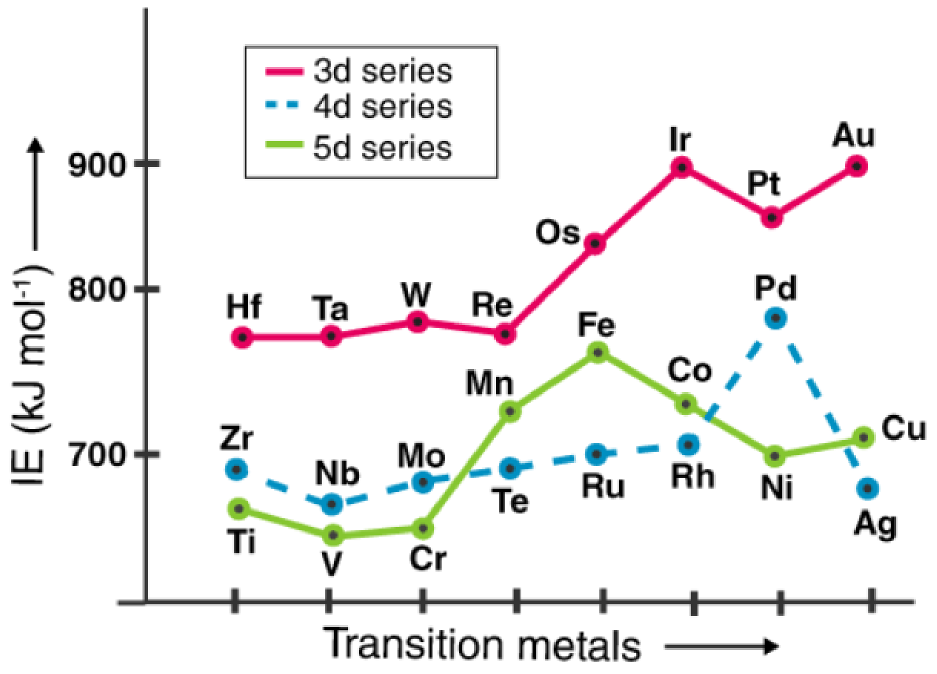
Ionization Energy of D Block Elements



Ionization energy is the energy needed to remove the valence electron from the atom/ion and is directly related to the force of attraction on the electron. Hence, larger the nuclear charge and smaller the radii of the electron larger will be the ionization energy (IE). Ionization Energy also will be more for half-filled and fully filled orbitals.

Ionization Energy of the d block elements is larger than s-block and smaller than the p-block elements, between which, they are placed. In the first series, except chromium and copper first Ionization Energy involves removal from filled s-orbital. Among them, the ionization energy of d block elements increases with the increase in atomic number up to Fe.

In Co and Ni, increasing sharing of d-electrons compensate for the atomic number increase resulting in the decrease of Ionization Energy. Copper and zinc show increasing IE, as s -block elements. In the second series, elements from Niobium have single electrons in the s-orbital.

Hence, they show a gradual increase in IE with increasing atomic number. Palladium, on the other hand, has a completed d-shell and no electron in the s-shell. So, Pd shows the maximum IE. Because of lanthanide contraction, the attraction of electrons by the nuclear charge is much higher and hence IE of 5d elements are much larger than 4d and 3d. In 5d series, all elements except Pt and Au have filled s-shell.

Elements from Hafnium to rhenium have the same IE and after IE increases with the number of shared d-electrons such that Iridium and Gold have the maximum IE.

Oxidation States of D Block Elements

Oxidation state is a hypothetical state, where the atom appears to release or gain electrons more than the usual valency state. It is still useful in explaining the properties of the atom/ion. Transition elements/ions may have electrons in both s and d-orbitals.

Since the energy difference between s and d-orbital are small, both the electrons can involve in ionic and covalent bond formation and hence exhibit multiple(variable) valency states (oxidation states).

Each transition element can hence exhibit a minimum oxidation state corresponding to the number of s-electrons and maximum oxidation state equivalent to the total number of electrons available in both s and d-orbitals. In between oxidation states also become possible.