# CONCEPT MAP

## The *d*- AND *f*- BLOCK ELEMENTS

### The *d*-Block Elements

(Transition elements)
$(n-1)d^{1-10}ns^{1-2}$

#### 3 complete rows of 10 elements and 1 incomplete row

I Transition series :
Sc ($Z$=21) to Zn ($Z$=30)

II Transition series :
Y ($Z$=39) to Cd ($Z$=48)

III Transition series :
La ($Z$=57), Hf ($Z$=72) to Hg ($Z$=80)

IV Transition series :
Ac ($Z$=89) → incomplete.

#### Properties

- **Atomic radii :** In I, II, III series → first decrease and then remains same.
  atomic radii of III transition series = II transition series > I transition series (due to lanthanoid contraction).
- **Oxidation states** → variable.
- **M.P. and B.P** → rise to max. and then decrease.
  Mn and Tc → abnormally low M.P.
  W → high M.P. (3414°C).
- **Ionisation energies :** In periods → increases.
  In groups → decreases from I member to II, increases from II to III member.
- Mostly coloured due to excitation of *d*-electrons.
- Form complexes due to
  (i) small size
  (ii) high nuclear charge
  (iii) vacant orbitals where ligands donated electrons can be accomodated.
- Catalytic property.
- Form interstitial compounds.

### The *f*-Block Elements

(Inner transition elements)
$(n-2)f^{1-14}(n-1)d^{0,1}ns^{2}$

#### 4*f*-series (Lanthanoids)

14 elements from Ce ($Z$ = 58) to Lu ($Z$ = 71)

#### Properties

- **Atomic radii :** Decrease (Lanthanoid contraction)
- **Oxidation states :** Common +3, +2, +4 by some.
- **Low ionisation energies :** Highly, electropositive, reducing agents.
- Many coloured due to *f*-*f* transitions in partially filled *f*-orbitals.
  Most tripositive ions are colourless.
- Low complex formation tendency.
- Except Pr, all other are non-radioactive.
- Do not form oxo-ions.

#### 5*f*-series (Actinoids)

14 elements from Th ($Z$ = 90) to Lw ($Z$ = 103)
$Z$ = 93 onwards : transuranic elements (man made elements)

#### Properties

- **Atomic radii :** Decreases (Actinide contraction)
- **Oxidation states :** Common +3, for Am → Lr (except No), for Th (+4), Pa (+5), U(+6).
- Generally coloured.
- Most tripositive and tetrapositive ions are coloured.

→ High tendency to form complexes $M^{4+} > MO_2^{2+} > M^{3+} < MO_2^{+}$

→ Low ionisation energies → highly electropositive, strong reducing agents.

→ All are radioactive.

→ Form oxo-ions.