GENERAL CHEMISTRY STANDARD 4.2

4.2: Define atomic radii, ionic radii, ionization energy, electron affinity, and electronegativity in terms of the Periodic Table

PERIODIC PROPERTIES

- **Ionization Energy**: The energy required to remove the most loosely held electron from the outermost energy level of that atom in the gaseous phase.

$$M\ (g) + \text{energy} \rightarrow M^{+}\ (g) + e^{-}$$

- **First Ionization Energy**: The energy required to remove the first outermost electron.

- **Second Ionization Energy**: The energy required to remove the second outermost electron

and so on…

IONIZATION ENERGY

- Ionization Energy increases from left to right on the Periodic Table
- Ionization Energy increases with every subsequent electron removed
- Ionization Energy decreases as you go down the Periodic Table with a group → **Shielding Effect**.
- Ionization Energy table on Page 370 in your textbook.

ELECTRONEGATIVITY

- **Electronegativity**: A measure of the ability of an atom of an element that is chemically combined with another element to attract electrons to itself.
    - Devised by Linus Pauling
- Metals generally have low electronegativity values, halogens have higher electronegativity values

ATOMIC/IONIC RADII

- **Covalent Atomic Radius**: The effective distance between the nucleus of the atom and its valence shell when the atom has formed a covalent bond by sharing of electrons
  - Decreases within a period
  - Increases within a group
- **van der Waals Radius**: Half the distance between the nuclei of identical atoms at their point of closest approach when no bond is formed
- **Ionic Radius**: The effective distance from the nucleus of an atom to its outer shell of electrons
  - No clear pattern within a period
  - Increases within a group

ISOELECTRONIC SPECIES

- **Isoelectronic Species**: Atoms or ions that have the same electron configuration
  - N^{-3}, O^{-2}, Ne, Na^{+1}, Mg^{+2}, Al^{+3} is an isoelectronic series
- As you move from left to right above, the size of the particle decreases
- As atomic number increases within an isoelectronic series, radius decreases

METALLIC VS NONMETALLIC CHARACTER

- Metals are on the left side of the Periodic Table
- Nonmetals are on the right side of the Periodic Table
- Metalloids are adjacent to the stair-step line in the *p* block of elements
- Most metallic character → lower leftmost side of Periodic Table
- Most nonmetallic character → upper rightmost side of Periodic Table