Do Now

- Get your lab book
- Check that your grades match what's online.
- Let me know if there are any errors.

Alkali Metals in Water

Tonight:
Watch Khan Academy Videos:
1) Orbitals:
https://www.khanacademy.org/science/chemistry/electronic-structure-of-atoms/new-topic-2015-01-24T18:25:43.072Z/v/orbitals
2) More Orbitals and electron configuration:
https://www.khanacademy.org/science/chemistry/electronic-structure-of-atoms/new-topic-2015-01-24T18:25:43.072Z/v/more-on-orbitals-and-electron-configuration

Ch. 5 Guiding ?s

- How are electrons (e-) arranged around the nucleus?
- How does the behavior of an element depend on the number of electrons that it has?
- How are the wavelength and frequency of light related?

Rutherford

- Electrons move around the nucleus like the planet around the sun.

Incomplete Model

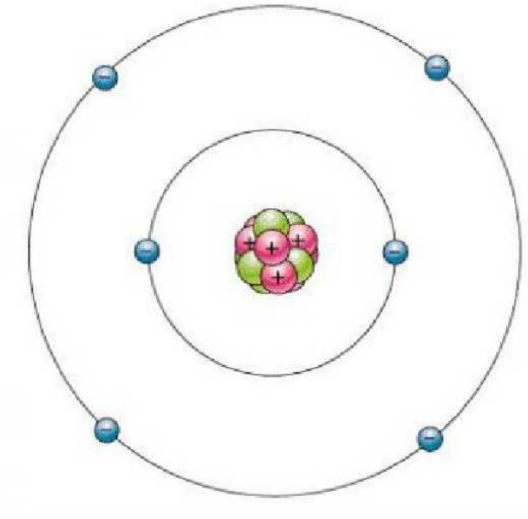
- Couldn't explain the behavior of electrons in atoms.
- Couldn't explain chemical properties of elements.
- Couldn't explain why metals glow when heated.

Niels Bohr

- Student of Rutherford.
- Electrons have fixed paths that they travel around the nucleus.

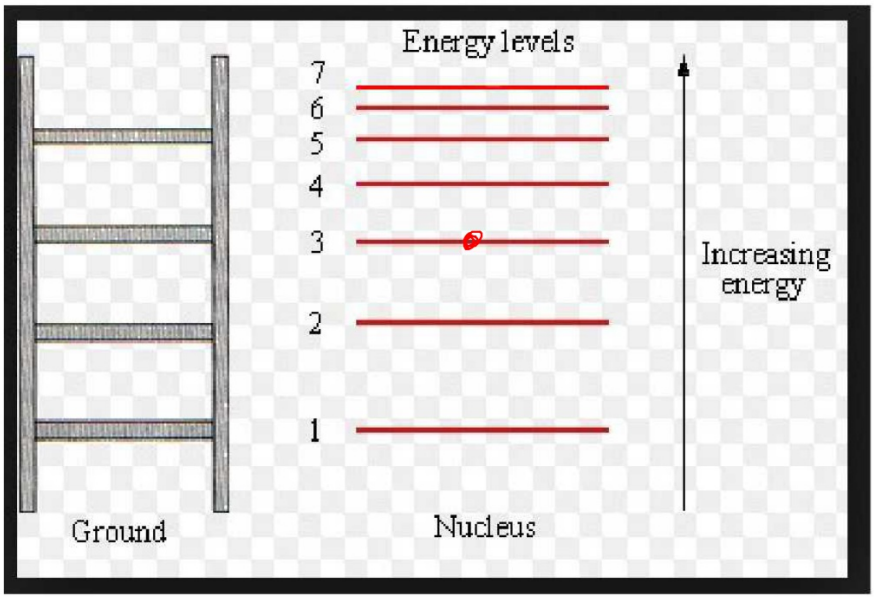
Bohr Model

- Specific, circular paths for electrons.
- Each orbit has a particular energy level.



