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A new approach to the study of atomic structure and quantum numbers

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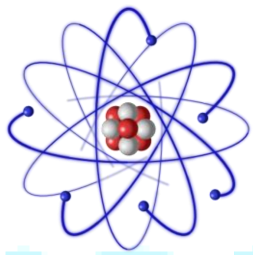
Abstract: *This article deals with the main fields of study in chemistry: the atom, atomic structure, and quantum numbers. The article also discusses teaching methods in the above areas.*

Keywords: *Atom. Quantum, quantum numbers, Chemistry, matter, electron, particle, energy level.*

1. Introduction

Chemistry is one of the natural sciences that studies the entire universe, its extremely diverse forms, and the various phenomena that take place in the universe. The whole universe exists objectively outside the human mind and independently of it. Every being in the universe is a different kind of being that is always in motion. These species can interact to form other species. In chemistry, a type of being that has certain properties that do not change under certain conditions is called a substance. Matter is made up of molecules and atoms. A closer look at the structure of the atom reveals that electrons have two different natures. It has both particle and wave properties. An electron is a particle of a certain mass and moving at great speed. However, the electron has the properties of a wave, yes, it travels across the entire volume of the atom and can be in any part of a certain space around the atomic nucleus.



An atom (In Greek atomos - indivisible) is the smallest particle that contains all the properties of a chemical element. The internal structure of this particle, originally called "indivisible", is much more complex. An atom consists of a positively charged base (nucleus) and electrons moving around the nucleus. Further research into the structure of the atom has shown that electrons have two different natures. It has both particle and wave properties. An electron is a particle of a certain mass and moving at great speed. Understanding the order in which the energy steps and steps in an atom are filled with electrons can be difficult for some students, applicants, and even teachers.

We have taken a new approach to this topic;

a) electronic floors-building floors

b) Stairs - houses

c) Assume that the orbitals are rooms

The symbol for each floor number is KLMNOPQRST

There are a certain number of houses on the first floor - s p d f g…. Each floor has a certain number of houses and they have a certain number of rooms. Each cell contains electrons. The electrons in the house are first filled in an odd state and then take in a double state

The order in which the layers are filled with electrons:

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$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^{10}\ 5p^6\ 6s^2\ 5d^1\ 4f^{14}\ 5d^{10}\ 6p^6\ 7s^2\ 6d^{1,2}\ 5f^{14}\ 6d^{10}\ 7p^6$

The motion of electrons is described by four quantum numbers.

№	Quantum numbers	What defines	Sign
1	General	Electronic energy quality. The number of orbitals	N
2	Orbital	Electronic cloud shape and energy state	L
3	Magnet	The direction of the electron cloud in space	M
4	Spin	Which direction the electron rotates around its axis	S

The radius of the atom is also very small: ~ 10-10 m (or ~ 0.1 nm). For example, if the radius of a hydrogen atom is 0.053 nm (nanometers), the radius of a silver atom is 0.144 nm. The radius of the nucleus is about 10-4–10-5 nm, which is about 105 times smaller (100,000) than that of the atom.

1. The principal quantum number is nn = l, 2, 3, 4, 5 ... KLMN O ... The smaller the value of the principal quantum number, the greater the binding energy of electrons to the nucleus from the same steps. The number of electrons in each energy step is given by the formula 2n2.

2. Orbital Quantum Number - l The orbital quantum number represents the energy of the electrons in the energy steps or the shape of the electron "clouds". The value of the orbital quantum number ranges from 0 to n-1

The number of electrons in the steps is given by the formula: 2 (21 + 1).

3. Magnetic quantum number- m. The magnetic quantum number represents the position of the electrons in the atom or the position of the electron "clouds" relative to the magnetic field. The numerical value of a magnetic quantum number is in the range of +1 to -1.

When 1 = 0, m = 0;

When l = 1, m = + l, 0, -l;

When l = 2, m = + 2, + l, 0, -l, -2.

The number of energy cells in the energy level is determined by n2.

For example, when n = 4, there are 42 = 16 cells.

4. Spin quantum number - s The quantum number spin represents the rotation of an electron around its axis. Its numerical value is + 1/2 for one electron and +1/2 and -1/2 for two electrons.

An atom cannot have two electrons with the same value of four quantum numbers. If there are two electrons with the same quantum numbers n, l, m, they will definitely be different because their spins are opposite (Pauli's principle).

The empty cells in the cells are first filled to the maximum with one electron, and then the remaining electrons begin to pair in order.

In general, the order in which the energy shell and the shells are filled with electrons can be described as follows:

The filling of electrons in the steps is determined according to the rule of VM Klechkovsky (1900-1972). Accordingly, the electrons fill the electron beams in the following order. The order in which cells in electron shells are filled with electrons follows Hund's rule. The electrons first fill the cells in an odd state. For example, each of the 2p cells is occupied by odd electrons, and the added electrons are paired with odd electrons.

General quantum number (n) (energy level)	Orbital quantum son (l) (energetic level)	Quantum magnetic field (m)
K n=1	s l=0	0
L n=2	s l=0 p l=1	0 -1 0 1
M n=3	s l=0 p l=1 d l=2	0 -1 0 1 -2 -1 0 1 2
N n=4	s l=0 p l=1 d l=2 f l=3	0 -1 0 1 -2 -1 0 1 2 -3 -2 -1 0 1 2 3

Elements that deviate from this order of filling: Cr, Cu, Nb, Mo, Ru, Rh, Pd, Ag, Pt. Au

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