Ch. 7, Periodic Trends

Chem1A, General Chemistry I

The periodic table is arranged by **increasing** atomic weight (atomic number). The groups and periods give rise to **periodic trends**, or shared properties and characteristics between elements in close proximity to each other.

Effective Nuclear Charge is the measure of the positive force from the nucleus that a valence electron in an atom actually feels. It is calculated by:

$$\mathbf{Z_{eff} = Z - S}$$

where Z is the atomic number (# of protons) and S is the shielding constant (approximately equivalent to the number of core electrons an atom contains). S also includes the slight shielding caused by other valence electrons as well as the differences between orbital shapes.

TREND: increases **RIGHT** and **DOWN**

Atomic Radius can be either **nonbonding** (1/2 the closest distance that two nuclei come before repelling apart) or **bonding** (1/2 the distance between two nuclei participating in a covalent bond).

TREND: increases **LEFT** and **DOWN**

Ionic Radius is the distance between the nucleus and the outer perimeter of electrons when an atomic is ionized.

TREND: cations **DECREASE** and anions **INCREASE**

Ionization Energy is the minimum amount of energy required to remove an electron from a gaseous element or ion in its ground state (be oxidized). The greater the ionization energy, the less likely the atom is to lose an electron (more endothermic process). Ionization energy **increases** with the more electrons removed, **increases** when removing core electrons, and **increases** when removing an electron from a filled or half-filled shell.

TREND: increases **RIGHT** and **UP**

Electron Affinity is the attraction of an atom to add another electron (be reduced). The more negative the electron affinity, the more attracted the atom is to the new electron.

TREND: nonmetals are **HIGHLY NEGATIVE** and noble gases are **HIGHLY POSITIVE**

TYPES OF ELEMENTS

- **METALS** are typically solids, conductors, malleable, and have a metallic luster. They tend to have low ionization energy and are thereby easily oxidized. They participate in **metallic bonding** (pooling electrons along the atoms' surfaces).
- **NONMETALS** are varied in state (gas, liquid, solid) and are non-conductors and non-malleable. They tend to have highly negative electron affinities and are thereby easily reduced. They participate in **covalent bonding** (shared electrons).
- **METALLOIDS** are intermediate in their properties as semi-conductors, semi-malleable, and varied states.