f-Block Elements
(General Introduction)
(Part-1)

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What are f Block Elements?

- Elements whose f orbital getting filled up by electrons are called f block elements.

- These elements have electrons, (1 to 14) in the f orbital, (0 to 1) in the d orbital of the penultimate energy level and in the outermost orbital.

- There are two series in the f block corresponding to the filling up of 4f and 5f orbitals.

- The elements are 4f series of Ce to Lu and 5f series of Th to Lw. There are 14 elements filling up the ‘f’ orbital in each series.
The position of F Block Elements in the Periodic Table

- F block elements are placed separately at the bottom of the periodic table.
- They are a subset of 6th and 7th periods.
Classification of F Block Elements

• The elements belonging to the f block are further differentiated into:

(i) The first series of elements are called lanthanides and include elements with atomic numbers beginning from 57 and ending at 71. These elements are non-radioactive (except for promethium, which is radioactive).
(ii) The second series of elements are called actinides and include elements with atomic numbers beginning from 89 and ending at 103. These elements generally have a radioactive nature.

• The list of all the f block elements is provided in the previous slide. The row beginning with Lanthanum is the row containing all the lanthanides whereas the row beginning with Actinium is the row that contains all the actinides.
F block Elements as Inner Transition Elements

• Since the f orbital lies much inside than d orbital, in relation to the transition metals naming, f block elements are called inner transition elements.

Properties of F block Elements

• Have electrons added to the ‘f’ sub-orbitals of (n-2) level.

• Are placed between (n-1)d and ns block elements in the periodic table.

• Properties are similar to d-block elements.
Properties of Lanthanides

- Lanthanides are soft metals with a silvery white colour.
- Their colour dulls and their brightness reduces rapidly when exposed to air.
- They have melting points ranging from 1000K to 1200K (Except Samarium, 1623K).
- Lanthanides are good conductors of heat and electricity.
- They are non-radioactive in nature with the exception of Promethium.
- A decrease in atomic and ionic radii from lanthanum to lutetium is observed. This is called the lanthanoid contraction.
The Actinide elements appear to be silvery in colour.

These elements have a radioactive nature.

These metals are highly reactive and their reactivity increases when they are finely divided.

A decrease in atomic and ionic radii from Actinium to Lawrencium is observed. This is called the actinoid contraction.

They generally exhibit an oxidation state of +3.

However, elements belonging to the first half of the series are known to exhibit higher oxidation states quite frequently.
Difference between Lanthanides and Actinides

• Lanthanoids are involved in the filling of 4f-orbitals whereas actinoids are involved in the filling of 5f-orbitals. The binding energy of 4f electrons is comparatively less than that of 5f-electrons. The shielding effect of 5f-electrons is less effective as compared to that of 4f-electrons.

• The paramagnetic properties of lanthanoids can be easily explained but this explanation is difficult in case of actinoids.

• Lanthanides are non-radioactive in nature except promethium whereas all actinide series elements are radioactive.

• Lanthanides do not have a tendency to form oxo-cations, but several oxo-cations of actinide series exist. The compounds formed by lanthanides are less basic on the other hand the compounds of actinides are highly basic.
Similarities between Lanthanides and Actinides

- The elements of lanthanide and actinide series are characterized by filling of \((n-2)\) f subshell. They possess almost similar outermost electronic configuration hence have similar properties. Following are the significant similarities:

(i) Both have a prominent oxidation state of +3.

(ii) They are involved in the filling of \((n-2)\) f orbitals.

(iii) They are highly electropositive and very reactive in nature.

(iv) With an increase in atomic number, there is a decrease in atomic and ionic size.

(v) Both show magnetic properties.
References