Bohr Model

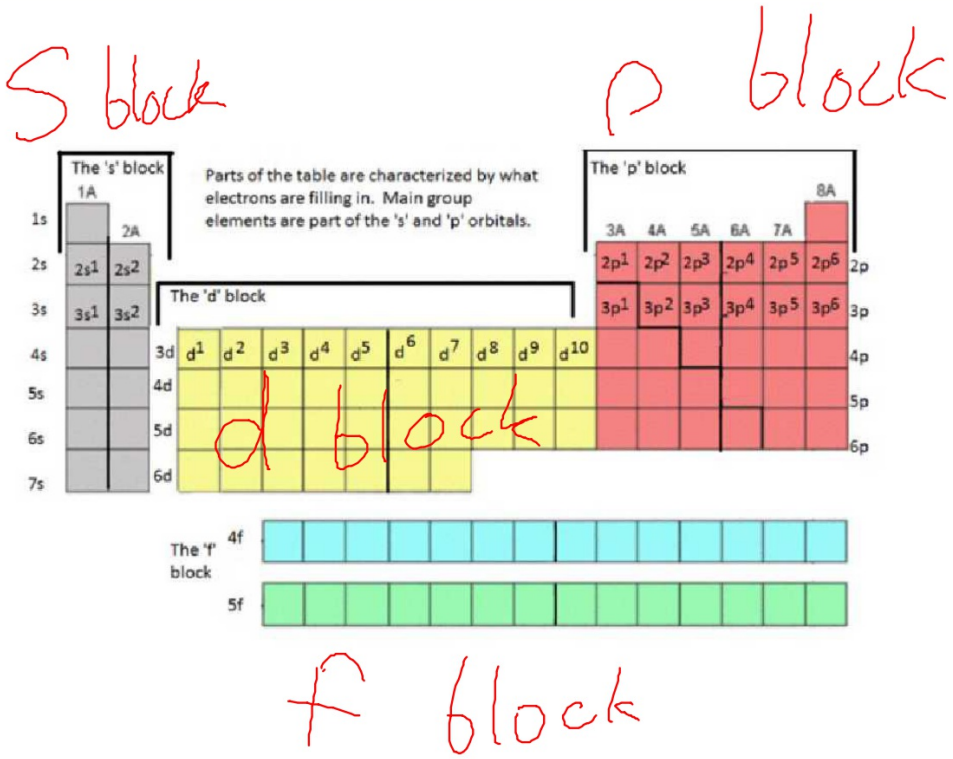
- Each energy level has a specific energy level.
- Think of each level as a ladder. There are defined "rungs" that you can stand on.
- You can't stand in between rungs on a ladder.



Energy Levels of e-

Quanta

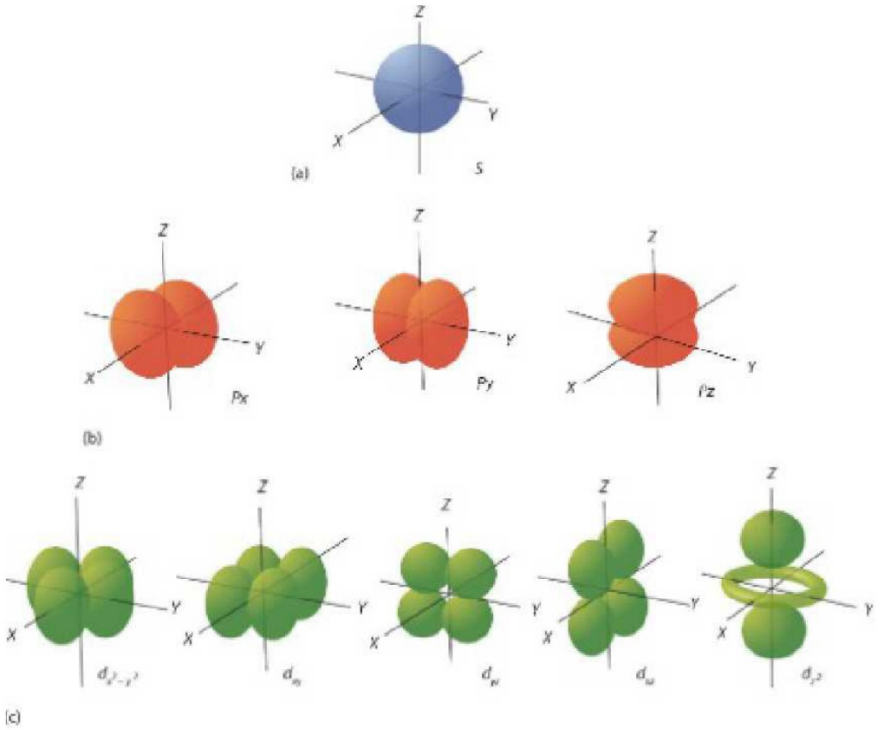
- The amount of energy required to move an electron from one level to another.
- Energy needed to move an electron **up** the ladder.
- When an e- moves up the ladder it is *quantized*. "Quantum leap."



