

**Worksheet #1: Atomic Spectra**

1. How did Bohr expand on Rutherford's model of the atom?
2. Compare the energy of an electron in the ground state and an electron in the excited state.
3. When an electron falls from a higher energy level to a lower energy level, how is the energy released?
4. What is the difference between the previous models of the atom and the modern quantum mechanical model?
5. The further the electron is from the nucleus, the \_\_\_\_\_ energy the electron has.
6. A(n) \_\_\_\_\_ is often thought of as a region of space in which there is a high probability of finding an electron.
7. What is the term used to label the energy levels of electrons? \_\_\_\_\_
8. How are *s* orbitals different from *p* orbitals? \_\_\_\_\_
9. How many electrons can each of the following orbitals hold?
  - a. 2s = \_\_\_\_\_
  - b. 3p = \_\_\_\_\_
  - c. 5f = \_\_\_\_\_
  - d. 6d = \_\_\_\_\_
  - e. 4p = \_\_\_\_\_
  - f. 3d = \_\_\_\_\_
10. How many "*p*" orbitals can there be in any energy level? \_\_\_\_\_
11. What is the **maximum** number of electrons in the 3<sup>rd</sup> principle energy level? \_\_\_\_\_
12. How many orbitals are in each of the following sublevels??
  - a. 4*p* sublevel \_\_\_\_\_
  - b. 3*d* sublevel \_\_\_\_\_
  - c. 4*f* sublevel \_\_\_\_\_
  - d. 2*s* sublevel \_\_\_\_\_

## Worksheet #2: Orbital Diagrams

1. Fill in the electron configurations for the elements given in the table. Use the orbital filling diagrams to complete the table.

Electron Configurations for Some Selected Elements							
Element	Orbital filling						Electron configuration
	1s	2s	2p <sub>x</sub>	2p <sub>y</sub>	2p <sub>z</sub>	3s	
<input type="text"/>	↑	□	□	□	□	□	1s <sup>1</sup>
He	↑↓	□	□	□	□	□	<input type="text"/>
<input type="text"/>	↑↓	↑	□	□	□	□	1s <sup>2</sup> 2s <sup>1</sup>
C	↑↓	↑↓	↑	↑	□	□	<input type="text"/>
<input type="text"/>	↑↓	↑↓	↑	↑	↑	□	1s <sup>2</sup> 2s <sup>2</sup> 2p <sup>3</sup>
O	↑↓	↑↓	↑↓	↑	↑	□	<input type="text"/>
<input type="text"/>	↑↓	↑↓	↑↓	↑↓	↑	□	1s <sup>2</sup> 2s <sup>2</sup> 2p <sup>5</sup>
Ne	↑↓	↑↓	↑↓	↑↓	↑↓	□	<input type="text"/>
<input type="text"/>	↑↓	↑↓	↑↓	↑↓	↑↓	↑	1s <sup>2</sup> 2s <sup>2</sup> 2p <sup>6</sup> 3s <sup>1</sup>

2. Which element has the following orbital diagram?

	1s	2s	2p	3s	3p	4s	3d	element (answer)
a	↑↓	↑↓	↑↑↑	↑↓	↑↓↑	↑↓	□□□□	
b	↑↓	↑↓	↑↓↑	↑↓	↑↓↑	↑↓	□□□□	
c	↑↓	↑↓	↑↓↑	↑↓	↑↓↑	↑↓	↑	

3. Using arrows, show how the following orbitals will fill with electrons.

	Electron Configuration	1s	2s	2p	3s	3p	4s	3d
<b>Mg</b>	1s <sup>2</sup> 2s <sup>2</sup> 2p <sup>6</sup> 3s <sup>2</sup>							
<b>Cl</b>	1s <sup>2</sup> 2s <sup>2</sup> 2p <sup>6</sup> 3s <sup>2</sup> 3p <sup>5</sup>							
<b>Si</b>	1s <sup>2</sup> 2s <sup>2</sup> 2p <sup>6</sup> 3s <sup>2</sup> 3p <sup>2</sup>							
<b>Ti</b>	1s <sup>2</sup> 2s <sup>2</sup> 2p <sup>6</sup> 3s <sup>2</sup> 3p <sup>6</sup> 4s <sup>2</sup> 3d <sup>2</sup>							

