What is Electron Affinity?

The **electron affinity** is defined as the energy change that occurs when an atom gains an electron, releasing energy in the process. Let's remember that an electron is negatively charged, so when an atom gains an electron, it becomes a **negative ion**.

Since we are talking about a change in energy, when an electron is added to an atom, there is an equation used to determine the electron affinity:

$$E_{EA} = Electron\ Affinity$$
$$\Delta E = Change\ in\ Energy$$
$$\boldsymbol{E_{EA} = -\Delta E}$$

This equation shows that electron affinity is equal to the negative change in energy. Let's clarify the sign convention for the energy change associated with the gain of an electron. Remember that the definition of an electron affinity is the energy released, so that means that the reaction is **exothermic**. *If a reaction is exothermic, the change in energy is negative. This means that the electron affinity is positive*.
For example, the electron affinity of chlorine has the negative sign, which shows us the energy that is released to add one electron to an atom. The giving off of energy is shown with a negative sign.

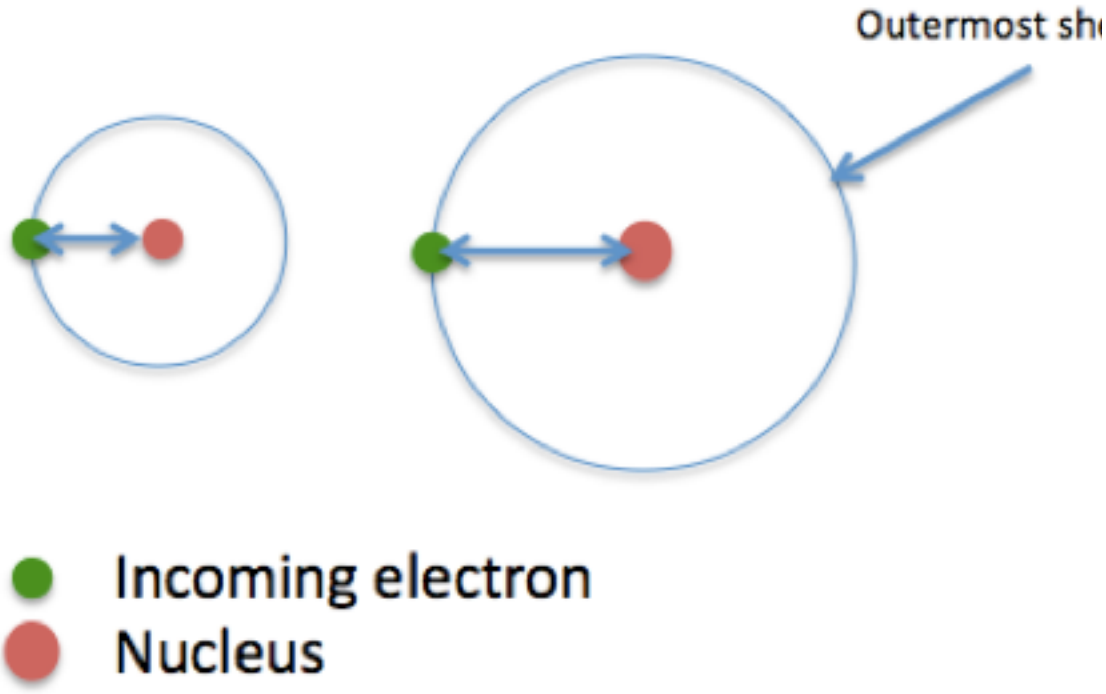
$$Cl_{(g)} + e^- \rightarrow Cl^-_{(g)} \quad \boldsymbol{\Delta E = -349\ kJ/mol}$$
$$\boldsymbol{E_{EA} = -\Delta E}$$
$$\boldsymbol{E_{EA} = +349\ kJ/mol}$$

Based on this sign convention, this means that *a higher electron affinity indicates that an atom more easily accepts electrons. A lower electron affinity indicates that an atom does not accept electrons as easily.*

Factors That Affect Electron Affinity

There are two factors that can affect electron affinity. These are atomic size and nuclear charge. With regard to atomic size, let's think about a magnet and a refrigerator. When a magnet is closer to the surface of the refrigerator, you can clearly feel the pull of the attraction between the magnet and the refrigerator. The farther the magnet gets away from the fridge, the less you feel the attraction or pull.

When looking at a drawing of a smaller atom side by side with a bigger atom, it can be seen that a smaller atom's outermost shell is closer to the nucleus than that of a bigger atom. Just like our magnet and refrigerator analogy, the electron will feel more attraction to the nucleus if it is closer.



The smaller the atom is, the closer the outermost shell is; therefore, it is a stronger attraction between the nucleus and the incoming electron. That means the electron affinity is higher for smaller atoms.

When looking at the periodic table the atomic radius increases from top to bottom, moving down a column; therefore, the electron affinity increases from the bottom to the top of the column.

Nuclear charge also affects electron affinity. The **nuclear charge** is also known as the atomic number, which is the same as the number of protons. **Protons** are positive subatomic particles. The more protons there are, the greater the attraction is to electrons.

Trends or patterns can be seen in the periodic table with regard to electron affinity. We look at this in terms of **across the period**, **not down a group**. From left to right, the nuclear charge increases, resulting in a greater attraction to incoming electrons. So, we can say that *from left to right across a period, the electron affinity increases*