

Periodic Properties

In the periodic table, the properties of elements change gradually, with change in atomic number (or electronic configuration) of the elements.

- a) Valency
- b) Atomic Radius
- c) Ionization energy
- d) Electron affinity
- e) Electronegativity
- f) Metallic and Non-Metallic Properties

Valency:

Valency refers to the ability of an atom or a group of chemically bonded atoms to form chemical bonds with other atoms or groups of atoms.

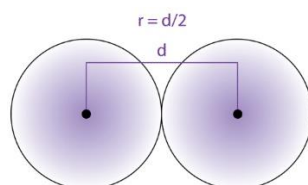
The valency of an element is determined by the number of outer shell (valence) electrons.

Elements are placed in groups (columns) in the periodic table according to the number of valence electrons, so naturally the position of the element in the periodic table should give us an idea of its valency.

+1												-4 or +3		-2		-1	0
H	+2	Valency Table										B	C	N	O	F	He
Li	Be											Al	Si	P	S	Cl	Ne
Na	Mg	<i>transition metals</i>										Ga	Ge	As	Se	Br	Kr
K	Ca											In	Sn	Sb	Te	I	Xe
Rb	Sr	<i>Members of this group of metals display a number of valencies</i>										Tl	Pb	Bi	Po	At	Rn
Cs	Ba																
Fr	Ra																
1	2											3	4	5	6	7	8

Atomic Radius

Atomic radius of the elements is defined as the distance between the centre of the nucleus of the atom to the to its outermost shell. Atomic radius calculated in picometers ($1\text{pm} = 10^{-12}\text{ m}$). It is difficult to calculate the atomic radius of the isolated atom, so they calculated the distance between the two adjacent nuclei (Metallic bond or covalent bond or ionic bond) and they divide it by half to get the atomic radii of the atom. There are three type of atomic radii: Metallic radii, Covalent radii and Ionic radii.

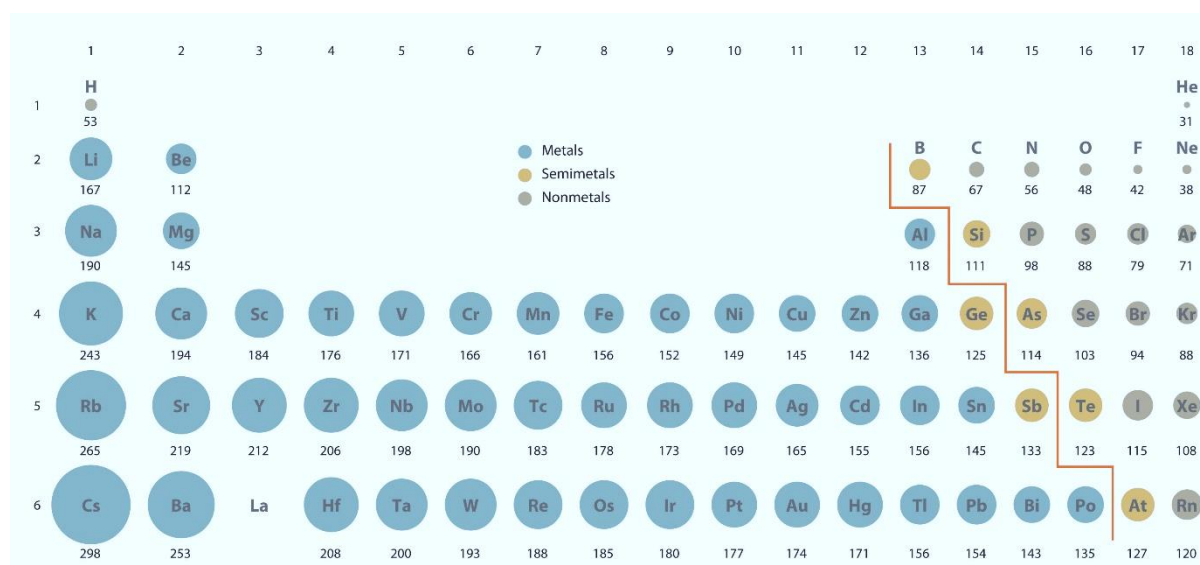


Periodic trend:

The atomic radius of atoms generally decreases from left to right across a period. Within a period, protons are added to the nucleus as electrons are being added to the same principal energy level. These electrons are gradually pulled closer to the nucleus because of its increased positive charge. Since the force of attraction between nuclei and electrons increases, the size of the atoms decreases.

Group Trend:

The atomic radius of atoms generally increases from top to bottom within a group. As the atomic number increases, the number of atomic orbitals increases, the size of the atom increases down the group..



Ionization Energy

Ionization energy is the energy required to remove an electron from the outermost shell of the atom. It is measured in kJ/mol, which is an energy unit, much like calories.

Periodic Trend

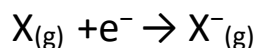
Moving from left to right across the periodic table, the ionization energy for an atom increases because nuclear charge of the atom increases. The more protons in the nucleus, the stronger the attraction of the nucleus to electrons. This stronger attraction makes it more difficult to remove electrons.

Group Trend

Ionization decreases moving top to bottom in a group. This is because of more electron shells are added moving down a group, so the outermost electron becomes increasingly distance from the nucleus.

Electron Affinity

Electron affinity is defined as the energy liberated when an electron is added to its neutral gaseous atom. Its also called as Electron gain Enthalpy.



Group trend:

Electron affinity generally decreases down a group of elements because each atom is larger than the atom above it, which means that an added electron is further away from the atom's nucleus compared with its position in the smaller atom. With a larger distance between the negatively charged electron and the positively charged nucleus, the force of attraction is relatively weaker. Therefore, electron affinity decreases.

Periodic Trend:

Moving from left to right across a period, atoms become smaller as the forces of attraction become stronger. This causes the electron to move closer to the nucleus, thus increasing the electron affinity from left to right across a period.

Electronegativity

The electronegativity of an element is defined as the relative tendency of its atom to attract the electrons towards itself when it is bonded to the atom of another element.

Electronegativity of the elements decreases as we go down the group and increases along a period from left to right. Fluorine has the highest electronegativity and Caesium has the least electronegativity.

Metallic and Non-Metallic Properties

The metallic character of an element can be defined as how readily an atom can lose an electron.

Moving from left to right across a period, metallic character decreases because the attraction between valence electron and the nucleus is stronger, it will tougher for the atom to lose electrons.

Metallic character increases as we move down a group because the atomic size is increasing. When the atomic size increases, the outer shells are farther away. The electrons of the valence shell have less attraction to the nucleus and, as a result, can lose electrons more readily. This causes an increase in metallic character.