Name: _____ **Date:** _____

Chemistry *~ Ms. Hart* **Class:** Anions or Cations

THE URBAN ASSEMBLY SCHOOL FOR CRIMINAL JUSTICE

4.2 Guided Notes: Bohr Model – Electron Configuration

Question of the day: *How do electrons move in order to create different colors of fireworks?*

Objective: SWBAT identify a stable and excited electron configuration for the Bohr Model of an atom

DO NOW:

Subatomic Particle	Charge	Location in an atom	Mass
Protons			
Neutrons			
Electrons			

Thought provoker- ***The Bohr Atomic Model***
Directions*: Read the excerpt from your textbook below about the Bohr Atomic Model (annotating the text as always!) and answer the questions below.*

As you learned in class yesterday, certain atoms will emit specific wavelengths of light (colors of light) that can help identify the element. Scientists did not understand though why each element had a unique color or what exactly led to that specific color being formed. Niels Bohr helped solve that puzzle. Bohr proposed a model of the atom that linked the atom's electrons with this light emission. According to the model, the electron can circle the nucleus only in allowed paths, or orbits. When the electron is in one of these orbits, the atom has a definite, fixed energy. We call each of these orbits an energy level. The electron is in the lowest energy state when it is in the orbit closest to the nucleus. This orbit is separated from the nucleus by a large empty space where the electron cannot exist. The energy of the electron is higher when it is in orbits that are farther from the nucleus. These energy levels can be compared to the rungs in a ladder. When you're standing on a ladder, your feet are on one rung. You cannot stand in midair, just like the electrons have to be in a specific orbit, but not in between.

1. How is the Bohr Model different from Rutherford model? _____

_____

2. In the box, draw what you think the Bohr atomic model looks like:

Key Ideas of Bohr Model:

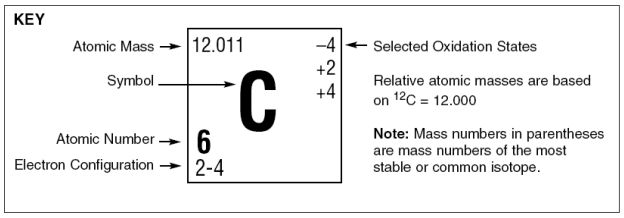
_____

_____

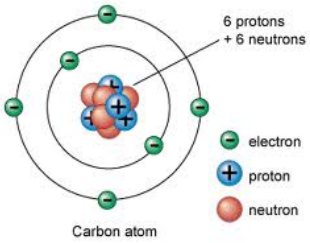
_____

_____

Electron Configurations!



How to Write/Draw an Electron Configuration

Electron Configuration of Carbon	Bohr Planetary Model of Carbon
Write the electron configuration of carbon in the space below: (Hint: Check reference table)	

1. Each circle orbit around the nucleus is known as an "electron shell." How many electron shells does a carbon atom have? _____
2. What do the numbers of an electron configuration represent? In other words, what does the 2 and 4 represent in the electron configuration of carbon? (Be sure to use the word "electron shell" in your response.

   _____

   _____

   _____
3. What is the electron configuration of oxygen? _____
4. What is the electron configuration of chlorine? _____
5. What is the electron configuration of magnesium? _____
6. Draw the Bohr model of oxygen and sodium.

7. What do you notice about how many electrons are in each shell? _____

_____

8. What is always true about the first shell? _____

_____

9. What is always true about the second shell? _____

_____

Edible Atoms – Creating Bohr Models

Task: demonstrate knowledge of the Bohr atom by creating and analyzing models made out of M & Ms

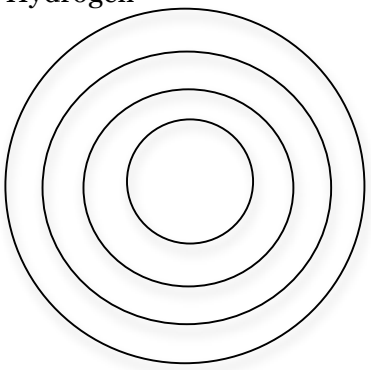
Part 1:

Directions:

1) Record the number of protons, neutrons and electrons the atom will have.
2) Use the paper plate as an outline of the model. (Inner circle is the nucleus, and there are 3 additional energy levels.)
3) Create a Bohr model of the element using your cup of M&M's. **Use a different color to represent each type of subatomic particle: proton, neutrons, electrons.**
4) When you are finished making the model with M&M's, **make sure to copy your model onto your paper**. Then move on to the next problem.