**Worksheet #3: Electron Configurations**

1. Write the complete electron configuration for each atom on the blank line.

- a. Lithium \_\_\_\_\_
- b. Fluorine \_\_\_\_\_
- c. Carbon \_\_\_\_\_
- d. Argon \_\_\_\_\_
- e. Sulfur \_\_\_\_\_
- f. Nickel \_\_\_\_\_
- g. Rubidium \_\_\_\_\_
- h. Xeon \_\_\_\_\_

2. What elements are represented by each of the following electron configurations?

- a.  $1s^2 2s^2 2p^5$
- b.  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$
- c.  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^4$
- d.  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5$

3. a. What are valence electrons? \_\_\_\_\_

b. Explain how an atom's valence electron configuration determines its place on the periodic table.

c. List the number of valence electrons for the following atoms:

potassium = \_\_\_\_\_ magnesium = \_\_\_\_\_ carbon = \_\_\_\_\_ nitrogen = \_\_\_\_\_

4. Place the following orbitals in order of increasing energy:

1s, 3s, 4s, 6s, 3d, 4f, 3p, 7s, 5d, 5p \_\_\_\_\_

5. What two elements are exceptions to the way we normally write electron configurations? Write the expected and the actual configuration of each. What rules are followed? What rules are violated?

**Worksheet #4: Periodic Table**

1. Identify each element as a **metal**, **metalloid**, or **nonmetal**.

- |              |       |               |       |
|--------------|-------|---------------|-------|
| a. fluorine  | _____ | d. phosphorus | _____ |
| b. germanium | _____ | e. lithium    | _____ |
| c. zinc      | _____ | f. oxygen     | _____ |

2. a. **Circle** the transition metals below.

magnesium                  titanium                  chromium                  mercury                  aluminum

b. Which block (s, p, d, or f) are the transition metals found? \_\_\_\_\_

3. Give **two** examples of elements for each category.

- |                          |       |
|--------------------------|-------|
| a. Noble gases           | _____ |
| b. Halogens              | _____ |
| c. Alkali metals         | _____ |
| d. Alkaline earth metals | _____ |

4. Explain why the s-block of the periodic table is two groups wide, the p-block is six groups wide, and the d-block is ten groups wide.

5. Why do the elements potassium and sodium have similar chemical and physical properties?

6. Identify the element that:

- |   |       |  |       |
|---|-------|--|-------|
| a. Contains a full 3 <sup>rd</sup> energy level | _____ | c. Outer energy level is 4s <sup>2</sup> | _____ |
| b. Contains 3 electrons in the 2p level         | _____ | d. Contains 5 electrons in the 4d level  | _____ |

**FLASHBACK TIME ☺!!**

1. Write the electron configuration for the following elements:

Cesium = \_\_\_\_\_

Potassium = \_\_\_\_\_

Uranium = \_\_\_\_\_

2. Give an example of the following:

a. Homogenous mixture = \_\_\_\_\_

b. Heterogeneous mixture = \_\_\_\_\_

c. Element = \_\_\_\_\_

d. Compound = \_\_\_\_\_

3. Name the scientist who contributed the following to the discovery of the atom:

a. Discovered the nucleus \_\_\_\_\_

b. Used the cathode ray tube \_\_\_\_\_

c. Discovered protons \_\_\_\_\_

4. How many protons, neutrons, and electrons does the element **cobalt** have?

**Worksheet # 5: Check What Ya Know**

*Answer the following questions using your Unit 3 notes.*

1. How many orbitals are in the following sublevels?

- a)  $3p$  sublevel = \_\_\_\_\_      d)  $3d$  sublevel = \_\_\_\_\_  
b)  $2s$  sublevel = \_\_\_\_\_      e)  $4f$  sublevel = \_\_\_\_\_  
c)  $4p$  sublevel = \_\_\_\_\_

2. Write the full electron configuration for each atom.

- a) Phosphorus = \_\_\_\_\_  
b) Gold = \_\_\_\_\_  
c) Iodine = \_\_\_\_\_

3. Give the symbol and names of the elements that correspond to these configurations of an atom. Where does this element belong in the period table (e.g. noble gas, metalloid, etc..)

- a)  $1s^2 2s^2 2p^6 3s^1$  = \_\_\_\_\_  
b)  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^8$  = \_\_\_\_\_  
c)  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^4$  = \_\_\_\_\_

4. Distinguish between the ground state and the excited state of an atom.

5. Draw the orbital diagram for the element **Manganese**.