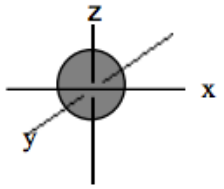
The Bonding and Molecular Structure of Organic Chemicals

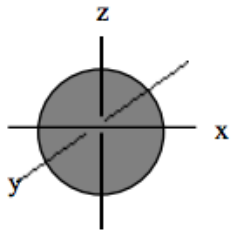
The atomic theory of electrons began in the early 1900s and gained acceptance around 1926 after Heisenberg and Schroedinger found mathematical solutions to the electronic energy levels found in atoms, the field is now called quantum mechanics. Electrons exist in energy levels that surround the nucleus of the atom. The energy of these levels increases as they get farther from the nucleus. The energy levels are called shells, and within these shells are other energy levels, called subshells or orbitals., that contain up to two electrons. The calculations from atomic theory give the following results for electron energy and orbitals. The results for the first two energy levels (shells 1 and 2) are the most important for bonding in organic chemistry.

	Orbitals				
Shell	s	p	d	f	Total Electrons Possible
1	1				2
2	2	3			8
3	3	3	5		18
4	1	3	5	7	32

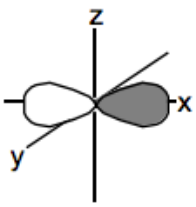
The energy levels of atomic orbitals can be seen below. The energy level-1 includes up to two electrons in spherical orbital named 1s, and energy level-2 holds up to eight electrons, built by two electrons in 2s orbital six electrons in 2p orbital which is divided into three differently directed 2p orbitals ($2p_x$, $2p_y$, and $2p_z$). The p-orbitals have a barbell type shape and are aligned along the x, y, and z axes. They are thus named the p_x, p_y, and p_z orbitals, as shown below.



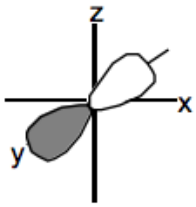
1s orbital



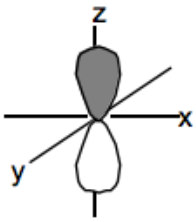
2s orbital



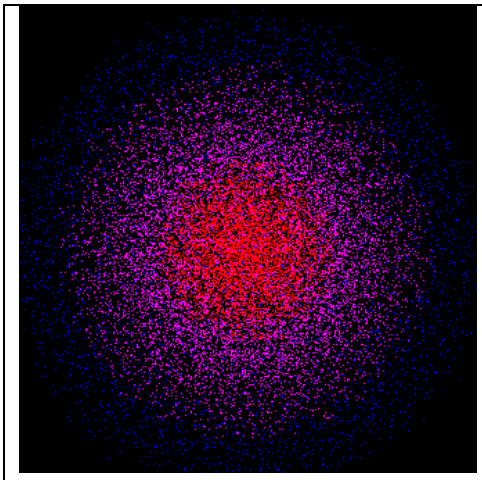
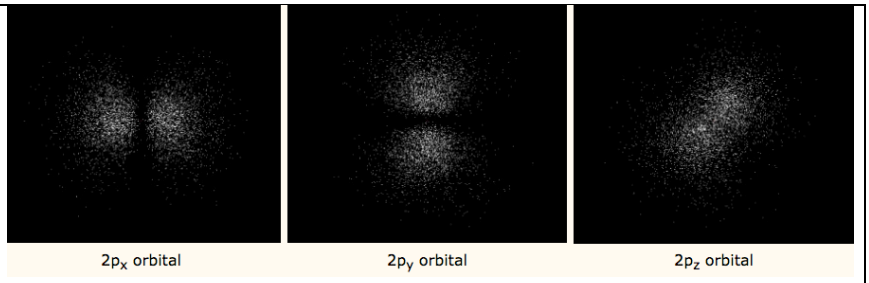
2px orbital



2py orbital



2pz orbital

	
1s Orbital	2p Orbitals

As it may be seen that the energy level-3 allows up to eighteen electrons in where two electrons in 3s, six electrons in three 3p, and ten electrons in five 3d orbitals, respectively. The latter one is 3n3rgy level-4 contains up to 32 electrons according the sequence-filled rules mentioned previously. Here, two electrons in 4s orbital, six electrons in the three 4p orbitals, 10 electrons in the five 4d orbitals, and finally, 14 electrons in the seven 4f orbitals, are managed to make different elements as shown in the periodic table. The filled electrons are tent to be in a lower energy states until all of the electrons are repetitively used. This is called “Aufbau Principle”. An element comprises the number of electrons is equivalent to its atomic number. For the first and second row elements the electron configurations are relatively modest. The below Table indicates the basic sequence of the atomic configuration of the known elements.

Element	Atomic Number	Electron Configuration
Hydrogen (H)	1	$1s^1$ (First shell, one electron)
Helium (He)	2	$1s^2$
Lithium (Li)	3	$1s^2$, $2s^1$
Beryllium (Be)	4	$1s^2$, $2s^2$
Boron (B)	5	$1s^2$, $2s^2$, $2p^1$
Carbon (C)	6	$1s^2$, $2s^2$, $2p^2$
Nitrogen (N)	7	$1s^2$, $2s^2$, $2p^3$
Oxygen (O)	8	$1s^2$, $2s^2$, $2p^4$
Fluorine (F)	9	$1s^2$, $2s^2$, $2p^5$
Neon	10	$1s^2$, $2s^2$, $2p^6$ (Inert, completely filled)