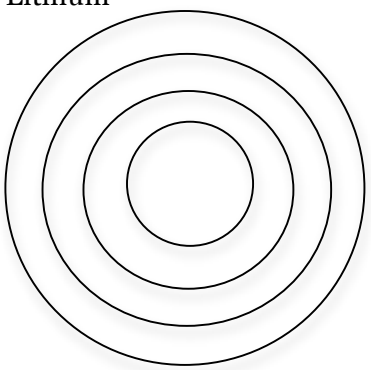
Problems:

1) Hydrogen



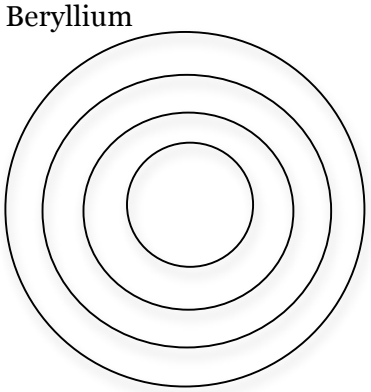
Total number			Electrons in outermost energy level
Protons	Neutrons	Electrons	

2) Lithium



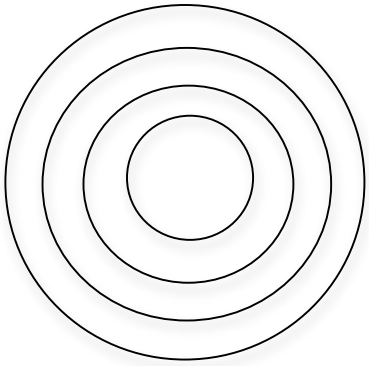
Total number			Electrons in outermost energy level
Protons	Neutrons	Electrons	

3) Beryllium



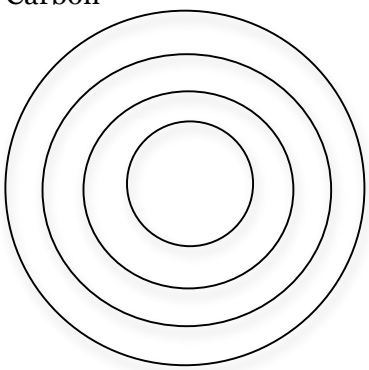
Total number			Electrons in outermost energy level
Protons	Neutrons	Electrons	

4) Boron



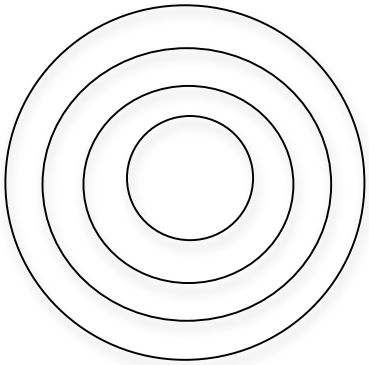
Total number			Electrons in outermost energy level
Protons	Neutrons	Electrons	

5) Carbon



Total number			Electrons in outermost energy level
Protons	Neutrons	Electrons	

6) Bonus: N^{+1}



Total number			Electrons in outermost energy level
Protons	Neutrons	Electrons	

6) Answer the question below in complete sentences using evidence from the lab.
What trend in the number of electrons, (of neutral atoms), did you notice as you went **across the rows** of the periodic table (Li to Be to B to C)?

_____

_____

_____

_____

_____

Do not eat your M&Ms until you are finished with the lab
KEEP GOING on the next page!

