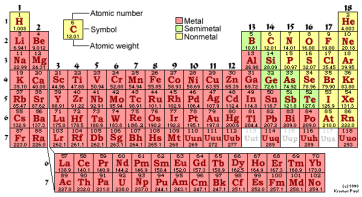


The Periodic Law

Mr. Sudbury

Periodic Trends

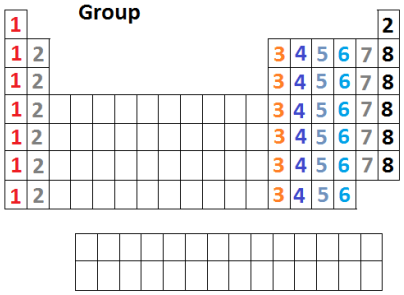
Mr. Sudbury

Periodic Trends – Valence Electrons

- Valence electrons are the electrons available to be lost, gained, or shared in the formation of a chemical compound.
- Only the s & p orbitals (8 total electrons)
- Atoms desire to have their outer valence electron shell full.
- OCTET RULE – atoms want to fill their valence shell with 8 electrons.
- Noble gases have full outer shells.

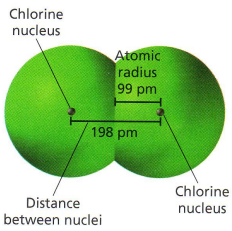
Valence Electrons

Valence Electrons in Each Group



Periodic Trends – Atomic Radii

- Atomic Radius: One-half the distance between the nuclei of identical atoms that are bonded together.



Periodic Trends – Atomic Radii

- Periodic Trends of atomic radii
  - Radius decreases across a period
  - Radius increases down a group
    - Addition of new energy levels (AKA principal quantum numbers.)

Table of Atomic Radii

- Look at the patterns in periods and groups!

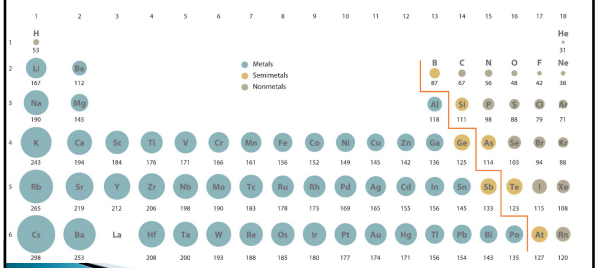
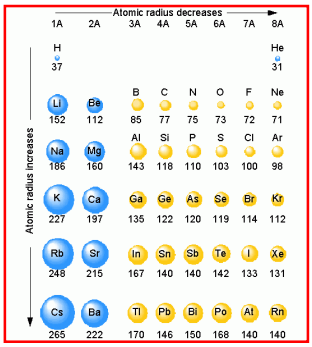


Table of Atomic Radii

- Atomic Radius INCREASES as you go down a group.
- Atomic Radius DECREASES as you go right on a period.



Periodic Trends – Ionization Energy

- An Ion is an atom or group of bonded atoms that has a positive or negative charge.
- Ionization is any process that results in the formation of an ion.
- ***Ionization energy is the energy required to remove one electron from a neutral atom of an element.*** (measured in kJ/mol)

Ionization Energy Trends

- Increases across a period.
- Decreases down a group.
  - Outer electrons are farther from the nucleus and easier to remove (requires less energy)

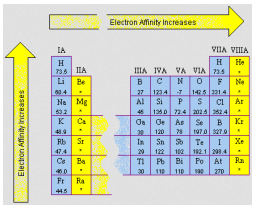
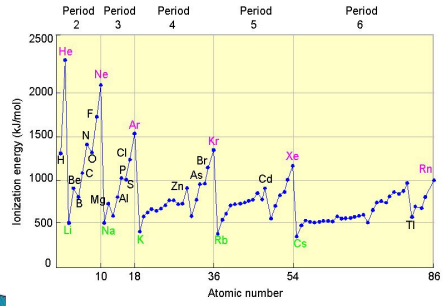
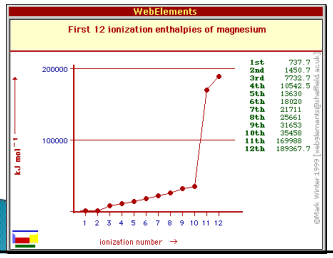


