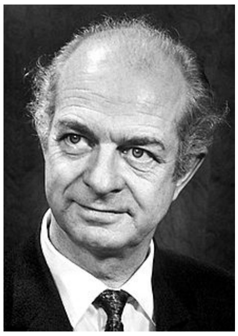
The Electronegativity is a chemical property. It describes the tendency of an atom to attract shared electron pairs towards itself. The Electronegativity of an atom is influenced by both its atomic number and distance between valance shell electrons. The Electronegativity increases in correspondence with the magnitude of attraction of electrons towards itself. Electronegativity is determined by factors like the nuclear charge and the number of electrons present in the atoms shells. The farther from the valence electrons be, less positive charge they will experience because of their increased distance from the nucleus. Presence of electrons in the inner shells also act to shield the valence electrons from the positively charged nucleus.

The opposite of electronegativity is electropositivity. It is the measure of an elements ability to give out electrons. Electronegativity has long history since the time of J.J. Berzelius and Avogadro. An accurate scale of electronegativity was developed in 1932, when Linus Pauling proposed and electronegative scale. It depends on bond energy. The electronegativity values are shown in (Fig. 4)



In general, electronegativity increases on passing from left to right across a period and decreases on descending a group.

Linus Pauling

Electronegativity of the Atoms

Average valence electron binding energy as T → 0K

eV e^{-1}

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	H $1s^1$ 13.6																	He $1s^2$ 24.6
2	Li $2s^1$ 5.4	Be $2s^2$ 9.3											B $2s^22p^1$ 11.4	C $2s^22p^2$ 13.9	N $2s^22p^3$ 16.9	O $2s^22p^4$ 18.6	F $2s^22p^5$ 23.3	Ne $2s^22p^6$ 28.3
3	Na $3s^1$ 5.1	Mg $3s^2$ 7.6											Al $3s^23p^1$ 9.1	Si $3s^23p^2$ 10.8	P $3s^23p^3$ 12.8	S $3s^23p^4$ 13.6	Cl $3s^23p^5$ 16.3	Ar $3s^23p^6$ 19.1
4	K $4s^1$ 4.3	Ca $4s^2$ 6.1	Sc $4s^23d^1$ 7.0	Ti $4s^23d^2$ 8.4	V $4s^23d^3$ 9.7	Cr $4s^13d^5$ 8.0	Mn $4s^23d^5$ 12.3	Fe $4s^23d^6$ 10.1	Co $4s^23d^7$ 11.9	Ni $4s^23d^8$ 12.9	Cu $4s^13d^{10}$ 10.2	Zn $4s^23d^{10}$ 15.9	Ga $4s^24p^1$ 9.9	Ge $4s^24p^2$ 11.1	As $4s^24p^3$ 12.5	Se $4s^24p^4$ 13.2	Br $4s^24p^5$ 15.2	Kr $4s^24p^6$ 17.4
5	Rb $5s^1$ 4.2	Sr $5s^2$ 5.7	Y $5s^24d^1$ 6.3	Zr $5s^24d^2$ 7.5	Nb $5s^14d^4$ 7.0	Mo $5s^14d^5$ 8.3	Tc $5s^24d^5$ 10.9	Ru $5s^14d^7$ 8.4	Rh $5s^14d^8$ 9.3	Pd $4d^{10}$ 8.3	Ag $5s^14d^{10}$ 12.0	Cd $5s^24d^{10}$ 16.1	In $5s^25p^1$ 9.3	Sn $5s^25p^2$ 10.2	Sb $5s^25p^3$ 11.2	Te $5s^25p^4$ 12.0	I $5s^25p^5$ 13.4	Xe $5s^25p^6$ 14.9
6	Cs $6s^1$ 3.9	Ba $6s^2$ 5.2	Lu $6s^25d^1$ 6.4	Hf $6s^25d^2$ 7.1	Ta $6s^25d^3$ 7.8	W $6s^25d^4$ 8.6	Re $6s^25d^5$ 9.1	Os $6s^25d^6$ 9.2	Ir $6s^25d^7$ 10.8	Pt $6s^15d^9$ 9.5	Au $6s^15d^{10}$ 10.9	Hg $6s^25d^{10}$ 14.1	Tl $6s^26p^1$ 10.2	Pb $6s^26p^2$ 11.0	Bi $6s^26p^3$ 10.7	Po $6s^26p^4$ 12.2	At $6s^26p^5$ 12.6	Rn $6s^26p^6$ 14.6
7	Fr $7s^1$ 4.1	Ra $7s^2$ 5.3																