Atomic Orbitals

Quantum Mechanics

- Determined the energy that electrons have at a particular rung on the ladder.
- Determined the likelihood of the location of an electron. 90%
- This was not like Rutherford or Bohr



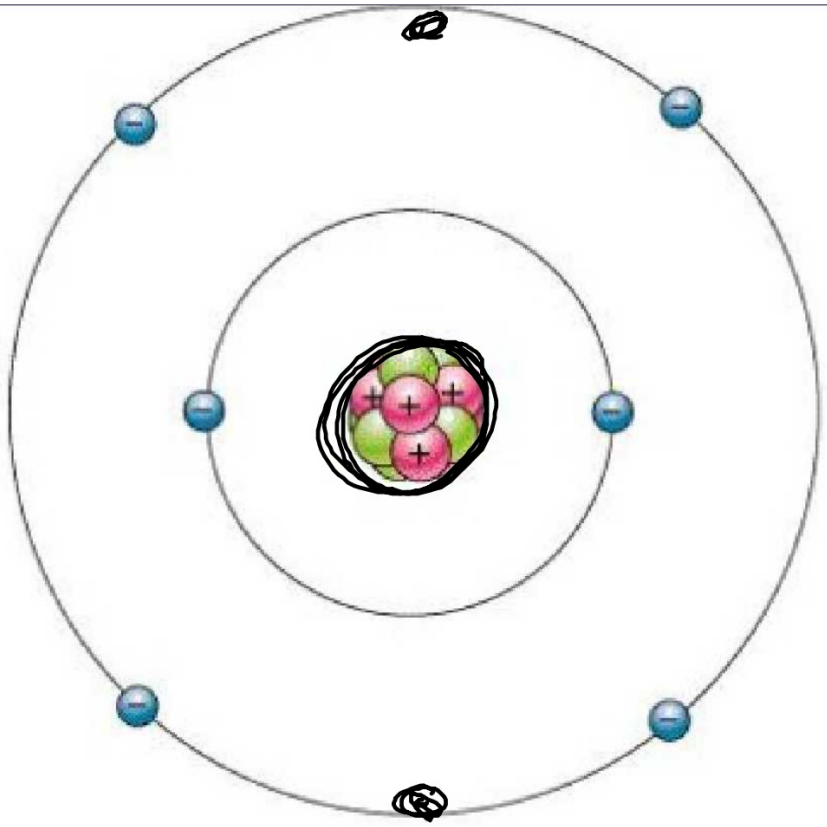
Orbital Shapes

Name

$p^+ = \#$

$n^\circ = \#$

$e^- = \#$



Drawing the Bohr Model

Your Name

Requirements

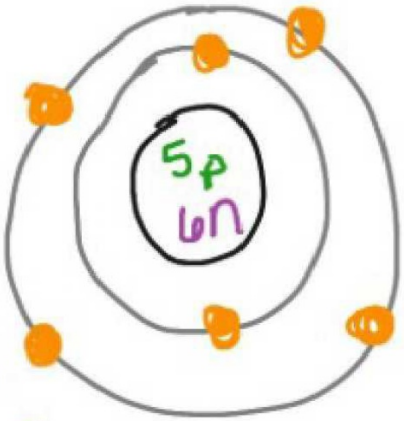
- Name of Atom
- # of p+, n, and e- on the side.
- Nucleus labeled with # of n, and p+.
- Electrons on the rings around it.