Table of 1st Ionization Energy

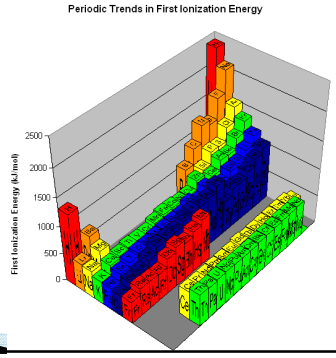


Ionization of Magnesium

- $Mg + 738\ kJ \rightarrow Mg^{+} + e^{-}$
- $Mg^{+} + 1451\ kJ \rightarrow Mg^{2+} + e^{-}$
- $Mg^{2+} + 7733\ kJ \rightarrow Mg^{3+} + e^{-}$



Ionization Energy – Another Look



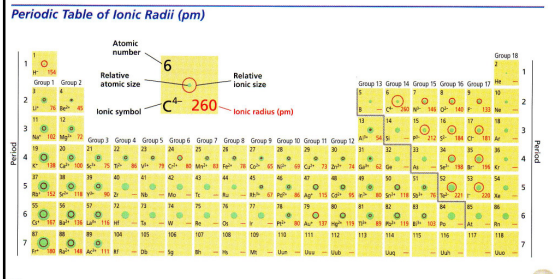
Periodic Trends – Electron Affinity

- The energy change that occurs when an electron is acquired by a neutral atom.
  - Affinity increases across a period.
  - Affinity decreases as you go down a period.
    - Electrons are farther from the nucleus so they experience less nuclear attraction

Periodic Trends – Ionic Radii

- Ions – an atom or group of bonded atoms that has a positive or negative charge.
- Cation = a positive ion.
- Anion = a negative Ion.
- Periodic Trends
  - Cationic radii decrease across a period.
    - Since you are losing electrons, the p+ in the nucleus hold the remaining electrons closer.
  - Anionic radii decrease across each period.
  - Ionic radii increases down a group.

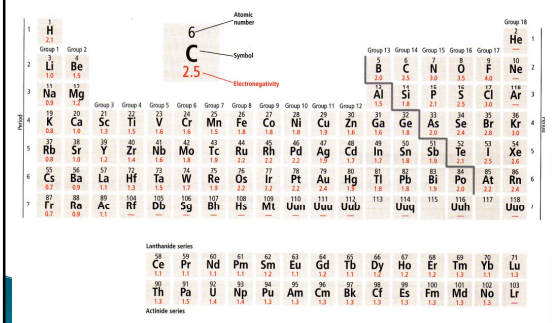
Ionic Radii Chart



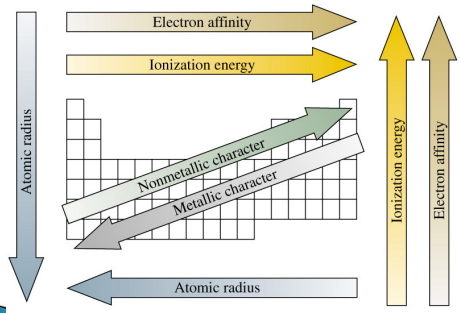
Periodic Trends – Electronegativity

- ***Electronegativity is a measure of the ability of an atom in a chemical compound to attract electrons.***
- PT Trends
  - Typically increase across each period.
  - Increase up a group.

PT of Electronegativity



Summary of Periodic Trends



The End

- Periodic Tends:
  - Valence Electrons
  - Atomic Radius
  - Ionization Energy
  - Electron Affinity
  - Ionic Radius
  - Electronegativity