6	La $6s^25d^1$ 6.0	Ce $6s^24f^15d^1$ 7.3	Pr $6s^24f^3$ 6.7	Nd $6s^24f^4$ 7.2	Pm $6s^24f^5$ 7.4	Sm $6s^24f^6$ 8.3	Eu $6s^24f^7$ 9.4	Gd $6s^24f^75d^1$ 13.8	Tb $6s^24f^9$ 7.7	Dy $6s^24f^{10}$ 8.4	Ho $6s^24f^{11}$ 8.3	Er $6s^24f^{12}$ 7.6	Tm $6s^24f^{13}$ 9.0	Yb $6s^24f^{14}$ 10.2	**Element** ground state valence configuration $\bar{\chi}$
7	Ac $7s^26d^1$ 5.8	Th $7s^26d^2$ 6.4	Pa $7s^25f^26d^1$ 6.3	U $7s^25f^36d^1$ 7.5	Np $7s^25f^46d^1$ 8.2	Pu $7s^25f^6$ 7.3	Am $7s^25f^7$ 8.3	Cm $7s^25f^76d^1$ 10.9							

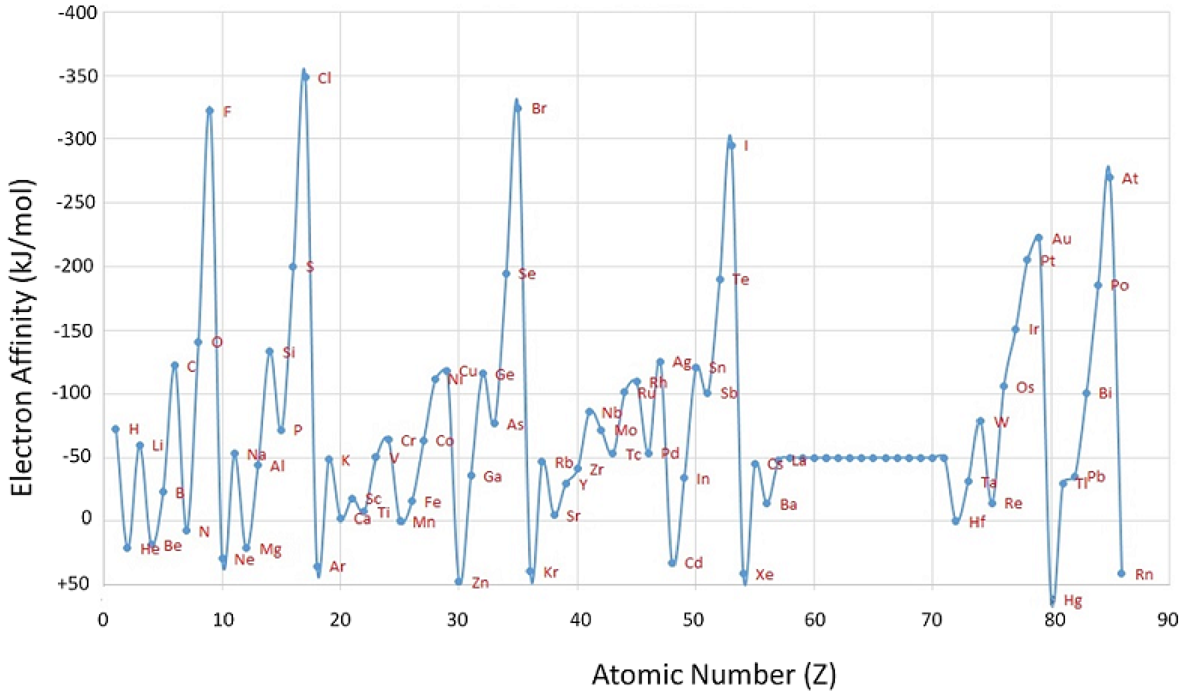
(Table. 3)

Fluorine is the most electronegative element and Caesium is least electronegative. This means Caesium fluoride is the compound whose bonding features represent the most ionic character.

