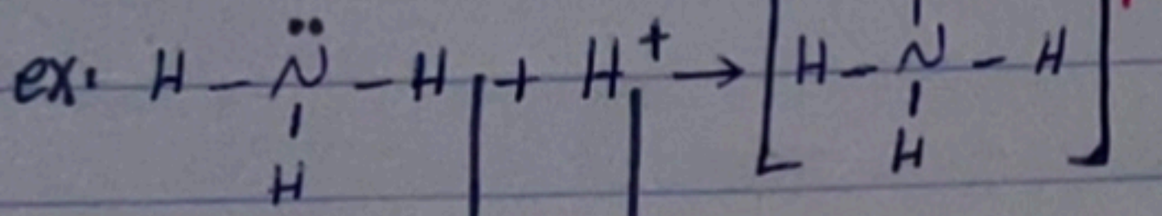
the bonding electrons are no longer shared equally (unequally)

1. polar covalent bond → the more electronegative atom assumes a partical -ve charge (take longer time around it)

ex:  or  → the less electronegative atom assumes a partical +ve charge

2. Coordinate covalent bond:

there are molecules in which one atom supplies (both electrons) to another atom in the formation of the covalent bond

ex: 

lewis base: The species that furnishes the electron pair to form a coordinate covelent bond

lewis acid:- The specis that accepts the electron pair to complete it's valance shell

→ electrons are located in atomic orbitals (s, p, d, f) and it grouped in shells.

* orbitals tell us
  - the energy level of electron
  - the volume of space around the nucleus an electron is most likely to be found.
  - the reactivity of reactions and if the reactions produce compounds or not (e↑ c orbitals↑ c atom size↑ c immpression of the size of compound)

• each orbital can hold a maximum of (2 e and have opposite spin) (not crowded)
(repulsion التنافر)

→ covalence number: the number of covelant bonds that an atom can form with other atom.

the covalance number = the number of electrons need to fill it's valance shell.

ex: elements	nVE	n of electrons in filled VE	covalence number
C	4	8	4
O	6	8	2
F, Cl, Br, I	7	8	1

ملاحظة: كل ما كان الـ orbital أبعد عن الـ nucleus يكون الـ energy level أعلى ← reason لأنه كما يكون أقرب للـ nucleus ← أقوى للـ protons (علاقة تجاذب بين p و e)

Shapes of organic molecules + orbital picture of covalent Bonds

Atomic orbitals :-

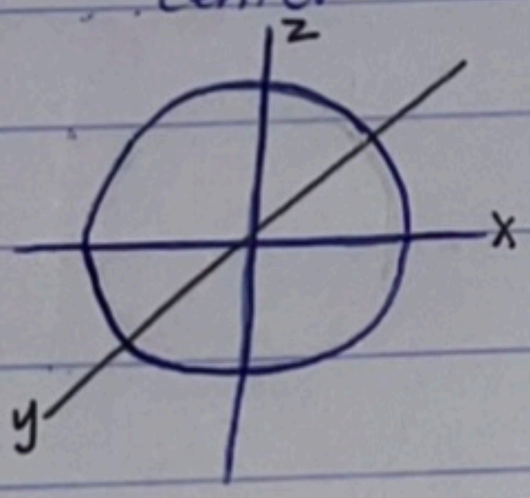
① represent a specific region in space in which an electron is most likely to be found.

② are designated in the order in which they are filled by the letters s, p, d and f.

ex:- K shell has only one 1s orbital

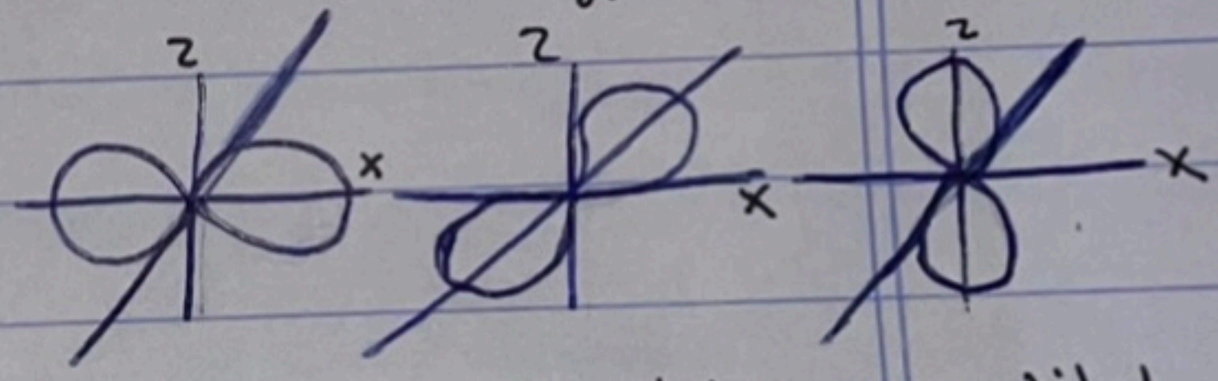
L shell has one 2s and 3 2p ($2p_x$, $2p_y$, $2p_z$)

↓ an s orbital
spherically shaped
electrons could with the atomic nucleus and it's center.



