▶ Video explanation (YouTube Short)

The d- and f-Block Elements: Chapter Introduction

Iron in bridges, copper in wires, and the bright colours of copper sulphate (blue), potassium permanganate (purple) and potassium dichromate (orange) all come from one part of the periodic table: the **d-block**.

1. Where they sit (NCERT 4.1)

Block	Position	Orbitals being filled	Series
d-block	middle of the table, groups 3–12	d orbitals, (n−1)d	3d (Sc–Zn), 4d (Y–Cd), 5d (La, Hf–Hg), 6d (Ac, Rf–Cn)
f-block	two separate rows at the bottom	f orbitals, (n−2)f	4f: lanthanoids (Ce–Lu); 5f: actinoids (Th–Lr)

A d subshell has 5 orbitals (up to 10 electrons); an f subshell has 7 orbitals (up to 14 electrons).

2. Why they are special

- **Variable oxidation states** (manganese: +2 to +7).
- **Coloured compounds** (most transition-metal ions are coloured).
- **Magnetic behaviour**: many ions are paramagnetic (unpaired electrons).
- **Catalysts**: iron (Haber process), V_2O_5 (contact process), nickel (hydrogenation).
- They also form complexes and alloys and have high melting points.

3. What the chapter covers

1. Electronic configurations of the d-block (and the Cr, Cu exceptions).
2. General properties: size, ionisation enthalpy, oxidation states, E°, magnetism, colour, complexes, catalysis, interstitial compounds, alloys.
3. Two important compounds: $K_2Cr_2O_7$ and $KMnO_4$.
4. The lanthanoids (lanthanoid contraction) and the actinoids.

Solved example

Q. Which of these are d-block elements: Na, Fe, Cu, Al, Cr, Ce?
A. Fe, Cu and Cr (groups 8, 11 and 6). Na (group 1) is s-block, Al (group 13) is p-block, Ce is f-block (a lanthanoid).

Key takeaways

- d-block: groups 3–12, d orbitals filling; f-block: two rows below, f orbitals filling.
- Transition metals: variable oxidation states, coloured compounds, paramagnetism, catalysis.
- The middle of the periodic table = metals, colours and catalysts.

Practice questions

1. (MCQ) The d-block occupies groups: (a) 1–2 (b) 3–12 (c) 13–18 (d) only 8–10
2. (MCQ) The lanthanoids fill the: (a) 3d (b) 4d (c) 4f (d) 5f orbitals
3. (MCQ) Which is NOT a typical property of transition metals? (a) variable oxidation states (b) coloured ions (c) catalytic activity (d) only one fixed valency
4. (Very short) How many orbitals does a d subshell have? How many electrons can it hold?
5. (Very short) Name the two series of the f-block.
6. (Short) Why are the f-block elements placed separately at the bottom of the periodic table?
7. (Short) Name two everyday uses of d-block metals.
8. (Application) Classify as s, p, d or f-block: K, Mn, Zn, Br, U.

Answer key

1. (b) 3–12.
2. (c) 4f.
3. (d) only one fixed valency.
4. Five orbitals; 10 electrons.
5. Lanthanoids (4f) and actinoids (5f).
6. So that the table stays compact: the 14 elements of each f series would otherwise widen periods 6 and 7; they all fill (n−2)f orbitals and are shown as two separate rows.
7. Iron (steel, bridges, the Haber catalyst); copper (electric wires); also chromium (stainless steel), titanium (aircraft).
8. K: s; Mn: d; Zn: d; Br: p; U: f.

▶ Watch the video explanation