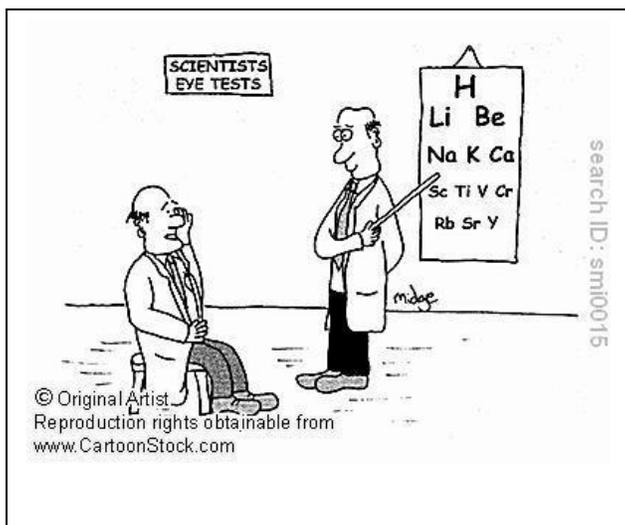


Lab: Periodic Trends



The creators of the Periodic table grouped the elements according to their chemical and physical properties. The elements exhibit trends or periodicity that can be predicted examining the groups and periods. These trends are based on the element's electron configurations. All elements desire a stable configuration and will gain or lose valence electrons to obtain that important stability. This is called the "Octet Rule" and will determine reactivity of the element.

Two other important factors occur while looking at the trends of the groups and periods. As the electrons

increase along with increasing protons across a period, there is a strong attraction that increases with increasing positive charge in the nucleus. Secondly, the electrons become less attracted to the nucleus as energy levels increase because of shielding of the inner energy level electrons. These two factors can affect period trends such as the ones being examined in this activity: Atomic Radii, Ionization Energy, Electron Affinity and Electronegativity.

Procedure:

1. For the following data, plot the atomic number on the x-axis and the property on the y-axis. Each property should be graphed on a separate sheet of graph paper.
2. Make a key on the bottom right side of the Period 1, 2, 3, 4. With Period 1 being blue, 2 - green, 3 - yellow

DATA: Table 1: Element Properties

| Element | Atomic Number | Atomic Radius (pm) | 1 st Ionization Energy (kJ/mol) | Electron Affinity (kJ/mol) | Electro negativity (Pauling Units) |
|---------|---------------|--------------------|--|----------------------------|------------------------------------|
| H | 1 | 53 | 1312 | -73 | 2.1 |
| He | 2 | 31 | 2372 | 0 | NA |
| Li | 3 | 167 | 520 | -60 | 1.0 |
| Be | 4 | 112 | 899 | 240 | 1.5 |
| B | 5 | 87 | 801 | -27 | 2.0 |
| C | 6 | 67 | 1086 | -122 | 2.5 |
| N | 7 | 56 | 1402 | 0 | 3.0 |
| O | 8 | 48 | 1314 | -141 | 3.5 |
| F | 9 | 42 | 1681 | -328 | 4.0 |
| Ne | 10 | 38 | 2081 | 0 | NA |
| Na | 11 | 190 | 496 | -53 | 0.9 |
| Mg | 12 | 145 | 738 | 230 | 1.2 |
| Al | 13 | 118 | 578 | -44 | 1.5 |
| Si | 14 | 111 | 787 | -134 | 1.8 |
| P | 15 | 98 | 1012 | -72 | 2.1 |
| S | 16 | 88 | 1000 | -200 | 2.5 |
| Cl | 17 | 79 | 1251 | -349 | 3.0 |
| Ar | 18 | 71 | 1521 | 0 | NA |

LAB: PERIOD TRENDS ANSWER SHEET

Prelab: Questions

1. What do we mean by trends on the periodic table?
2. How are the radii of atoms measured?
3. What is ionization energy?
4. What is second ionization energy?
5. What is electron affinity?
6. What is electronegativity?
7. Make a **prediction** as to what will happen to the sizes of atoms as one progresses from left to right across a period on the periodic table. (Example: the sizes of atoms will (increase, decrease, remain constant) as one goes left to right across a period. Then do the same for first ionization energy, electron affinity and electron negativity.

According to your prediction, make a **sketch** of how you would EXPECT a graph to appear if you plotted atomic number on the X-axis and atomic radius (size of the atom) on the Y-axis. Then do the same for first ionization energy, electron affinity and electronegativity. (You don't have to do this on graph paper. Just on your paper.)

Atomic Radii

Ionization Energy

Electron Affinity

Electronegativity

LAB: PERIOD TRENDS Analysis of DATA

1. Based on your graphs, what is the trend in atomic radius across a period? down a family?
2. Based on your graphs, what is the trend in ionization energy across a period? down a family?
3. Based on your graphs, what is the trend in electron affinity across a period? down a family?
4. Based on your graphs, what is the trend in electro negativity across a period? down a family?
5. What can you deduce about the relationship between ionization energy and reactivity of metals?
6. What can you deduce about the relationship between electron affinity and reactivity of nonmetals?
7. Is the property of reactivity different for metals than nonmetals?
8. Based on your graphs, can a prediction for chemical or physical properties of an unknown element be predicted? Explain in detail.