

PERIODIC TABLE AND PERIODICITY (Cont.....)

d-block element: - Elements in which the last electron enters any one of the five available d-orbitals of their respective penultimate shell are called d-block elements. Since a d-subshell has five d-orbitals, each one of which can accommodate two electrons, there are ten vertical columns comprising ten groups of d-block elements; they are 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12. The atoms of the d-block elements usually have 1 or 2 (0 in few cases) electrons in the s-orbital of outermost shell, while the electrons are being progressively filled in, one at a time, in the d-orbitals of their respective penultimate shell. The general formula of d-block elements: $(n-1) d^{1-10} ns^{1-2}$ (d^0 in few cases).

Since the properties of these elements are midway between those s-block and p-block elements, they are also called transition elements. All these elements further divided into four series: first, second, third and fourth transition series.

The first transition series forms a part of the fourth period of the long form of the periodic table. It contains $_{21}\text{Sc}$ to $_{30}\text{Zn}$ in which 3d electrons are being progressively filled in.

The second transition series of the fifth period from $_{39}\text{Y}$ to $_{48}\text{Cd}$, the third transition series of the sixth period from $_{57}\text{La}$ to $_{80}\text{Hg}$. The fourth transition series of the seventh period from $_{89}\text{Ac}$ to $_{112}\text{Uub}$. Some of the general characteristics of d-block elements are:

1. These elements are frequently show variable oxidation states
2. They are hard, malleable and ductile metal with high melting and boiling points.
3. Their ionization potential elements between s- and p-block
4. Most of the transition metals and their compounds are used as catalysts.
5. They form both ionic and covalent compounds.
6. Their compounds are generally coloured and paramagnetic. The colour is due to d-d transition or sometimes due to charge transfer mechanism.
7. They form complexes.
8. They are good conductors of heat and electricity.
9. These elements can form a number of interstitial compounds
10. These elements are good at forming alloys due to their comparable sizes

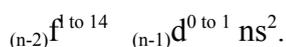
f-block elements: - Elements in which the last electrons enter any one of the seven f-orbitals of their respective ante-penultimate shells are called f-block elements. In all these elements, the s-orbitals of the last shell (n) is completely filled, the d-orbitals of the penultimate (n-1) shell invariably contains zero or one electron but the f-orbital of the anti-penultimate (n-2)

shell gets progressively filled. There are two series of f-block elements each containing 14 elements.

Therefore 28 f-block elements are in the long form of the periodic table. These are placed at the bottom of the periodic table. The elements of first series $_{58}\text{Ce}$ to $_{71}\text{Lu}$ which form a part of the sixth period are collectively called Lanthanides since all these elements follow lanthanum in the periodic table and also closely resemble Lanthanum in their properties.

These are also called rare earth elements. The elements of the second series $_{90}\text{Th}$ - $_{103}\text{Lr}$ which form a part of the seventh period are collectively called actinoids since all these elements follow actinium in the periodic table and also closely resemble Actinium in their properties.

In actinoids 5f- orbitals are being progressively filled in. The first three elements Thorium, Protactinium and Uranium occur in nature but remaining 11 elements, from Neptunium to Lawrencium have been prepared artificially through nuclear reactions. These 11 elements are called transuranic elements since they follow uranium and also derived from it through nuclear reactions. The general electronic configuration of the f-block element is



Some of the general characteristics of f-block elements are:

1. Most of the elements of the actinide series are radioactive.
2. They have generally high melting and boiling points.
3. They show variable oxidation states.
4. They are heavy metals.
5. They have a high tendency to form complexes.
6. They are generally coloured.

Thus, the periodicity chemical and physical properties among elements is a natural result of the periodic recurrence of similar electronic configuration in the outer shell of the respective atoms when they are arranged in the order of their increasing atomic number.