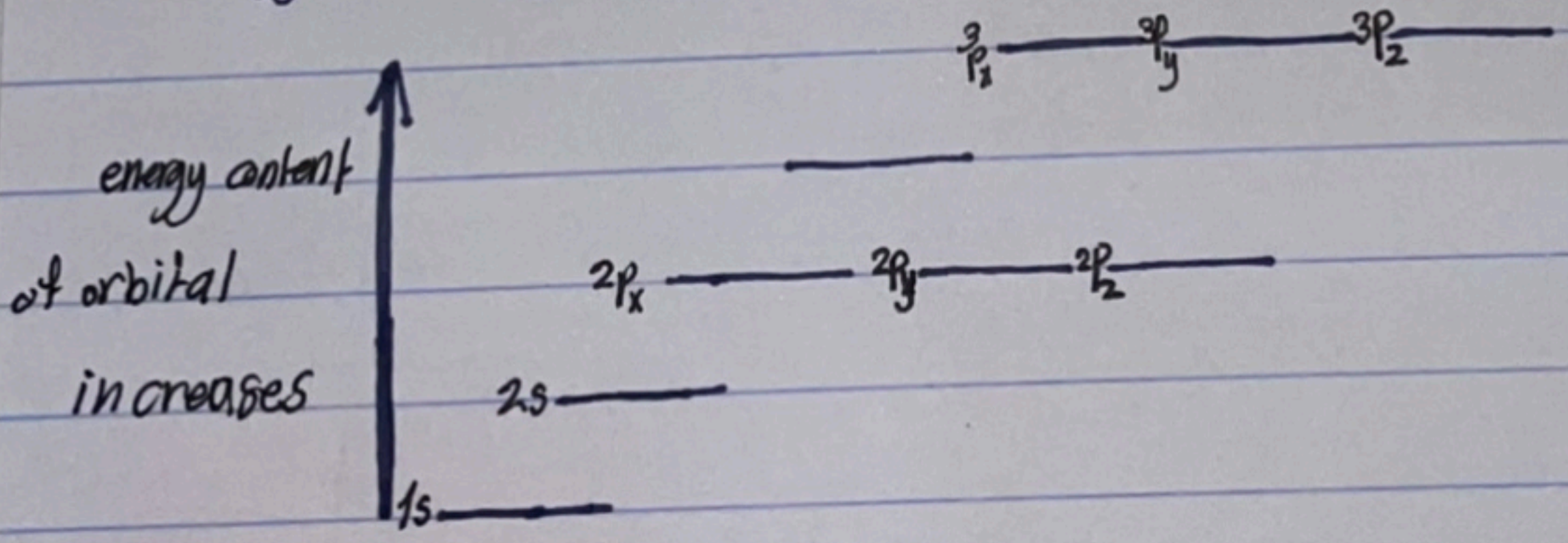
↓ a p orbital
dumbbell-shaped
electron could with the nucleus between the two lobes.

each p orbital oriented along one of three perpandicular coordinate axes (in the x, y, z direction)



P_x orbital P_y orbital P_z orbital

An energy level diagram of atomic orbitals



→ when filling the atmic orbitals, Keep in mind that

(1) An atomic orbital contain no more 2é

(2) é fill orbitals of lower energy (3) No orbital is filled by 2é until all the orbitals or equal energy have at least one electron.

