Periodic Trends: A Graphical Analysis

Elements on the periodic table are arranged in such a way that they exhibit patterns in their properties. In this lab you and your partner will graph 4 periodic properties (atomic radius, ionization energy, electronegativity, and ionic radius) and analyze the patterns.

Graphing

You may graph the data by hand using a full piece of graph paper for each property, or you may enter the data into your computer and create a graph on your computer (See hints below). The x-axis will be the atomic number and the y-axis will be Atomic Radius on one graph and Electronegativity on the other the other graph. The graphs need to have **a title, and both axis label with appropriate units**. Your graphs should be oriented in the landscape direction.

Using a colored pen or pencil and ruler, draw a vertical line **between** atomic number 2 and 3, 10 and 11, and 18 and 19, separating the elements into the first four periods. *Label the sections appropriately*.

If you are doing the graph on the computer, I suggest opening a spreadsheet in Excel, put the atomic numbers in column A and the property in column B. Choose the (XY) Scatter graph with straight lines connecting each point. Put each set of information that you will graph on a different sheet to make different graphs. (See tabs at the bottom of excel.) You should include all major and minor gridlines so you can more easily determine the atomic numbers of the plotted points. You could also label the data points with the atomic numbers only. You will need to work with your graph to get it the way you want it. You don't need a legend since there is only one trend plotted on each graph. Don't make the lines too fat or plotted points too big. Your graph should fill up most of one side of a paper.

Analysis Questions - Put the answers for the analysis question on the back of the graph

Atomic Radius

Circle the points representing the elements in **group 1** (atomic # 1, 3, 11, and 19) with a colored pencil or pen and then circle data points representing the elements in **group 18** (atomic # 2, 10, 18, and 36) with a different color.

1. What is Atomic Radius?
2. Examine your graph. Find the period 2 elements (atomic numbers #3-10). What happens to the atomic radius values as you move across period 2?
3. Find the period 3elements (atomic numbers #11-18) and the period 4 elements (# 19 – 36). Do period 3 and period 4 have the same trend you saw in period 2?
4. Examine your graph. Find the group 1elements (atomic numbers #1, 3, 11, and 19). What happens to atomic radius as you move down the group?
5. Do you see this same trend in group 18 elements (# 2, 10, 18, 36)?
6. Put the Summary of trend for atomic radius **below the title on your graph:** Atomic radius _____ across a period and _____ down a group.

Electronegativity

Circle the points representing the elements in **group 1** (atomic # 1, 3, 11, and 19) with a colored pencil or pen and then circle data points representing the elements in **group 17** (atomic # 9, 17, and 35) with a different color.

1. What is electronegativity?
2. Examine your graph. Find the period 2 elements (atomic numbers #3-10). What happens to the electronegativity values as you move across the period?
3. Do period 3 (#11-17) and period 4(#19 – 36) have the same trend you saw in period 2?
4. Examine your graph. Find atomic numbers #1, 3, 11, and 19 that correspond to the elements in Group 1. What happens to electronegativity as you move down the group 1 elements?
5. Do you see this same trend in group 17 elements (# 9, 17, and 35)?
6. Which elements do not have an electronegativity value? Why do you think this is?
7. Put the Summary of trend for electronegativity **below the title on your graph:** Electronegativity _____ across a period and _____ down a group.

*A Blank does NOT mean Zero. You will have some breaks in your graph. Your lines will stop and then start again after the missing points.

Ionization Energy

Circle the points representing the elements in **group 1** (atomic # 1, 3, 11, and 19) with a colored pen or pencil and then circle data points representing the elements in **group 18** (atomic # 2, 10, 18, and 36) with a different color.

1. What is ionization energy?
2. Examine your graph. Find the period 2 elements (atomic numbers #3-10). What happens to the ionization energy values as you move across the period?
3. Find the period 3elements (atomic numbers #11-18) and the period 4 elements (# 19 – 36). Do period 3 and period 4 have the same trend you saw in period 2?
4. Examine your graph. Find atomic numbers #1, 3, 11, and 19 that correspond to the elements in Group 1. What happens to ionization energy as you move down the group 1 elements?
5. Do you see this same trend in group 18 elements (# 2, 10, 18, 36)?
6. Put the Summary of trend for ionization energy **below the title on your graph:** Ionization energy _____ across a period and _____ down a group.

Ionic Radius

Put a "+" over the points representing the **cations** in **period 1** (atomic # 3-6), **period 2** (11-14), **period 3** (19-32) with a colored pen or pencil. Put a "-" over the other points representing the anions. Circle the points representing the elements in **group 1** (atomic #3, 11, and 19) with a colored pen or pencil and then circle data points representing the elements in **group 17** (atomic # 9, 17, and 35) with a different color.

1. How does an atom become a cation and an anion?
2. What happens to the ionic radius values of the **cations (+)** as you move across period 2?
3. What happens to the ionic radius values of the **anions (-)** as you move across period 2?
4. Do period 3 and period 4 have the same trend you saw in period 2 for both the cations and anions?
5. Examine your graph. Find atomic numbers #3, 11, and 19 that correspond to the elements in Group 1. What happens to ionic radius as you move down the group 1 elements?
6. Do you see this same trend in group 17 elements (# 9, 17, and 35)?
7. Put the Summary of trend for ionic radius **below the title on your graph**: Ionic radius _____ across a period and _____ down a group