

Periodic Trends: Atomic Radius and Ionization Energy

When the elements are arranged as they are on the modern periodic table, it is observed that there are a number of trends (patterns) that exist. In this activity you will plot data for the first 20 elements and then determine two of these trends.

Graphing

Using a computer, you will need to make two line graphs; one showing atomic radius (y-axis) as a function of atomic number (x-axis) and the other showing ionization energy (y-axis) as a function of atomic number (x-axis). At the top of the graph there should be a descriptive title and each axis should have a scale, a label and units. (It is possible to put both sets of data on the same graph. However, you will need to have a left y-axis and a right y-axis. These two axis must have different labels and different scales. If you are interested in doing this, feel free to ask for extra clarification.)

Data

Atomic Number	Atomic Radius (pm)	Ionization Energy (eV)
1	30	13.6
2	93	24.6
3	152	5.4
4	111	9.3
5	88	8.3
6	77	11.3
7	70	14.5
8	66	13.6
9	64	17.4
10	112	21.6
11	186	5.1
12	160	7.6
13	143	6.0
14	117	8.1
15	110	11.0
16	104	10.4
17	99	13.0
18	154	15.8
19	231	4.4
20	197	6.1

Analysis

1. Atomic radius
 - a. Look at the section of your graph that includes all of the elements from the first period except the noble gas $_{10}\text{Ne}$ (i.e. $_{3}\text{Li}$ to $_{9}\text{F}$). What happens to the atomic radius as you go from $_{3}\text{Li}$ to $_{9}\text{F}$? Try looking at the elements in the second period. Is the trend the same or different? Summarize the overall “left to right” trend in one brief statement. For example, “As you move left to right across a period, the atomic radius...”
 - b. If you take a look at all of the elements in a group (e.g. $_{3}\text{Li}$, $_{11}\text{Na}$, $_{19}\text{K}$), what trend do you observe? Look at more than one group to see if the trend is consistent. Summarize the trend in one brief statement.
2. Ionization Energy
 - a. Answer a and b from question 1 for the ionization energy graph.

Conclusion

1. Draw a rectangular outline version of the periodic table. Label the corner in which you would expect the elements to have the largest atomic radius and the corner that would have the smallest atomic radius. Draw a second periodic table and repeat the labeling procedure with the highest and lowest ionization energy.
2. Using the trends you have discovered in this activity, predict values for the atomic radius and ionization energy for $_{37}\text{Rb}$. Show the calculations or explain the logic you used to determine your values.