Boron

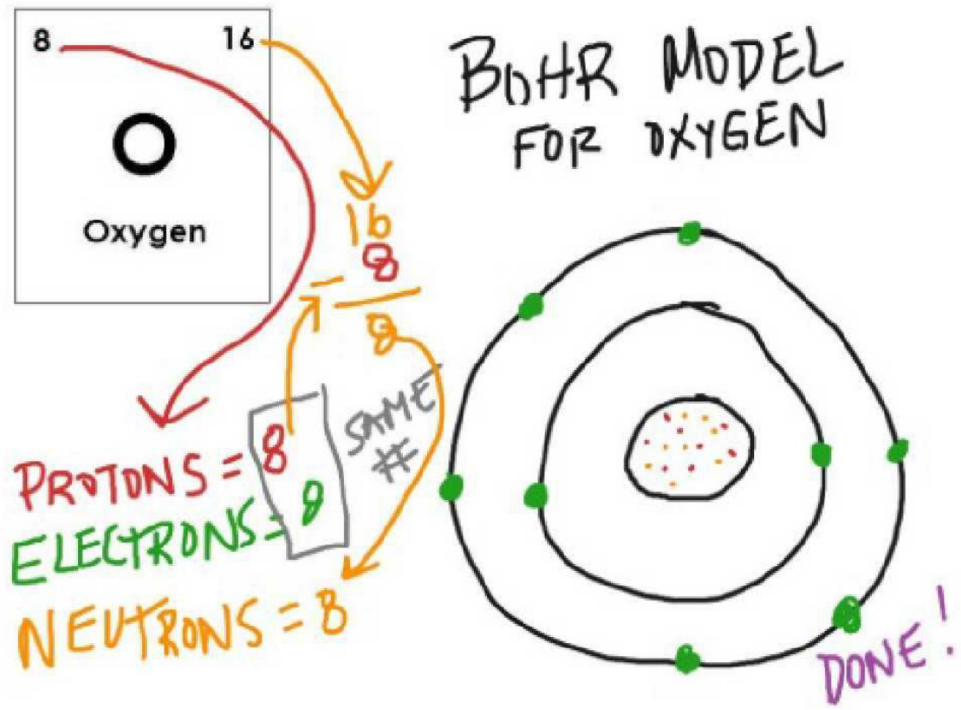
P = 5

e = 5

n = 11 − 5 = 6



Example


8
16
O
Oxygen
16
8
8
BOHR MODEL
FOR OXYGEN
PROTONS = 8
ELECTRONS = 8
NEUTRONS = 8
SAME #
DONE!

