ChemQuest 20

Electron Configurations and the

Periodic Table

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Hour: \_\_\_\_\_

**Information**: Relating Electron Configurations to the Periodic Table

In this section you will see how the periodic table serves as a road map for writing electron configurations. Get your periodic table out and get ready. Remember that a row on the periodic table goes horizontally from left to right. Columns are vertical (up and down).

**Critical Thinking Questions**

1. Write the electron configurations for Li, Na and K. (Remember for electron configurations, arrows are not necessary.)
2. What is similar about the electron configurations of all of the elements in question 1? Look at the very end of their configurations.
3. Lithium (Li) is in row 2 of the periodic table, sodium (Na) is in row 3, and potassium is in row 4. How do their row numbers affect how their electron configurations end?
4. Write the electron configurations for Be, Mg, and Ca.
5. What is similar about the ending of the electron configurations for all of the elements in question 16?
6. Beryllium (Be) is in row 2 of the periodic table, magnesium (Mg) is in row 3, and Calcium (Ca) is in row 4. How do their row numbers affect how their electron configurations end?
7. Given what you have done in questions 1-6, complete the following statement.

Elements ending in s1 are in column number \_\_\_\_\_ and those ending in s2 are in column number \_\_\_\_\_ of the periodic table.

1. Name the element that have an electron configuration ending with… (the first is done for you)

a) 5s1 \_Rubidium (Rb)\_\_ b) 6s2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_ c) 7s1 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Write the electron configurations for B, Al, and Ga and note their similarities.
2. Write the electron configurations for N, P and As and note their similarities.
3. Complete the following statement: Elements ending in p1 are in column number \_\_\_\_\_\_\_\_ of the periodic table and elements ending in p3 are in column number \_\_\_\_\_\_\_\_\_ of the periodic table. Therefore, elements ending in p2 must be in column \_\_\_\_\_\_\_\_\_ of the periodic table.
4. Name the elements that have an electron configuration ending with…(the first is done for you)

a) 3p4 \_\_Sulfur (S)\_\_ b) 5p6 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ c) 6p5 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Write the electron configurations for Ti, Zr, and Hf and note their similarities.
2. Write the electron configurations for Cr, Mo, and W and note what is similar about them.
3. Complete the following: Elements ending in d2 are in column number \_\_\_\_\_\_\_ and those ending in d4 are in column number \_\_\_\_\_\_. Therefore, elements ending in d3 are in column number \_\_\_\_\_\_. Elements ending in d7 must be in column number \_\_\_\_\_\_\_.
4. Notice from question 6 that an element that ends in 3s is in the 3rd row. Also, from questions 9-12 it should be clear that an element that ends in 3p is in the 3rd row. However, notice that an element that ends in 3d is in the 4th row instead of the 3rd row. Offer an explanation for this.
5. Name the elements that have an electron configuration ending with…(the first is done for you)

a) 4d3 \_Niobium (Nb)\_ b) 5d8 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ c) 3d6\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. There are three major divisions on the periodic table: the “s block”, the “d block” and the “p block”. Where are these blocks of elements located? Give the column numbers of their locations. (Yes, there is also an “f block” but we won’t consider that now.)

s block: columns \_\_\_\_\_\_\_ d block: columns \_\_\_\_\_\_ p block: columns \_\_\_\_\_\_

**Information**: Abbreviating the Electron Configurations

Electron configurations can be shortened using a special group of elements called the noble gases. They are found in the column furthest to the right on the periodic table: helium, neon, argon, krypton, xenon, and radon. These gases are very non-reactive. All of the noble gases have electron configurations that end in p6. Because of their unique non-reactivity, they are often used to abbreviate long electron configurations.

Take note of krypton’s electron configuration: 1s22s22p63s23p64s23d104p6.

Now notice that strontium’s electron configuration is the same as krypton’s except that strontium has 38 electrons instead of 36. Strontium’s electron configuration is 1s22s22p63s23p64s23d104p65s2. Strontium has the same electron configuration as krypton and then two additional electrons in the 5s orbital. Therefore strontium’s electron configuration can be abbreviated as [Kr]5s2. This notation means that strontium has all of krypton’s electrons plus two more in the 5s sublevel.

As another example, consider iodine. Instead of writing a long electron configuration, we can abbreviate it. Follow these steps:

1. Going backward from iodine on the periodic table, find the previous noble gas. It is krypton.
2. Take note of what krypton’s electron configuration ends with. It ends with 4p6 since it is in the 4th row and in the p6 column.
3. Iodine has 17 more electrons than krypton and so you can begin by writing [Kr] followed by orbitals for 17 more electrons. After 4p6 comes 5s2…

Iodine = [Kr]5s24d105p5

Any of the noble gases can be used for abbreviations. Here are a few more examples:

iron = [Ar]4s23d6 cesium = [Xe]6s1 phosphorus = [Ne]3s23p3

Study the above examples and make sure you understand why they are written that way.

**Critical Thinking Questions**

1. Write abbreviated electron configurations for the following elements:
   1. Ruthenium (Ru)
   2. Arsenic (As)
   3. Tellurium (Te)