Atomic Structure and Periodic Trends

Raddii, Ionization Energy, and Electronegativity

Periodic Trends

- Before considering the types of compounds formed we will consider general trends
  - Atomic radii
  - Ionization Energy (defined soon)
  - Electron Affinity (defined soon)
- The shape of molecules, and chemical formulas can also be understood by studying electronic configurations, we will look at these later.

Atomic Radii Expectations

- Reasonable to expect the size to increase with atomic number, after all even though they are tiny the electrons need space.
- Reasonable to expect the radii to be diminished because the positive charge on the nucleus increases and so the electronic force between the electrons and the nucleus increases.
- We see the radii increasing and decreasing.
Atomic Radii Increase Down Columns, and Decrease Across the Table

Atomic Radii

determined by the amount of space the electrons take up.

If the electrons are held in closer the radius of an element will be less, than that of another element

What is the force that holds electrons near the nucleus?

The electric force – positively charged nucleus + negatively charged electron.

Radii Smaller Going Across

- As atomic number increases the charge in the nucleus increases and so the electrons are held closer to the nucleus.
- But if this is true why do the radii increase in size down the columns?

Electronic Shielding

http://grandinetti.org/Teaching/Chem121/Lectures/MultiElectronAtoms/assets/multielectron.gif
Radii Increase Down a Column

- The charge “felt” by an electron is decreased by other electrons that spend more time near the nucleus.
- The shells with a lower principle quantum number shield the one above it.
- Each successive layer feels about the same force as the one above it in the column.
- The radii increase because there are more electrons and the nuclear charge is nearly unchanged.

Radii and the Current Model of Electron Configuration

- That the electrons are arranged in successive layers has a significant role in these observations.
- Dispersed arrangement within a period, eliminates shielding across a period.
- Layered arrangement is needed to explain why shielding increases so effectively from one row to the next.

Ionization Energy and Electron Affinity

- Ionization Energy is a measure of how easy it is to pull an electron off an atom. For Example
  Na → Na⁺ + e⁻ (In this reaction a sodium ion has been formed.
- Electron Affinity is a similar idea but it is concerned with how strongly an element attracts an electron. A high electron affinity can lead to the formation of ions as well.
  Cl₂ + → 2Cl⁻ (In this reaction chlorine reacts to give a chloride ion.)

Giving and Receiving Electrons

Sodium metal reacts with chlorine gas to form sodium chloride. (http://www.youtube.com/watch?v=Ftw7a5ccubs&feature=related)