Example

Your Turn

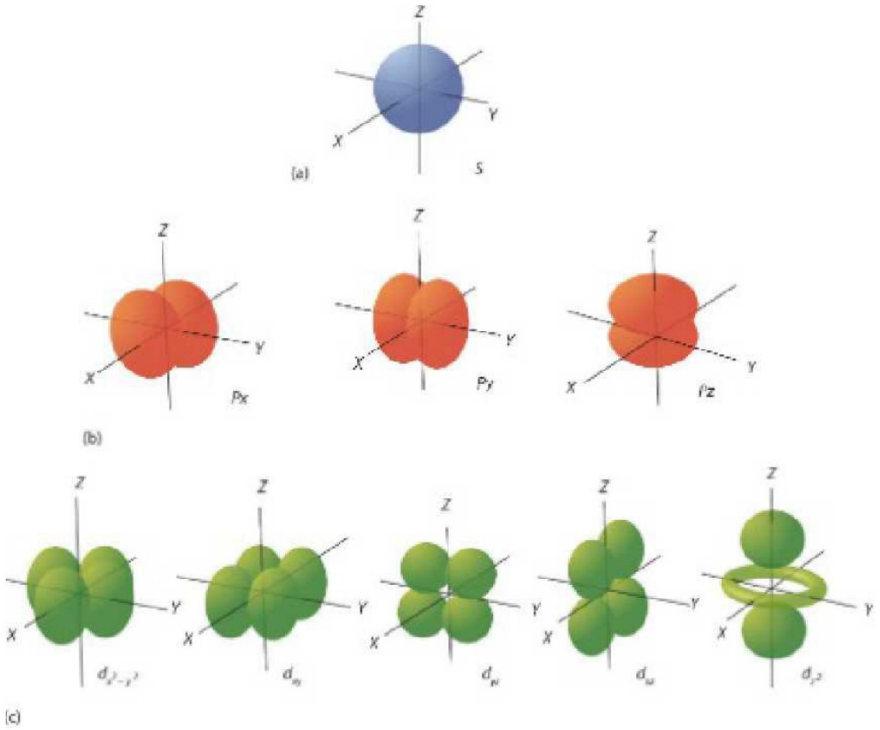
- Take the atom with the atomic number that corresponds to the day of the month that you were born.
- Name of Atom

In 20's use Last Digit!!

- # of p+, n, and e- on the side.
- Nucleus labeled with # of n, and p+.
- Electrons on the rings around it.

Quantum Atomic Orbitals model

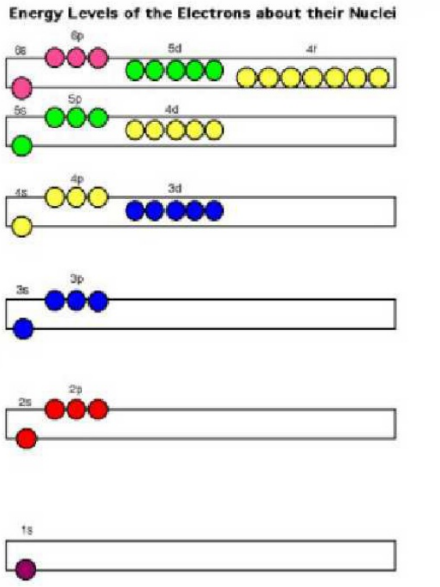
- Each energy level has an orbital with a different shape.
- This is where the electron is *likely* to be found. 90%
- Each level is a rung on the ladder.

