

Transition Elements Overview

ChatGPT said:



Position of d-Block Elements in the Periodic Table

The d-block elements occupy the central part of the periodic table, specifically **groups 3 to 12**. These elements are also known as **transition elements** because their properties transition between the s-block (electropositive metals) and p-block (electronegative non-metals).

Key Features:

1. Electron Configuration:

- The general valence shell electronic configuration for d-block elements is **$(n-1)d^{1-10} ns^{1-2}$** . This means that electrons progressively fill the d-orbitals of the penultimate shell.
- Examples:
 - **3d series:** Scandium (Sc) to Zinc (Zn)
 - **4d series:** Yttrium (Y) to Cadmium (Cd)
 - **5d series:** Lanthanum (La), Hafnium (Hf) to Mercury (Hg)

2. Series:

- The d-block is divided into four series based on the filling of the d-orbitals:
 - **3d series** (first transition series): Sc to Zn (4th period)
 - **4d series** (second transition series): Y to Cd (5th period)
 - **5d series** (third transition series): La, Hf to Hg (6th period)
 - **6d series** (incomplete): Starts with Actinium (Ac) and includes synthetic elements like Rutherfordium (Rf).

3. Transition Metals Definition:

- According to IUPAC, transition metals are elements whose atoms have an **incomplete d-subshell** or can give rise to cations with incomplete d-subshells.
- Elements like **Zinc (Zn), Cadmium (Cd), and Mercury (Hg)** have completely filled d-orbitals in both their elemental and common oxidation states, so they are **not considered transition metals** under this definition, despite being part of the d-block.

4. Characteristics:

- **Metallic nature:** All d-block elements are metals, characterized by properties such as high tensile strength, ductility, malleability, and high thermal and electrical conductivity.
- **Melting and boiling points:** These elements generally have high melting and boiling points due to the involvement of d-electrons in metallic bonding.
- **Variable oxidation states:** D-block elements exhibit a variety of oxidation states due to the involvement of both $(n-1)d$ and ns electrons in bonding.
- **Formation of complexes:** These elements tend to form complex ions, often with colored compounds due to d-d transitions.

The d-block occupies a large portion of the periodic table between the s-block (groups 1 and 2) and the p-block (groups 13 to 18). The f-block elements, also known as inner transition elements (lanthanides and actinides), are placed separately at the bottom of the periodic table .