Part 2: Identifying atoms

Directions: When you finish part 1 ask Ms. Hart for Bohr model cards for part 2. Based on the protons, neutrons, and electrons, identify the elements from the Bohr Model cards.

1)

Identify the Atom (write the name)	Total number			Electrons in outermost energy level
	Protons	Neutrons	Electrons	

2)

Identify the Atom (write the name)	Total number			Electrons in outermost energy level
	Protons	Neutrons	Electrons	

3)

Identify the Atom (write the name)	Total number			Electrons in outermost energy level
	Protons	Neutrons	Electrons	

4)

Identify the Atom (write the name)	Total number			Electrons in outermost energy level
	Protons	Neutrons	Electrons	

5) Bonus

Identify the Atom (write the name)	Total number			Electrons in outermost energy level
	Protons	Neutrons	Electrons	

6) Answer the question below in complete sentences using evidence from the lab.
What **trend in the number of electrons**, (of neutral atoms), **in the outermost energy levels** did you notice as you went **down the columns** of the periodic table (**H to Li to Na** and **B to Al**)?

____

____

____

____

____

____

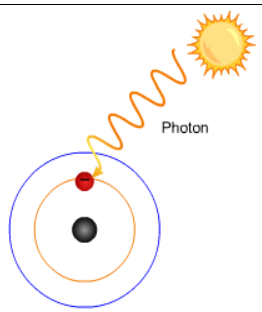
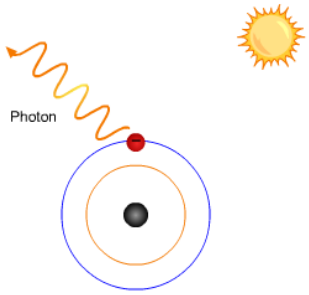
If you finish this activity early, add the following vocabulary words to your science glossary:

- Bohr Model
- Electron Configuration
- Energy Level

~*~

Ground State Electron Configuration versus Excited State Electron Configuration

Video from: http://learning.covcollege.ac.uk/content/Jorum/MET_Intro-to-photosynthesis_LM-1.2/page52.htm

	Description of what is happening
	
	

KEY IDEA: _____

_____

Kinesthetic Demonstration

Ms. Hart will demonstrate how an electron releases a photon (light) that we see as the beautiful colors we learned about yesterday in class.

Describe how Ms. Hart's demonstration is a good representation of the Bohr Model?

_____

_____

_____

What is a limitation to Ms. Hart's demonstration?

_____

_____

_____

Do you see a pattern? Putting electron configurations on paper

Element	Ground State	Excited State(s)
Carbon	2-4	2-3-1 or 1-5
Oxygen	2-6	2-5-1 or 1-7
Aluminum	2-8-3	2-7-4 or 2-8-2-1
Phosphorus		
Calcium		

1. Does the total number of electrons in an element change when the atom is in the ground state or the excited state?

2. How would you describe the difference between the ground state electron configuration and the excited state configuration?

3. Write one possible excited state configuration for F (fluorine).

Check for Understanding

1. What is the ground state configuration of Neon?

(1) 2-2
(2) 2-5
(3) 2-8
(4) 1-2

2.What is the excited state configuration of Neon?

(1) 3-7
(2) 2-9
(3) 2-7
(4) 2-7-1

4.2 Classwork

1. Which electron configuration could represent a strontium atom in an excited state?
   (1) 2-8-18-7-1 (2) 2-8-18-7-3
   (3) 2-8-18-8-1 (4) 2-8-18-8-2

2. Write *one* electron configuration for an atom of silicon in an excited state.

3. Write an electron configuration for an atom of aluminum-27 in an excited state.

4. Which electron configuration represents the excited state of a calcium atom.

Element	Electron Configuration
X	2–8–8–2
Y	2–8–7–3
Z	2–8–8

5. Which electron configuration represents the electrons of an atom in an excited state?
   (1) 2-8-1 (2) 2-8-6 (3) 2-8-17-6 (4) 2-8-18-5