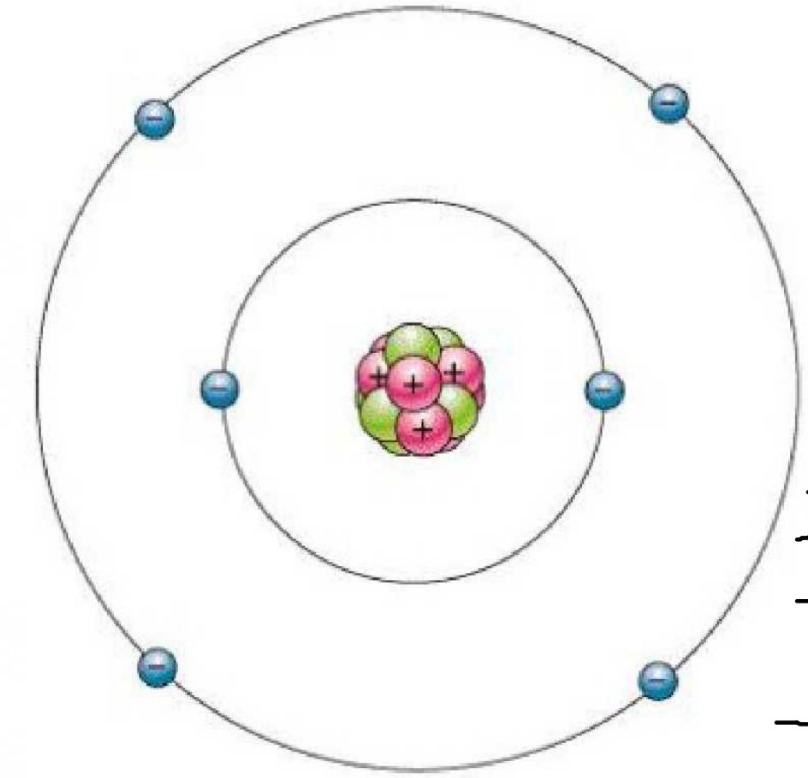


Orbital Shapes

n - Principal Energy Level

- Lower rung holds less e-.
- More e- means more energy.





Metaphor

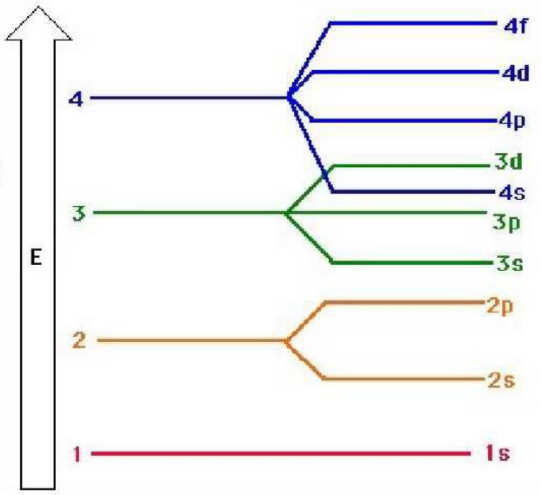
Do Now:
Get a whiteboard for you and your partner. Write down one thing that you learned from the Khan Academy videos that you saw last night.

