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Periodic Table and Periodicity of Elements (Continued):

Variation of atomic radii in the periodic table:

(1) Atomic Radii: The size or radius of an atom is important physical property of an elements which is a periodic function of the atomic number. In the long form of periodic table, the elements show periodic regularities in relation with atomic size.

(i) Along the period: As we move from left to right in a period. the atomic radii or size of element decreases. Thus, in any period alkali metal is largest and halogen is the smallest atom. This is because as the atomic number increases across a period, and the nuclear charge also increases and the electrons are attracted more strongly towards the nucleus, hence the atomic sizes or radii decreases as we move left to right across a period.

(ii) Down the group: The size of an atom increases on descending a group in the periodic table. As we move down the group, the number or valency electrons in the outermost shell remains the same but the number of shell increases with atomic number. This cause increase in size or radii as the atomic number increases down a group. As we go down in a group the nuclear charge also increases, so electrons are attracted more and more towards the nucleus and the size become smaller. The effect however, is much smaller as compared to the effect on the size of the atom because of addition of new shell which cause increase in atomic size or atomic radii. Therefor the atomic radii or size gradually increase as we move down a group.

(2) Ionization Enthalpy: If a small amount of energy to an atom, then an electron may be promoted to a higher energy level, but if the amount of energy supplied is sufficiently large the electron may be completely removed. The energy required to remove the most loosely bound electron from an isolated gaseous atom is called the ionization energy.

It is possible to remove more than one electron from most atoms. The first ionization energy is the energy required to remove the first electro and convert M to M^+ ,the second ionization energy is the energy required to remove the second electron and convert M^+ to m^{2+} the third ionization energy converts M^{2+} to M^{3+}, and so on.

The factors that influence the ionization energy are:

1. The size of the atom.
2. The charge on the nucleus.
3. How effectively the inner electron shells screen the nuclear charge.
4. The type of electron involved (s, p, d or f).

These factors are usually interrelated. In a small atom the electron are tightly held, while in a larger atom are less strongly held. Thus the ionization energy deceases as the size of atom increases. Comparison of first and second ionization energies for the first group shows that removal of the second electron required 7to 14 times energy than the first ionization energy, so a second electron is not removed. The large difference between the first and second ionization energies is related to the structure of the Group 1 atom. These atoms have just one electron in their outer shell. So it relatively easy to remove the single outer electron, it required much more energy to remove a second electron, since this involves breaking into a filled shell of electrons. The ionization energy also depends on the type of electron which is removed. s, p, d and f electrons have orbitals with different shape. S-orbitals electrons are nearer to the nucleus, and so more tightly held than p-electrons. The ionization energy is in the order :

s> p> d> f

Thus the ionization energy is not quite smooth moving from left to right in the periodic table. In general ionization energy decrease on descending a group and increase on crossing a period. Removal of successive electron becomes more difficult.

First I. E < second I.E < third I.E