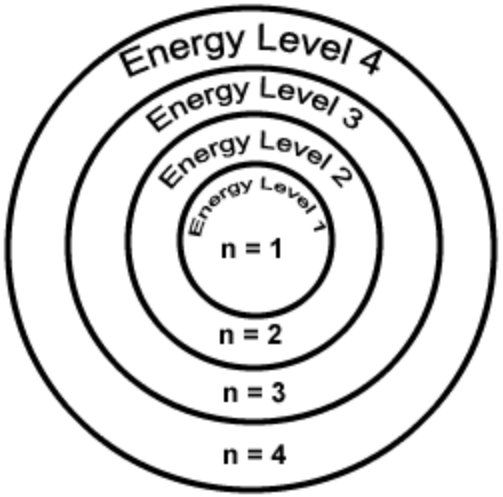
Electron Orbitals

Quantum Numbers specify the properties of atomic orbitals and the properties of the electrons in orbitals
Orbitals are regions inside an energy level where the probability of finding an electron is very high.



Principal Quantum Number (n)	Sublevels in main energy level (n sublevels)	Number of orbitals (n^2)	Number of electrons per sublevel	Number of electrons per main energy level ($2n^2$)
1	s	1	2	2
2	s p	1 3	2 6	8
3	s p d	1 3 5	2 6 10	18
4	s p d f	1 3 5 7	2 6 10 14	32

A. Principal Quantum Number (n)
   1. Indicates the main energy levels occupied by the electron
   2. Values of n are positive integers
      a. n=1 is closest to the nucleus, and lowest in energy
   3. The number of orbitals possible per energy level (or "shell") is equal to n^2

B. Angular Momentum Quantum Number
   1. Indicates the shape of the orbital
   2. Number of orbital shapes = n
   a. Shapes are designated *s, p, d, f*

C. Spin Quantum Number
   1. Indicates the fundamental spin states of an electron in an orbital
   2. Two possible values for spin, +1/2, -1/2
   3. A single orbital can contain only two electrons, which must have opposite spin

Electron Configurations

1. Aufbau Principle
   a. An electron occupies the lowest-energy orbital that can receive it
2. Hund's Rule
   a. Orbitals of equal energy are each occupied by one electron before any orbital is occupied by a second electron, and all electrons in singly occupied orbitals must have the same spin
3. Octet
   a. Highest energy level *s* and *p* electrons are filled (8 electrons)
   b. Characteristic of noble gases, Group 18
4. Noble gas configuration
   a. Outer main energy level fully occupied, usually (except for He) by eight electrons
   b. This configuration has extra stability

Element	**Configuration notation**	**Orbital notation**	**Noble gas notation**
Lithium	$1s^2 2s^1$	____ ____ ____ ____ ____ 1s 2s 2p	$[He]2s^1$
Beryllium	$1s^2 2s^2$	____ ____ ____ ____ ____ 1s 2s 2p	$[He]2s^2$
Boron	$1s^2 2s^2 p^1$	____ ____ ____ ____ ____ 1s 2s 2p	$[He]2s^2 p^1$
Carbon	$1s^2 2s^2 p^2$	____ ____ ____ ____ ____ 1s 2s 2p	$[He]2s^2 p^2$
Nitrogen	$1s^2 2s^2 p^3$	____ ____ ____ ____ ____ 1s 2s 2p	$[He]2s^2 p^3$
Oxygen	$1s^2 2s^2 p^4$	____ ____ ____ ____ ____ 1s 2s 2p	$[He]2s^2 p^4$
Fluorine	$1s^2 2s^2 p^5$	____ ____ ____ ____ ____ 1s 2s 2p	$[He]2s^2 p^5$
Neon	$1s^2 2s^2 p^6$	____ ____ ____ ____ ____ 1s 2s 2p	$[He]2s^2 p^6$