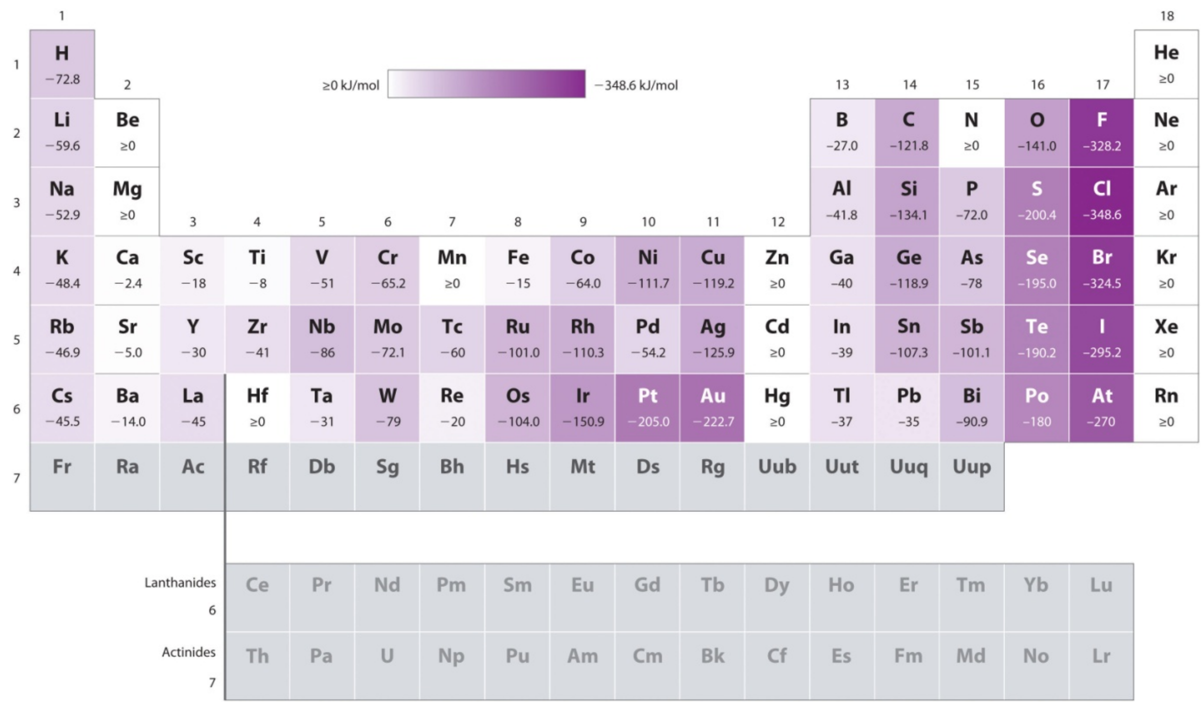
Electron Affinity

Electron affinity (EA) of an element is the change in energy that takes place when an electron is added to a gaseous atom. It is expresses in two different ways. (1) The energy that is released by adding an electron to an isolated gaseous atom, (2) the second or the reverse method that the electron affinity is the energy required to remove an electron from a single charged anion. It may be recollected that ionisation deals with the absorption of energy in the process of formation of the positively charged ion. In a similar manner electron affinities are the negative ion equivalent.

