Introduction

Matter: Everything occupies a place in space and has a mass.

Atom: The smallest particle in the substance is involved in the chemical reaction.

The smallest part of a substance that can exist individually may consist of more than one atom called the molecule. If the molecule of matter contains similar atoms (Example, H_2, Cl_2, N_2), it is an element, but if it contains atoms for different elements it is a compound (Example, H_2O, CO_2).

Molecular: the smallest part of the material carries the properties of that matte.

Atomic number = number of protons= number of Elections

Number of mass = number of protons + number of neutrons

Then number of mass = atomic number + number of neutrons

Number of neutrons = number of mass - atomic number

Example: The atomic number of carbon equals 6 and the mass number is equal to 12, Find the number of neutrons in the carbon atom?

Answer:

Number of neutrons = number of mass - atomic number

Number of neutrons = 12-6 = 6

Group	Number of Proton	Number of Mass	Number of neutron
^{14}N	7	14	7
^{39}K	19	39	20
^{20}Ne	10	20	?
^{23}Na	11	23	?

Electronic structure of the atom

Before the arrival of the scientific of Bohr and several other scientists, the common of the electronic structure of the atom was wrong until the scientific chemical came that's name Bohr and developed a theory named after it related to the electronic composition of the atom formerly known as classical theory.

Classical theory

One of the drawbacks of this theory is its interpretation. The electron is considered to lose energy when it revolves around the nucleus because of the force of attracting the nucleus. Therefore, it will move a helical movement and thus the atoms will gradually fade until the ~~world~~ Scientist comes to light and develop the theory which states as follows:

Bohr Theory

1. The atom consists of a nucleus surrounded by electrons.
2. Electrons rotate around the nucleus in specific circular orbits. These orbits have a specific radius, so these orbits have specific energy.
3. The energy of the level increases by increasing the distance from the nucleus. For example, the first main energy level is less energy than the second energy level, so the electron moves between energy levels when it is gain or loses energy.

Quantum theory

The orbits can be named according to a quantitative number, which is the principle quantum number (n) and takes positive integers equal to 1, 2, 3, 4,5, 6, 7 and each denotes a certain energy level and does not take n (zero).

Atom shell : K, L, M, N, O, P, Q

The value of n: 1, 2, 3, 4, 5, 6, 7

$\longrightarrow$

Increase energy

The greater the value of n, the greater the distance away from the nucleus and the increased the energy

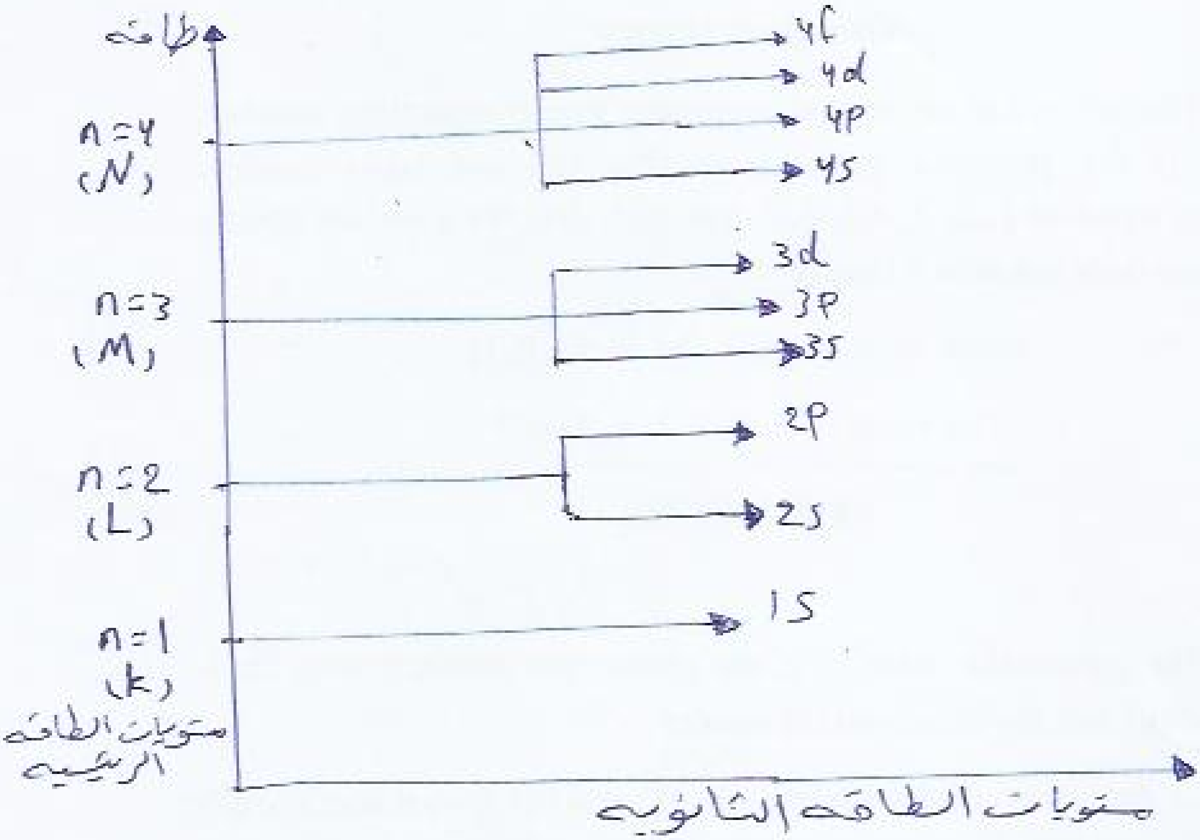
(n= 1) is the lowest of the nucleus (n = 1) and the lowest energy, (n=7) is the farthest from the nucleus, the most energy and the least connected to the nucleus, which facilitates loss.

