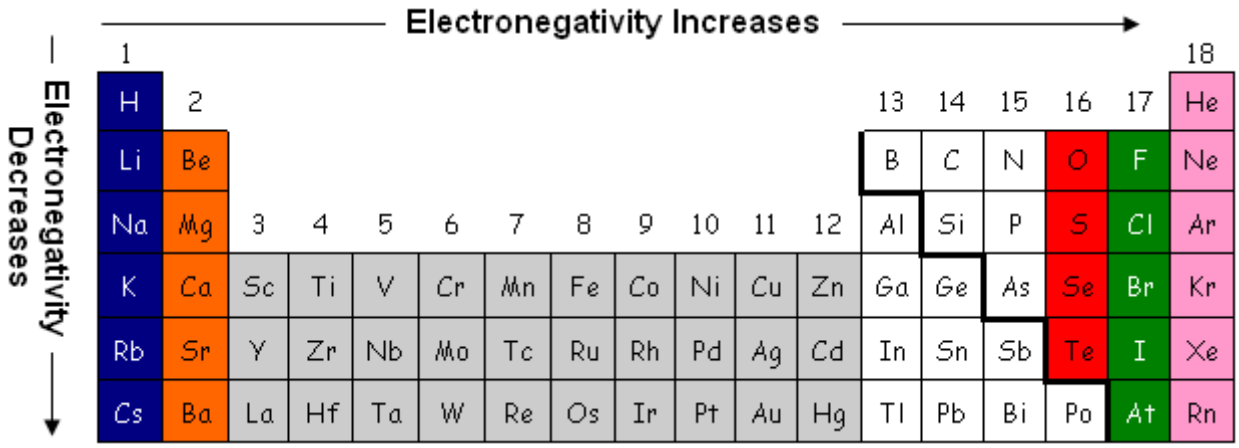
The modern periodic table is arranged based on the atomic number starting from 1 to 118 and increasing. All the elements are arranged into series of columns called groups or families and rows are called periods. Beginning with hydrogen in period 1 (row 1), there is a total of 7 periods. These periods as we will see later are also the energy level of the atom.

Periodic trends

In the periodic table, certain properties of the elements tend to change across the period or down the family. These certain properties are called trends.

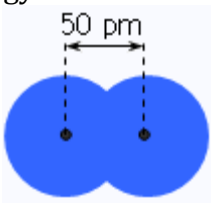
Electronegativity

Electronegativity of an element indicates the ability of the elements to attract electrons in a chemical bond. Electronegativity generally decreases as you move down a group and increases across the period. Fluorine is the most electronegative element on the periodic table.



Atomic radius.

Atomic radius is measured by calculating the distance between two nuclei of two bonded atoms and then divided by two. The atomic radius is influenced by electron configuration by the electron cloud that surrounds the nucleus. As the elements go across the period, the number of electrons and protons are increased. But since the electrons are added to the same principal energy level, there is positive charge from the nucleus will attract the electrons, thus, holding it closer. The electrons added are not affected by the "shielding" effect, where electrons from a lower energy level is "shielding" or block the positive charge from the nucleus to the outside valence electron.

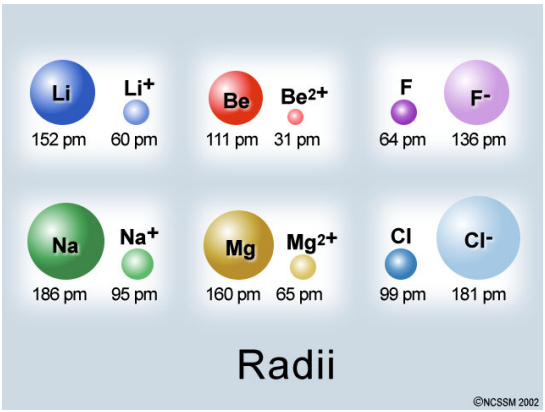


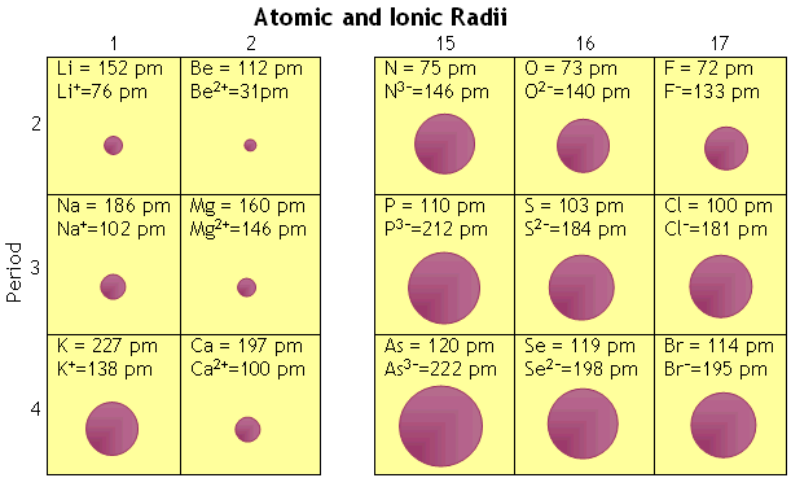
As the elements move down a group, electrons and protons are added but because the electrons are added to a new energy level, shielding effect takes place as the valence electrons are shielded from the nucleus allowing it to 'wander' farther away from the nucleus.

-Atomic radius decrease across the period and increases down a group.

Ionic radius

Recall, an ion is when an element has lost one or more electrons or gained one or more electrons. When an ion has gained an electron, the atomic radius will become larger since it has gained the extra negative charge. Thus, as more electrons are gained in the element, the larger the element's radius becomes. If an element has lost an electron, then there is an unbalanced charge between the protons and electrons leaving more positive than negative charge. Thus, the extra positive charge will be able to attract the negative charges making the atomic radius smaller.





Ionization Energy

Ionization energy is defined as the energy required to remove an electron from a gaseous atom. Since valence electrons are electrons found on the outer shell, valence electrons farthest away from the atom will be removed first. In order to understand ionization energy trend, one must think of how strongly an atom's nucleus is holding on to its valence electrons. A high ionization energy value indicates the atom as a strong hold on its electrons while a low ionization energy indicates a weaker hold on its electrons or can form positive ions quite easily.

Since atomic radius decreases across the periodic table, there is a tighter hold within the atom, thus requiring more energy to remove the electron. Conversely, atomic radius increases down a group, there is a weaker hold on the electrons, thus requiring less energy to remove electrons. In summary, ionization energy increases across the periods and decreases down the groups.

On the figure to the right, ionization energy depends on where the valence electron is located. If the valence electron is on a full shell, the ionization energy will be larger (Li, Be… etc).

Ionization Energies of the First 20 Elements

Element	Ionization Energy (kJ/mol)		
	First	Second	Third
H	1312		
He	2372	5247	
Li	520	7297	11 810
Be	899	1757	14 840
B	801	2430	3659
C	1086	2352	4619
N	1402	2857	4577
O	1314	3391	5301
F	1681	3375	6045
Ne	2080	3963	6276
Na	496	4565	6912
Mg	738	1450	7732
Al	578	1816	2744
Si	786	1577	3229
P	1012	1896	2910
S	999	2260	3380
Cl	1256	2297	3850
Ar	1520	2665	3947
K	419	3069	4600
Ca	590	1146	4941