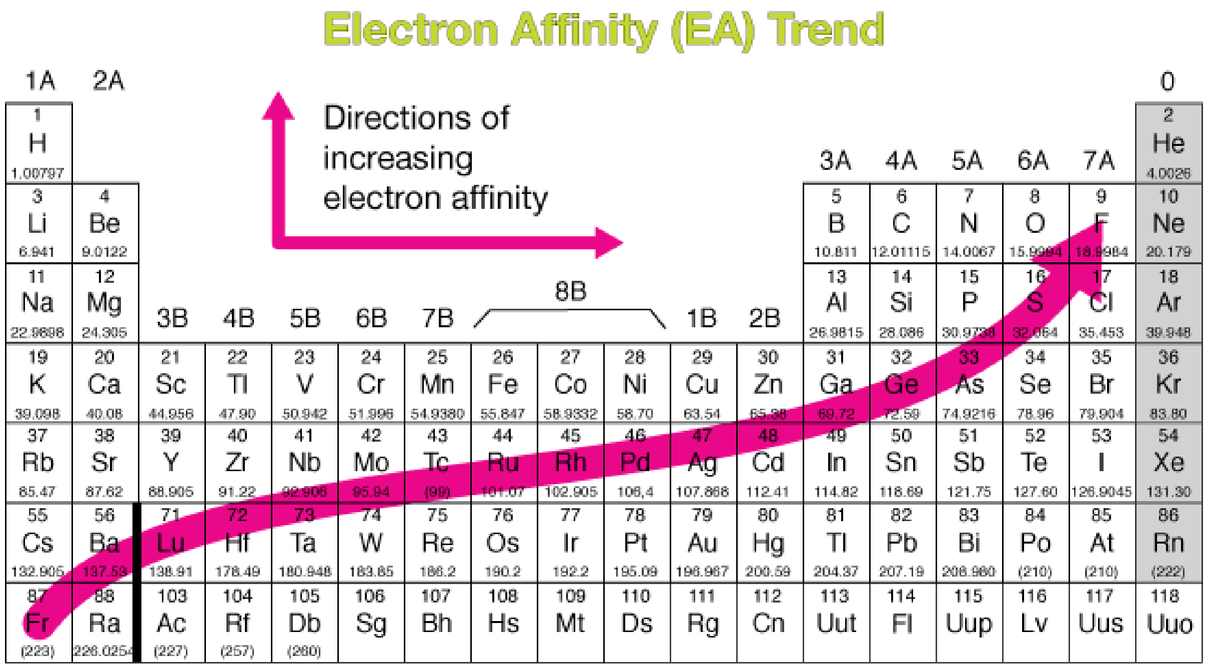
Electron capture by an atom requires energy as the electron has to overcome the force of repulsion of the electrons existing in the atom. The electron must possess enough kinetic energy to excite a resonance of the atom plus electron system. In the reverse process the release of the electron from the negatively charged ion, the energy is carried away in the form of kinetic energy of the electron. The electron affinity values of the elements of the periodic table are shown in (fig. 4) and (Fig. 5) given below.



(Fig. 4)



(Fig. 5)



(Fig. 6)

Valence and Oxidation States

The most important chemical property of an element is its valency. Valency refers to the number of hydrogen atoms that can combine with one atom of another element or twice the number of oxygen atoms. Instead of combination the phenomenon of displacement can be considered to define the valency of an element in the same way as combination. In binary ionic compounds the sum of the positive charges and negative charges is zero, thus in calcium bromide $CaBr_2$, the charge of calcium is +2 and the charge of two bromine atoms is -2. Their sum is zero.

Oxidation State

Complex chemical species which possess formula involving more than two elements and number of atoms of different elements are more than one is frequently encountered in chemistry. In order to write their formula correctly it has it has been useful to define a useful concept 'Oxidation state' of each element present in the molecule or ion. It is an arbitrary electric charge assigned to the atom following some simple rules.

In binary compounds the valency and oxidation state are same. Calcium chloride $CaCl_2$ is an ionic compound. It can be written as $Ca^{2+}(Cl^-)_2$. It shows the ionic nature of the compound. Calcium ion has charge +2 and its oxidation state is +II (Usually Roman letters are used to indicate oxidation state). Chloride ion has charge -1 and its oxidation state –I.

In non-ionic compounds electrons involve may not be completely transferred as in case of ionic compounds. For assigning oxidation states it is formally assumed that complete transfer of electron(s) occurs. For homonuclear molecules like H_2, O_2 and N_2 the atoms are in the state their respective elements. The oxidation state of atoms in elementary state is taken as zero. In heteronuclear molecules the more electronegative element is assumed to strip off the electron from the more electropositive element. For example, in H_2O, oxygen is more electronegative than hydrogen. So its oxidation state is –II. In sulphur dioxide oxygen is more electronegative than sulphur. So oxidation state of sulphur is +IV and oxygen is –II.

The following simple principle is useful to determine the oxidation states of an element in a compound or ion.

(1) Oxidation state of hydrogen in most of its compounds is +I except in ionic hydrides where it is -I

(2) Oxidation state of oxygen in most of its compounds is –II except in peroxides where it is –I

(3) The oxidation of atoms or elements in elementary state is zero.

(4) The oxidation state of an element in a molecule or ion is calculated with reference to hydrogen or oxygen when hydrogen or oxygen combines with the element to form a binary compound.