6. What is the electron configuration of a sulfur atom in the ground state?
   (1) 2–4 (3) 2–8–4
   (2) 2–6 (4) 2–8–6

7. An electron in an atom moves from the ground state to an excited state when the energy of the electron
   (1) decreases (2) increases (3) remains the same

8. Write out two possible excited state electron configurations for potassium.

9. In a laboratory, a glass tube is filled with hydrogen gas at a very low pressure. When a scientist applies a high voltage between metal electrodes in the tube, light is emitted. The scientist analyzes the light with a spectroscope and observes four distinct spectral lines. The table below gives the color, frequency, and energy for each of the four spectral lines. The unit for frequency is hertz, Hz.

Visible Spectrum of Hydrogen

Color	Frequency ($\times 10^{14}$ Hz)	Energy ($\times 10^{-19}$ J)
red	4.6	3.0
blue green	6.2	4.1
blue	6.9	4.6
violet	7.3	4.8

Explain, in terms of subatomic particles and energy states, why light is emitted by the hydrogen gas.

4.2 Homework Reading: Bohr Model- Electron Configuration

DIRECTIONS: Read the following passage about fireworks and answer the following questions. Be sure to use your annotation strategies for science class. Taken from: http://www.livescience.com/32675-how-do-fireworks-get-their-colors.html

Behind the scenes of the dazzling light shows that spectators ooh and ahh at on the Fourth of July, are carefully crafted fireworks. Whether red, white and blue fountains or purple sparklers, each firework is packed with just the right mix of chemicals to create these colorful lights.

Inside each handmade firework are small packets filled with special chemicals, mainly metal salts and metal oxides, which react to produce an array of colors. When heated, the atoms of each element in the mix absorb energy, causing its electrons to rearrange from their lowest energy state to a higher "excited" state. As the electrons plummet back down to their lower energy state, the excess energy gets emitted as light.

Each element releases a different amount of energy, and this energy is what determines the color or wavelength of the light that is emitted.

For instance, when sodium nitrate is heated, electrons in the sodium atoms absorb the energy and get excited. When the electrons come down from the high, they release their energy, about 200 kilojoules per molecule, or the energy of yellow light, according to the website of the University of Wisconsin-Madison chemistry professor Bassam Z. Shakhashiri.

The recipe that creates blue, for example, includes varying amounts of copper chloride compounds, while red comes from strontium and lithium salts.

Just like paints, secondary colors are made by mixing the ingredients of their primary-color relatives. A mixture of copper (blue) and strontium (red) makes purple.

READING COMPREHENSION QUESTIONS:

1. When do electrons release energy?

   _____

   _____

   _____

2. Where does the energy that moves ground state electrons into the excited state in fireworks come from?

   _____

   _____

   _____

3. What two things determine the color of the light that each firework produces?

   _____

   _____

   _____

4. How does this article relate to the concept we learned today in class?

   _____

   _____

Name: _____ **Date:** _____

Chemistry *~ Ms. Hart* **Class:** Anions or Cations

Exit Ticket 4.2- Bohr Model-Electron Configuration

1. Which electron configuration represents the electrons of an atom in an excited state? [1]
   (1) 2-1 (3) 2-8-7
   (2) 2-7-4 (4) 2-4

2. Write an electron configuration for a silicon atom in the excited state. [1]

3. Explain, in terms of subatomic particles and energy states, why light is emitted by a hydrogen atom. [2]

Name: _____ **Date:** _____

Chemistry *~ Ms. Hart* **Class:** Anions or Cations

Exit Ticket 4.2- Bohr Model-Electron Configuration

1. Which electron configuration represents the electrons of an atom in an excited state? [1]
   (3) 2-1 (3) 2-8-7
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Name: _____ **Date:** _____

Chemistry *~ Ms. Hart* **Class:** Anions or Cations

Exit Ticket 4.2- Bohr Model-Electron Configuration

1. Which electron configuration represents the electrons of an atom in an excited state? [1]
   (5) 2-1 (3) 2-8-7
   (6) 2-7-4 (4) 2-4

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