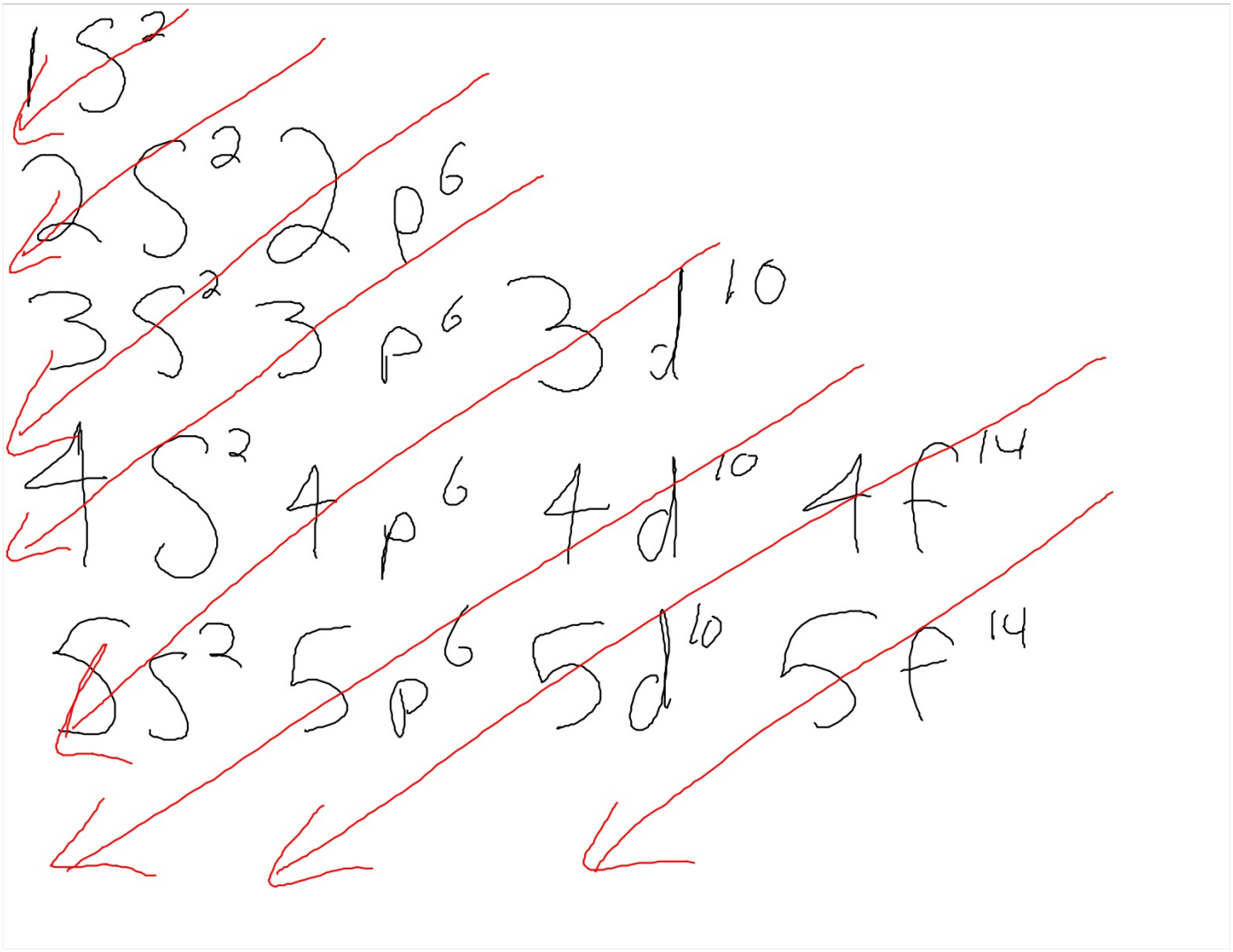
5.2 Electron Arrangement

- Configurations: the specific arrangement of orbitals.
- Three rules for electron configurations that dictate the order and placement of electrons.

Aufbau Principle

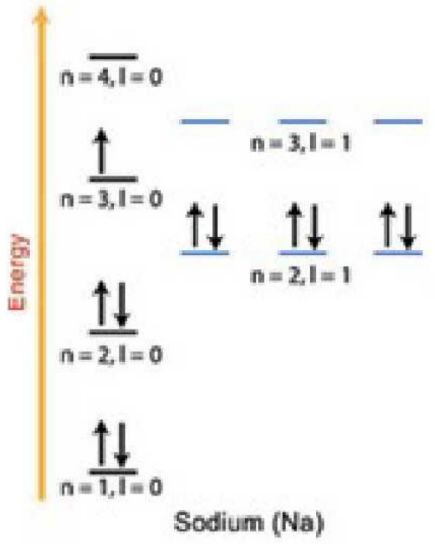
- Electrons fill the lowest energy levels first.

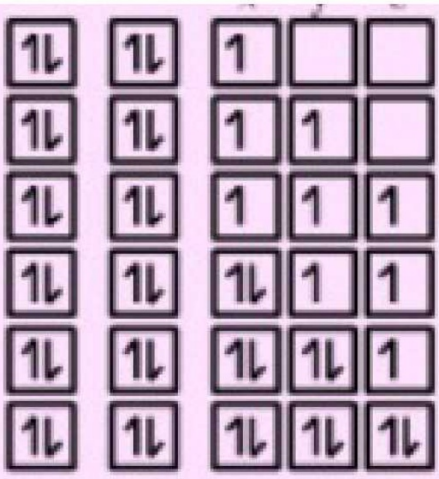



1S2
2S2 2P6
3S2 3P6 3d10
4S2 4P6 4d10 4f14
5S2 5P6 5d10 5f14

Pauli Exclusion Principle

- An orbital can describe up to 2 electrons.
- These electrons have opposite spins.



