

Transition Elements Overview

ChatGPT said:



The electronic configuration of d-block elements follows a general pattern where electrons are added to the (n-1) d orbitals, with the outermost ns orbital filled as well. Here's a summary:

General Electronic Configuration:

- The d-block elements follow the configuration **(n-1) d¹⁻¹⁰ ns¹⁻²**.
- For example:
 - **Scandium (Sc):** [Ar] 3d¹ 4s²
 - **Titanium (Ti):** [Ar] 3d² 4s²

Important Points:

1. Filling of Orbitals:

- According to the **Aufbau principle**, 4s orbitals are filled before 3d orbitals. However, exceptions occur when achieving half-filled or fully filled d-orbitals provides extra stability.
- **Chromium (Cr):** [Ar] 3d⁵ 4s¹ (Instead of [Ar] 3d⁴ 4s²)
- **Copper (Cu):** [Ar] 3d¹⁰ 4s¹ (Instead of [Ar] 3d⁹ 4s²)

2. Stability of Half-filled and Fully-filled Configurations:

- Half-filled (d⁵) and fully-filled (d¹⁰) configurations are especially stable due to **symmetry** and **exchange energy**.
- The symmetrical distribution of electrons in these configurations results in a more stable electron arrangement.

3. 3d Series Transition Metals:

- **3d series:** Elements from **Scandium (Sc)** to **Zinc (Zn)** belong to the first transition series.
- Notable configurations:
 - **Scandium:** [Ar] 3d¹ 4s²
 - **Zinc:** [Ar] 3d¹⁰ 4s²

4. Ion Formation:

- In transition metals, ns electrons are lost before (n-1)d electrons. Hence, the typical oxidation states of these elements involve the loss of both s and d electrons.
- For example:
 - **Iron (Fe²⁺):** [Ar] 3d⁶ 4s⁰
 - **Copper (Cu²⁺):** [Ar] 3d⁹ 4s⁰

5. Variability in Configurations:

- Transition elements often exhibit variable oxidation states due to the similar energies of ns and (n-1)d orbitals.
- For example, **Iron (Fe)** can exist in +2 and +3 oxidation states (Fe²⁺: 3d⁶; Fe³⁺: 3d⁵).

In summary, the d-block elements exhibit a wide range of electronic configurations, influenced by factors such as stability of half-filled and fully-filled orbitals, and the close energy levels of ns and (n-1)d orbitals.