+slide 24

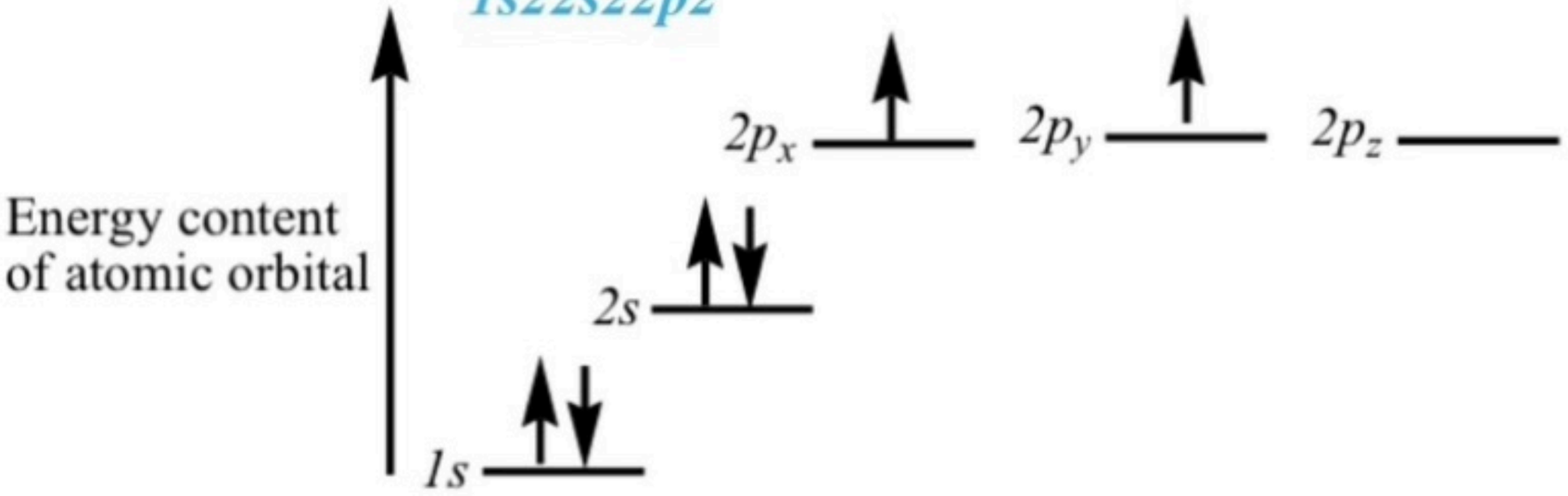
Shapes of Organic Molecules: Orbital Picture of Covalent Bonds

Atomic Orbitals

- The electronic configuration of carbon (atomic number 6) can be represented as

1s22s2sp1x2p1y or

1s22s22p2



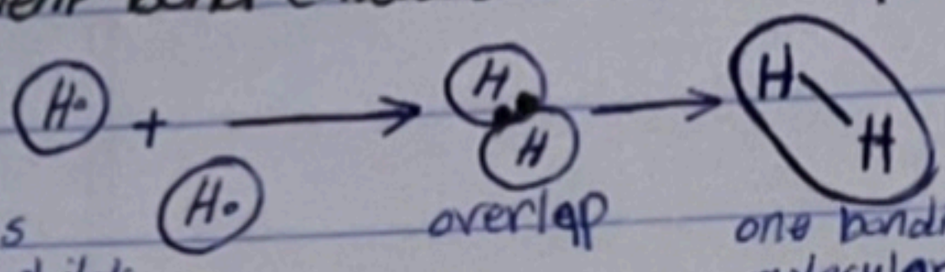
Energy level diagram for carbon.

slide 24

by: Gufran Khaseeb

* molecular orbitals:

A covalent bond consists of the overlap between two atomic orbitals

ex: 

Two 1s atomic orbitals — overlap — one bonding sigma molecular orbital

sigma bond (σ bonds) can be formed from: (in single bond)

- the overlap two S atomic orbitals
- the end-on overlap of two patomic obitals
- the overlap of two S atomic orbitals and with a p atmic orbital
- the end-on overlap of two p atomic orbitals

pi bond (π bond) can be formed from the side-side overlap between two p atomic orbitals. (in double bond)

Bond energy and Bond length:

+ slide 26

(ionic bond):

ex: it's a strong bond when the drug bind with receptor in body and the drug have any element contan ionic bond ← the concantration of the body

(ionic bond):

if any drug have element contain a ionic bond and this drug bind with the body

1. the concentration of the drug is low → the drug is effective.

* the H can't be molecule in nutral (it just elements)

O : group 6

S : group 7

Cl : group 7

C : group 4

example in orbitals:-

a drug has C, H, N + carboxylic acid bond with the receptor (enzyme)

↳ size ↑, more interaction

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)**

  The amount of energy released when a bond is formed.

- **Bond dissociation energy**

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

- **Bond length**

  The distance between nuclei in the molecular structure.

oppisit

slide 26

→ commonly it too high

note :- all the distance was shorter → repulsion → clashing → becuse of nucleus