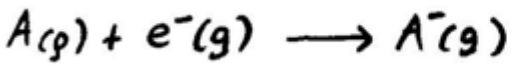
# PERIODIC PROPERTIES OF ATOMS

## ELECTRON AFFINITY

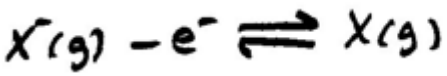
*Electron affinity is an energy released when one electron is given from outside to a neutral or gaseous atom. The electron affinity of an element is the energy given off when a neutral atom in the gas phase gains an extra electron to form a negatively charged ion. The energy exchange for the addition of electrons from the outside is called the electron gain enthalpy ($\Delta H_{eg}$). The term electron affinity is used instead of $\Delta H_{eg}$. Electron affinity is a negative sign of the value of the electron gain enthalpy of an element at T=O. In general, the electron affinity is given as eV and electron gain enthalpy is given as kJ.mol$^{-1}$. Electron gain reaction may be exothermic or endothermic.*



($\Delta H_{eg}$) $\quad$ **$EA = E(A,g)-E(A^-,g)$**

*Electron affinities are more difficult to measure than ionization energies. Electron affinity can also be defined as zero ionization energy.*

*1$^{st}$ electron affinity = zero ionization energy*

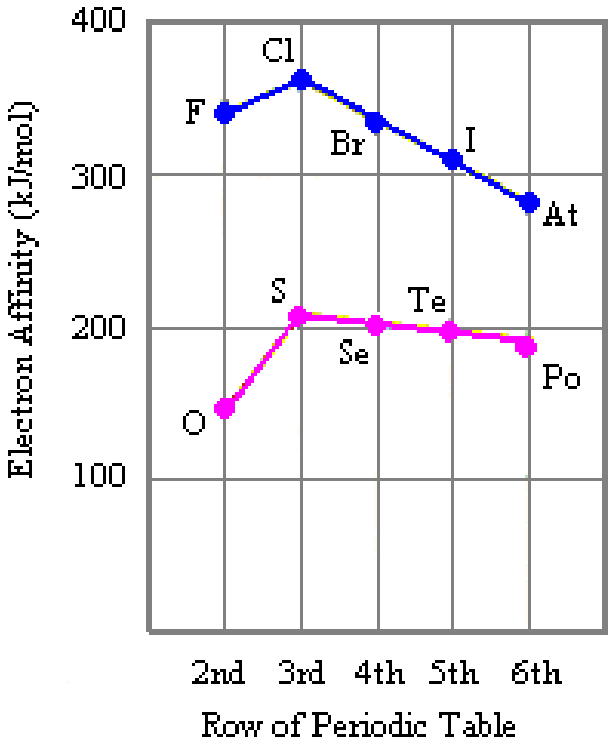


$\Delta H_1 = -\Delta H_{eg}$

*Electron affinity of IIA group and XVIII group elements are marked with (+).*
*In addition, electron affinity can be found in the Born-Haber cycle.*

*The electron affinity depends on the atomic size and the effective nuclear charge. If an electron joins from the outside is placed in an orbital under the influence of an effective nuclear charge, a large amount of energy is released and that element has a high electron affinity.*

- ✓ *When we go from left to right on the periodic table, the atomic radius becomes smaller, the electron affinity is generally increased. But, there are exceptions to the general pattern of the first electron affinity. The exceptions in the electron affinity when going from left to right are due to the global symmetrical properties of atoms.*
- ✓ *Negatively charged ions can be formed in the gas phase of the IA group elements. It is very difficult to obtain the negatively charged ions of IIA group elements.*
- ✓ *As the effective nuclear charge of Ne is larger than Be, the electron affinity of Ne is greater than that of Be.*
- ✓ *When we move down a group on the periodic table, the atomic radius increases. Due to increase of size, the electron affinity decreases. For example Li has only one electron in outermost shell so it will lose electron easily rather than gaining but sodium will lose electron easily as compared to lithium. So gaining of electron is greater in lithium as compare to sodium. So lithium has a high electron affinity. The decreasing of the electron affinity from the top to the down reverse (upside down) from the second to the third period when we move down the 7A group elements. In case of fluorine, it can gain electron easily but due to very small size its electron start repulsion to new electron. Therefore less energy releases as compare to chlorine. Electron affinities generally become smaller as we go down a column of the periodic table for two reasons. First, the electron being added to the atom is placed in larger orbitals, where it spends less time near the nucleus of the atom. Second, the number of electrons on an atom increases as we go down a column, so the force of repulsion between the electron being added and the electrons already present on a neutral atom becomes larger. The repulsion between the electron being added to the atom and the electrons already present on the atom depends on the volume of the atom. Among the nonmetals in Groups VIA and VIIA, this force of repulsion is largest for the very smallest atoms in these columns: oxygen and fluorine. As a result, these elements have a smaller electron affinity than the elements below them in these columns. From that point on, however, the electron affinities decrease as we continue down these columns.*




*The electron affinity of F is -328 kJ.mol$^{-1}$ and the electron affinity of C1 is -348 kJ.mol$^{-1}$. Radius increases from F to Cl. The pairing energy in F is greater than that of Cl. While the electron is approaching from outside, the effect of pushing through the electron cloud is important in F. It is not important in other halogens. In Cl, the electron is paired in a larger volume. The reason why the electron affinity of C1 does not decrease is that the electron enters the d orbital of Cl.*