

## Honors Chemistry Topic V: Periodic Trends and Properties

The **Periodic Law** states that many of the physical and chemical properties of the elements tend to recur in a systematic manner with increasing atomic number.

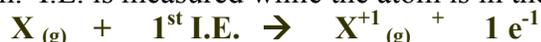
1. Atomic Size, measured as atomic radius

- Group Trend** - atomic radius increases down a group due to the increase in number of principle energy levels (n). Electrons in the valence shell are farther away from the protons in the nucleus and because of the increasing distance, less force of attraction acting on electrons.
- Periodic Trend** – atomic radius decreases across a period due to the increasing effective nuclear charge on the valence electrons as shielding remains constant.

2. Ionic Size, measured as ionic radius

- Cations** are always much smaller than the atoms from which they are formed.
- Anions** are always much larger than the atoms from which they are formed.

3. Ionization energy(I.E.) – the amount of energy (kJ/mole) required to remove an electron from an atom. I.E. is measured while the atom is in the gaseous state.



- Group Trend** – 1<sup>st</sup> ionization energy decreases down a group because atomic size increases, less force of attraction acting on electron, therefore requiring less energy to remove electron. (Shielding increases down a group/family)
- Periodic Trend** – 1<sup>st</sup> ionization energy increases across a period because of the increasing effective nuclear charge acting on the valence electrons; electrons located closer to nucleus, requiring more energy to pull them away. (Shielding remains constant across a period.)

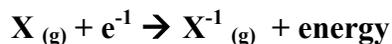
4. Electronegativity – the ability of an atom of an element to attract electrons in a chemical bond, expressed in units called Paulings. (Noble gases are omitted because they do not usually form compounds)

- Group Trend** – electronegativity values generally decrease moving down in a group.
- Periodic Trend** – for representative elements, the electronegativity value tend to increase from left to right across a period (excluding noble gases)

5. Metallic Character - a measure of how easily an atom gives up electrons and forms a positive ion. This depends on how tightly or loosely the electrons are held by the nucleus. (Atoms with better shielding tend to be more metallic.)

- Group Trend** – metallic character increases moving down in a group.
- Periodic Trend** – metallic character decreases moving left to right across a period.

6. Electron Affinity – the energy change that occurs when an electron is acquired by a neutral gaseous atom. Most atoms release energy (kJ/mol) when they acquire an electron. In this case, the quantity of energy is represented by a negative number.



\*We say that the electron is screened or shielded from the nuclear charge by the repulsion of the core electrons.