(5) The algebraic sum of the oxidation state of a neutral compound is zero.

(6) The algebraic sum of the positive or negative oxidation state is equal to the total positive or negative charge of the ion in case of an ion.

Some examples are given below as illustrations.

(1) Helium hydride HeH is the first chemical compound formed in the universe. Here He has oxidation state +I and hydrogen has oxidation state –I.

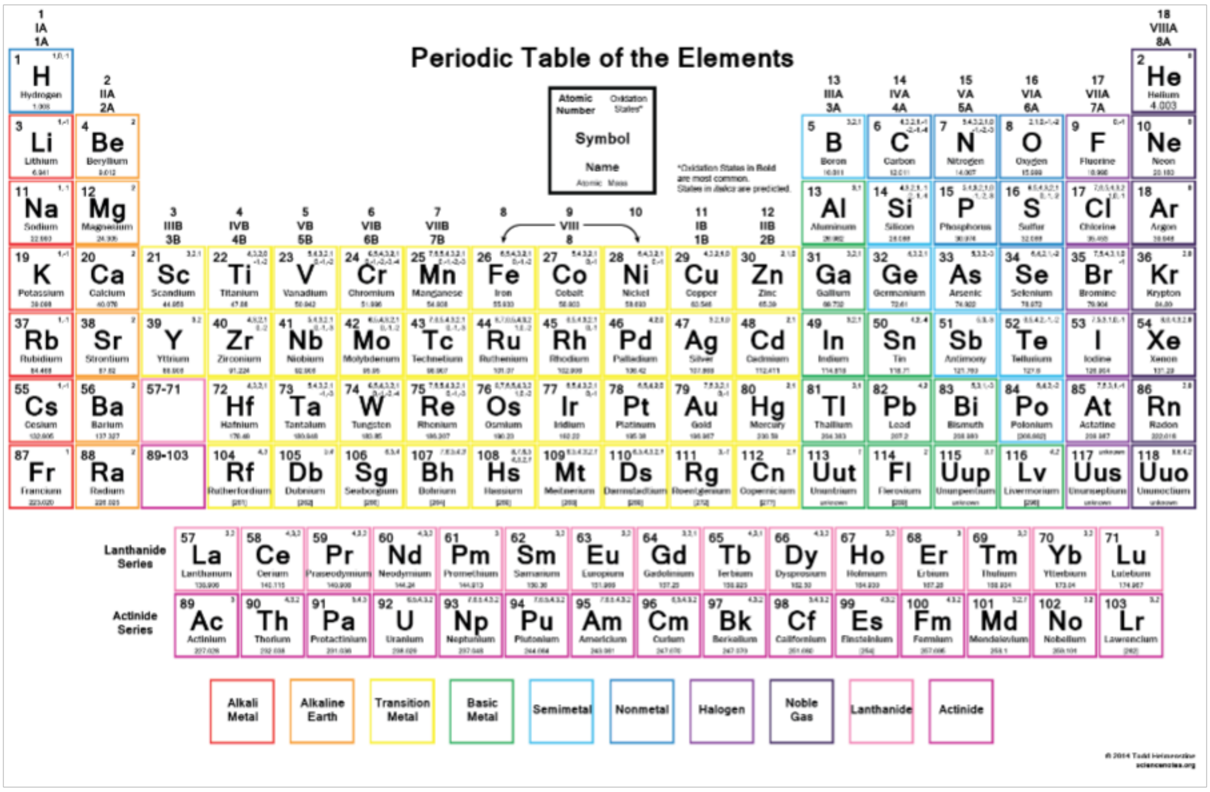
(2) The oxide of potassium KO_2 is a super oxide where potassium has oxidation

state +I and oxygen has oxidation state -1/2

(3) F_2O is a rare compound where oxidation state fluorine is –I and oxygen is +II.

(4) For chlorate ion (ClO_3^-) chlorine has oxidation state +V and three oxygen atoms together have oxidation state –VI and total charge is -1

The oxidation states of the elements of the periodic table are shown in (table. 4)



(Table. 4)

Oxidation states of elements range from -4(Si, C, Cr, Sn) to +8(Ru, Os). Chemical reaction between elements is an electromagnetic interaction and these oxidation states are attainable by chemical reactions.
