

# CHEMISTRY STUDY MATERIALS FOR CLASS 12 (NCERT BASED REVISION NOTES)

**GANESH KUMAR**

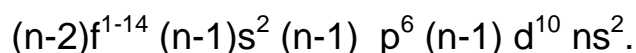
**DATE:- 03/03/2021**

---

## d – Block Elements

### INNER TRANSITION ELEMENTS:

The elements which in their atomic or ionic form, in addition to their incomplete *d*- sub shell of the penultimate shell have partly filled *f*-sub shell of the ante-penultimate (inner to the penultimate shell i.e. *n-2*) shell are called as *f*-block elements. They are also known as inner transition elements. These are so called because these form a series within the transition series. The general electronic configuration of the *f*-block elements is



### Classification of *f*-block elements:

The *f*-block elements can be subdivided into two series depending upon the nature of the *f*-orbital of the antepenultimate shell (*4f* or *5f*) in which the differentiating electron enters.

- (i) *4f*-series (First inner transition series). In these the differentiating electron goes to *4f* orbitals. This series consists of lanthanum ( $Z = 57$ ) and the next 14 elements ( $Z = 58$  to  $71$ ). These are known as Lanthanides.
- (ii) *5f*-series (Second inner transition series). In these elements differentiating electron goes to *5f*-orbitals. This series includes fifteen elements from actinium ( $Z=89$ ) to Lawrencium ( $Z = 103$ ).

These are known as actinides. Inner transition elements are placed outside the body of the periodic table. The reason for this is the remarkable similarities among the chemical properties of lanthanides and also among the various members of the actinides. The similarities in properties, in turn is due to the similar electronic configuration of the outermost shell.

These elements differ only in the number of f electrons which do not take part in chemical bonding (difference from d-block elements in which the differentiating d-electrons are involved in chemical interaction).

## **LANTHANIDES OR LANTHANIDS:**

In these elements differentiating electron goes to *4f*-subshell. This series consists of 14 elements which follow lanthanum ( $Z = 57$ ). It should be noted that fifteen elements starting from La<sub>57</sub> to Lu<sub>71</sub> are generally considered as lanthanides because they resemble one another closely. The name lanthanide has been derived from lanthanum which is the prototype of lanthanides. However, lanthanum is not an element of *f-block* of the periodic table.

Originally these elements were called rare earths because for many years pure compounds of these elements were difficult to obtain. Now a day the term rare earth is avoided because many of these elements are far from rare

Lanthanides				Actinides			
Name	Symb ol	At.No	Configuration	Name	Symb ol	At.No.	Configuration
Cerium	Ce	58	$[\text{Xe}]4f^2 5d^0 6s^2$	Thorium	Th	90	$[\text{Rn}]5f^0 6d^2 7s^2$
Praseodymium	Pr	59	$[\text{Xe}]4f^3 5d^0 6s^2$	Protactinium	Pa	91	$[\text{Rn}]5f^2 6d^1 7s^2$
Neodymium	Nd	60	$[\text{Xe}]4f^4 5d^0 6s^2$	Uranium	U	92	$[\text{Rn}]5f^3 6d^1 7s^2$
Promethium	Pm	61	$[\text{Xe}]4f^5 5d^0 6s^2$	Neptunium	Np	93	$[\text{Rn}]5f^4 6d^1 7s^2$
Samarium	Sm	62	$[\text{Xe}]4f^6 5d^0 6s^2$	Plutonium	Pu	94	$[\text{Rn}]5f^6 6d^0 7s^2$
Europium	Eu	63	$[\text{Xe}]4f^7 5d^0 6s^2$	Americium	Am	95	$[\text{Rn}]5f^7 6d^0 7s^2$
Gadolinium	Gd	64	$[\text{Xe}]4f^7 5d^1 6s^2$	Curium	Cm	96	$[\text{Rn}]5f^7 6d^1 7s^2$
Terbium	Tb	65	$[\text{Xe}]4f^9 5d^0 6s^2$	Berkelium	Bk	97	$[\text{Rn}]5f^8 6d^1 7s^2$
Dysprosium	Dy	66	$[\text{Xe}]4f^{10} 5d^0 6s^2$	Californium	Cf	98	$[\text{Rn}]5f^{10} 6d^0 7s^2$
Holmium	Ho	67	$[\text{Xe}]4f^{11} 5d^0 6s^2$	Einsteinium	Es	99	$[\text{Rn}]5f^{11} 6d^0 7s^2$
Erbium	Er	68	$[\text{Xe}]4f^{12} 5d^0 6s^2$	Fermium	Fm	100	$[\text{Rn}]5f^{12} 6d^0 7s^2$
Thulium	Tm	69	$[\text{Xe}]4f^{13} 5d^0 6s^2$	Mendelevium	Md	101	$[\text{Rn}]5f^{13} 6d^0 7s^2$
Ytterbium	Yb	70	$[\text{Xe}]4f^{14} 5d^0 6s^2$	Nobelium	No	102	$[\text{Rn}]5f^{14} 6d^0 7s^2$
Lutetium	Lu	71	$[\text{Xe}]4f^{14} 5d^1 6s^2$	Lawrencium	Lr	103	$[\text{Rn}]5f^{14} 6d^1 7s^2$

\*\*\*\*\*