

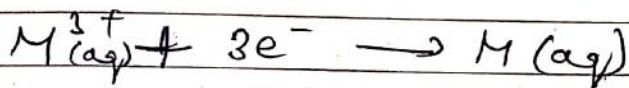
Cause of Lanthanoid Contraction

- In the lanthanoids, the electrons are getting filled in the 4f-subshell.
- From left to right, the nuclear charge increases is expected to be compensated by the increase in the magnitude of shielding effect by the 4f-electrons as in case of transition metals. So, the atomic or ionic radii are expected to be almost same.
- However, the f-electron orbitals have very poor shielding effects probably because of their shape. So, the atomic and ionic radii decrease from left to right which leads to lanthanoid contraction.

Consequences of Lanthanoid Contraction

- Separation of Lanthanoids - Since lanthanoids have quite similar properties and due to these properties they are difficult to separate. Lanthanoid contraction varies the properties slightly which leads to separation by ion-exchange methods.
- Variation in basic strength of hydroxides - The basic strength of oxides and hydroxides decreases from $\text{La}(\text{OH})_3$ to $\text{Lu}(\text{OH})_3$. Due to lanthanoid contraction, size of M^{3+} ions decreases and thus there is a corresponding increase in the covalent character in M-OH bond.

c) Variation in standard reduction potential - Due to lanthanoid contraction there is a small but steady increase in standard electrode potential (E°) for reduction process.



d) Variation in physical properties like mp, bp, hardness etc: due to attraction forces between the atom increase as the size decreases.

ii) > Oxidation State -

a) Stable O.S = +3. Other O.S = +2, +4.

The additional states of +2 and +4. ~~are~~ includes those elements which by doing so attain stable f^0 , f^7 , f^{14} configuration.

1) On what ground can you say that Sc ($Z=21$) is a transition element but Zn ($Z=30$) is not?

2) Silver atom has completely filled d-orbitals ($4d^{10}$) in its ground state. How is it a transition element?

3) Which of the 3d series of the transition metal exhibits the largest no. of O.S. and why?