Add another quantitative number, which is the secondary quantum number, denoted by ℓ (specify the shape of the orbital) and that l is associated with (n) with the following relation:

$\ell = (n-1)$

The main energy levels (K, L, M, N, O, P, Q) have secondary energy levels marked by letters s, p, d, f

These levels differ in terms of shape and number of electrons, since Orbital s has a spherical shape, either p has three orbitals, and each orbital is composed of two equal classes distributed in the vacuum (Px, Py, Pz)



Secondary levels contain a group of orpils symbolized by the square □

$\ell = 0$ **s** اوربيتال واحد

$\ell = 1$ **p** ثلاثه اوربيتالات

$\ell = 2$ **d** خمسه اوربيتالات

$\ell = 3$ **f** سبعه اوربيتالات

Examples:

When n = 1 the first shell is k, then ℓ is equal to zero, and the presence of Orbital s (saturated with electrons)

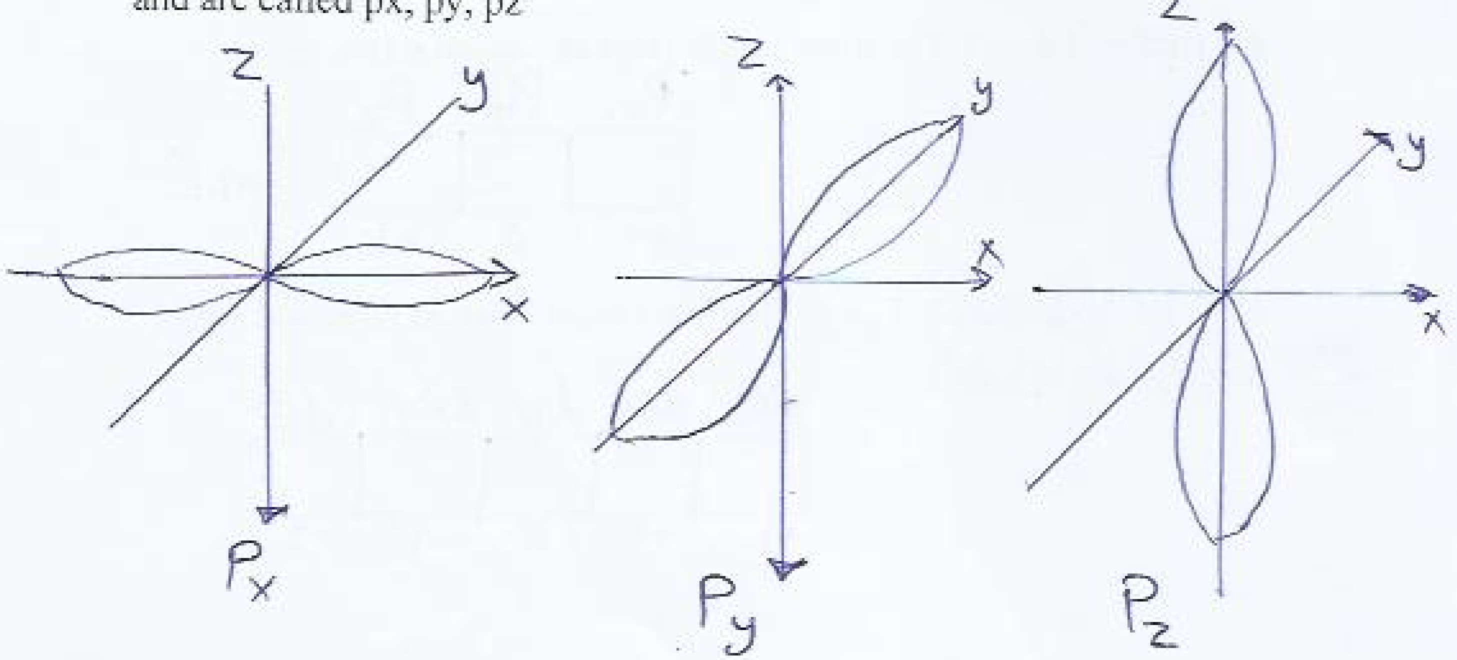
When n = 2 the second shell is L, then ℓ is equal to one and the presence of Orbitalin s, p (saturated with 8 electrons)

When n = 3, the third shell is M, then ℓ is equal to 0, 1, 2 and there are three orthotypes of type s, p, d (saturated by 18 electrons).

