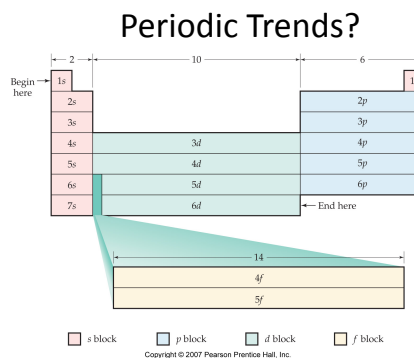


## Atomic Structure and Periodic Trends

Radii, Ionization Energy, and  
Electronegativity



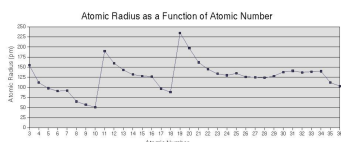
## Periodic Trends

- 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.

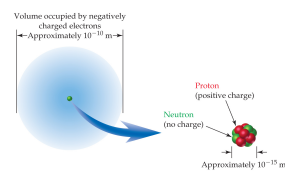
## Atomic Radii Increase Down Columns, and Decrease Across the Table



In Lecture we also viewed [http://www.crystallmaker.com/support/tutorials/crystallmaker/resources/VFI\\_Atomic\\_Radii.jpg](http://www.crystallmaker.com/support/tutorials/crystallmaker/resources/VFI_Atomic_Radii.jpg) and [http://www.webelements.com/\\_media/periodicity/tables/line/atomic\\_radius.gif](http://www.webelements.com/_media/periodicity/tables/line/atomic_radius.gif)

- 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?

## Atomic Radii



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
- $\text{Na} \rightarrow \text{Na}^+ + \text{e}^-$  (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.
- $\text{Cl}_2 + \rightarrow 2\text{Cl}^-$  (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>)



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Chapter Four

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