Orbital Notation, Aufbau's Principle, Hund's Rule,and Pauli's Exclusion Principle

Schrodinger (1926)- devised a mathematical equation that identifies the 3D region where an electron may exist. He called this 3D region an ORBITAL.

Energy Level:

Sublevels are made of ORBITALS

INCREASING ENERGY →

s	p	d	f
Shape:	Shape:	Shape:	Shape:
# of Orbitals:	# of Orbitals:	# of Orbitals:	# of Orbitals:

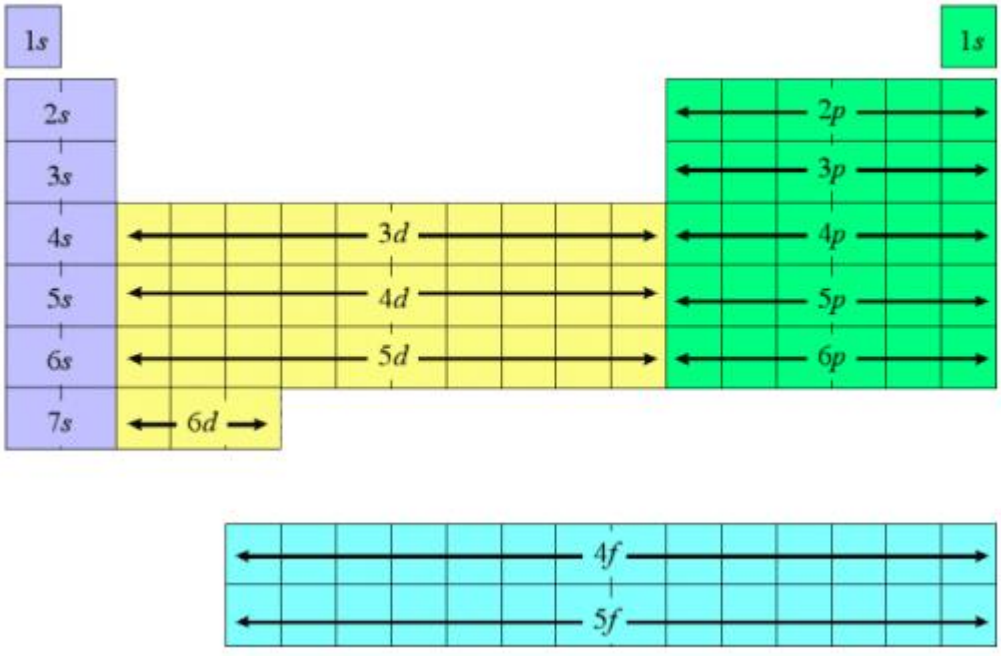
Orbitals can hold a maximum of 2 electrons each.

Aufbau's Principle – Electrons fill energy levels and orbitals from the lowest energy to the highest energy

Energy level 1 has an S orbital called 1s
Energy level 2 has S and P Orbitals called 2s and 2p
Energy level 3 has S, P, and D Orbitals called 3s, 3p, and 3d
Energy level 4 has S, P, D and F Orbitals called 4s, 4p, 4d, and 4f

USE periodic table to show how electrons fill according to energy levels.

1s 2s 2p 3s 3p 4s <u>3d</u> 4p 5s <u>4d</u> 5p 6s <u>4f 5d</u> 6p 7s <u>5f 6d</u> 7p



The periodic table tells the order in which the electrons fill. (D = Energy level -1 and F = Energy level – 2)

Hund's Rule – Electrons enter orbitals of equal energy one at a time to minimize repulsion

Pauli's Exclusion Principle – Each orbital can hold two electrons with opposite spins

Orbital Spin Diagrams:

1. Draw orbital lines/boxes for each orbital in each energy level.
2. Determine the number of electrons in the atom.
3. Fill the orbitals following Aufbau's Principle, Hund's rule and Pauli's Exclusion Principle.

Cl : p^+ _____ e^- _____

N : p^+ _____ e^- _____

Al : p^+ _____ e^- _____

O : p^+ _____ e^- _____

K : p^+ _____ e^- _____

V : p^+ _____ e^- _____

Table that shows energy levels and maximum amount of electrons each can occupy.

Energy Level (n)	# of Sublevels	Sublevels	# of Orbitals	Total # of Orbitals (n^2)	# of Electrons in each Sublevel	Total # of Electrons in Energy Level ($2n^2$)
1	1	s	1	1	2	2
2	2	s	1	4	2	8
		p	3		6	
3	3	s	1	9	2	18
		p	3		6	
		d	5		10	
4	4	s	1	16	2	32
		p	3		6	
		d	5		10	
		f	7		14	