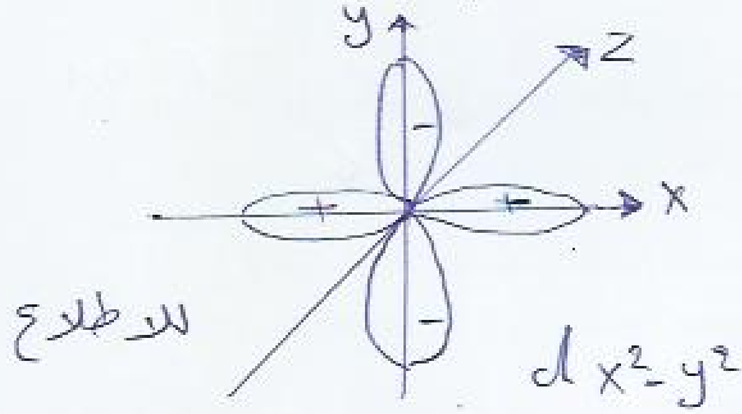
When n = 4, the fourth shell is N, then ℓ is equal to 0, 1, 2, 3 and there are four orthotypes of type s, p, d, f (saturated with 32 electrons).

A third number is called magnetic quantum number (ml) and indicates that the orpitals formed from more than one section, such as orbital, p, d, f are similar in shape and energy but different in direction.

For example, the three p-orbitals are oriented in axes x, y, z and are called px, py, pz



The five d orbital are different in the space direction and are therefore called dxy, dxz, dyz, dx^2-y^2, dz^2.



Since $m\ell$ is derived from ℓ (Secondary quantum number)

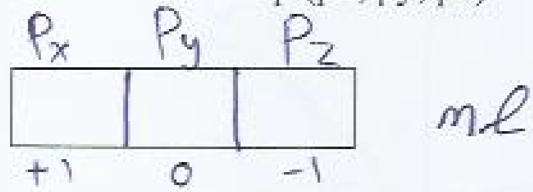
The number value of the magnetic quantum number

$m\ell = +l, ... -l$, including zero.

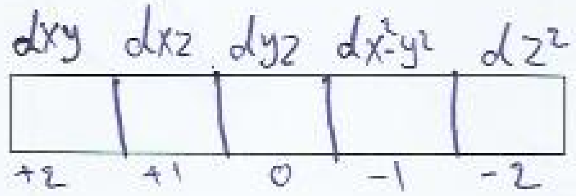
Example:

$\ell = 0$ $m\ell = 0$ Orbital s   قيمة واحدة $m\ell$

$\ell = 1$ $m\ell = -1,0,+1$ The three values refer to Orbital p (px, py, pz)



$\ell = 2$ $m\ell = -2, -1,0, +1, +2$ The five values refer to Orbital d (dxy, dxz, dyz, dx^2-y^2, dz^2)



The quantum number or spin quantum number (ms) is found to distinguish the electron to the right or to the left

ms (+1/2) will rotate to the right and will thus be half the arrow to the top

ms (-1/2) will rotate to the left and so will be half the arrow down

تطبيقية
Practical examples using quantum numbers

Note: There are two rules to observe during application.

1- The Hond rule:

Equivalent distribution of electrons on equal energy-powered orpital (p, d, f) and not couple unless necessary.

للاستبعاد
2 - Pauli rule for exclusion:

The two electrons in one atom can not have the same four quantum numbers, meaning that each orbital absorbs two electrons with opposite motion: [↑↓] ↑ $m_s = +\frac{1}{2}$, ↓ $m_s = -\frac{1}{2}$

Example: Write the four quantum numbers of the three electrons of the Li atom 3, indicating the symbol of the orbital and the type of the shell.

Answer:

$^{3}Li\ 1s^2\ 2s^1$

[↑↓] [↑]

رقم الالكترون	n	l	ml	ms	اوربيتال	الغلاف
الاول	1	0	0	$+\frac{1}{2}$	1s	K
الثاني	1	0	0	$-\frac{1}{2}$	1s	K
الثالث	2	0	0	$+\frac{1}{2}$	2s	L

Example: Write the four quantum numbers of the seven electrons of the nitrogen atom. Its atomic number 7 is a component of the second period, indicating the symbol of the orbital and the type of the shell.

Answer: $_{7}N$ $1s^2$ $2s^2$ $2p^3$ (p_x p_y p_z)

[↑↓] [↑↓] [↑|↑|↑]

Electron NO.	n	ℓ	mℓ	ms	orbital	shell
1	1	0	0	$+\frac{1}{2}$	1s	K
2	1	0	0	$-\frac{1}{2}$	1s	K
3	2	0	0	$+\frac{1}{2}$	2s	L
4	2	0	0	$-\frac{1}{2}$	2s	L
5	2	1	+1	$+\frac{1}{2}$	2p	L
6	2	1	0	$+\frac{1}{2}$	2p	L
7	2	1	-1	$+\frac{1}{2}$	2p	L