

Transition Elements Overview

ChatGPT said:



1. Variation of Atomic Size:

- **Atomic and Ionic Radii:** The atomic radii of transition metals generally decrease as you move across the period due to the increasing nuclear charge. However, the reduction in size is less pronounced compared to s- and p-block elements, due to the poor shielding effect of d-electrons.
- As electrons are added to the d-subshell, the nuclear charge increases, causing the atomic size to decrease slightly across the series.
- **Lanthanoid Contraction:** The radii of elements in the 5d series are nearly the same as those in the 4d series due to the lanthanoid contraction. This contraction results from the poor shielding effect of the 4f-electrons.

2. Ionisation Potential:

- **First Ionisation Enthalpy:** Across a period in the transition series, the ionisation enthalpy increases, though not as sharply as in s- and p-block elements. This is because d-electrons provide a shielding effect, making it easier to remove the outermost ns-electron.
- **Irregular Trends:** The irregular trend in the ionisation enthalpy is attributed to the stability of half-filled (e.g., d^5) and fully-filled (e.g., d^{10}) subshells, as seen in elements like manganese and copper.
- **Second and Third Ionisation Enthalpies:** These are significantly higher due to the increased effective nuclear charge felt by the inner d-electrons.

3. Oxidation States:

- **Variable Oxidation States:** Transition elements exhibit a wide range of oxidation states, primarily because both ns and (n-1)d electrons can participate in bonding. The number of oxidation states increases in the middle of the series (e.g., manganese exhibits oxidation states from +2 to +7).
- **Stability of Oxidation States:** Lower oxidation states (+2, +3) are more stable at the beginning and end of the series, while higher oxidation states (+6, +7) are common in the middle. This variation is due to the energy required to remove multiple electrons and the stabilization of half-filled and fully filled d-subshells.
 - For example, manganese exhibits multiple oxidation states, from +2 to +7, while copper typically exhibits +1 and +2 due to its stable d^{10} configuration in Cu^+ .

These key features help explain the unique chemical and physical behavior of d-block elements, including their reactivity and tendency to form colored compounds and complexes.