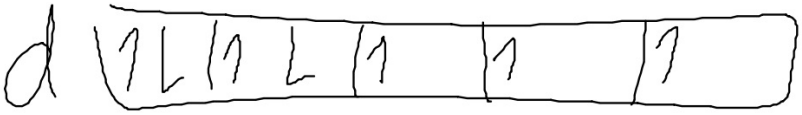
B	$1s^2\ 2s^2\ 2p_x^{\ 1}$	
C	$1s^2\ 2s^2\ 2p_x^{\ 1}\ 2p_y^{\ 1}$	
N	$1s^2\ 2s^2\ 2p_x^{\ 1}\ 2p_y^{\ 1}\ 2p_z^{\ 1}$	
O	$1s^2\ 2s^2\ 2p_x^{\ 2}\ 2p_y^{\ 1}\ 2p_z^{\ 1}$	
F	$1s^2\ 2s^2\ 2p_x^{\ 2}\ 2p_y^{\ 2}\ 2p_z^{\ 1}$	
Ne	$1s^2\ 2s^2\ 2p_x^{\ 2}\ 2p_y^{\ 2}\ 2p_z^{\ 2}$	

Hund's Rule

Orbital Notation:

Fill in ~~one~~ 2 electron for each orbital in a block (s, p, d, f).

7



All of the electrons should spin the same direction.

Fill in second electrons spinning in the opposite direction after that.

Once a block is full, go to the next. Remember the order of orbitals.

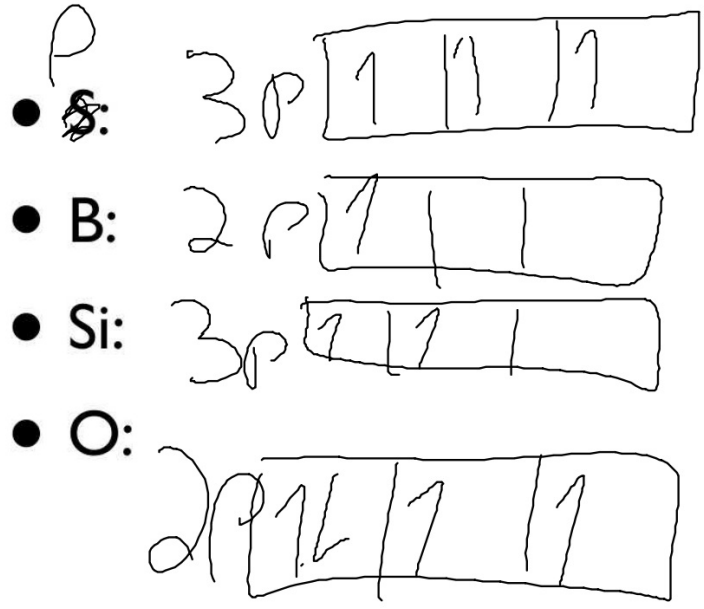
Example:

Write the orbital notation for S: 16 e^-

Write the orbital notation for Ca: 20 e^-

Whiteboards

- P:
- B:
- Si:
- O:



Order the Orbitals

$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$

$3d^{10} 4p^6 5s^2 4d^{10}$

$5p^6 6s^2 4f^{14} 5d^{10} 6p^6$

$7s^2 5f^{14} 6d^{10} 7p^6$

Electron configuration:

Electrons fill in orbitals on the same order as before.

Now you just need to write the obitals and the total number of electrons that occupy that orbital.

The last orbital may not be full.

Al: $13e^-$

$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$

Examples:

29 e^-

Cu: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^9$

32 e^-

Ge: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^2$

Cl:

Whiteboard it:

Mg: $3s^2$

Ag: $4d^9$

Shortcut:

You can put the noble gas (in the last column) that preceeds the element in brackets and then finish the configuration from there.

Example:

Ba: $[Xe]\ 6s^2$

W: $[Xe]\ 6s^2\ 4f^{14}\ 5d^4$

Whiteboard it:

Y:

Bi:

Ions: atoms that lose or gain electrons.

Cations: lose electrons and are positive. (Cats are great!)

Anions: gain electrons and are negatively charged.

Everyone wants 8 valence electons.

Electron Clock:

Electron Configuration for ions:

Mg (2+):

Cl (1-):

Worksheet:

You may work in pairs.

Finish the worksheet by the end of class today.

If you finish before the end of class, I have an additional worksheet that you are responcible for overnight. You may start that in class.