

Physical Properties of Transition Elements

Analyzing trends in melting points, enthalpies of atomisation, and metallic bonding.

Core Terminology

Lattice Structures (hcp, bcc, ccp)

Typical metallic geometries at normal temperatures.

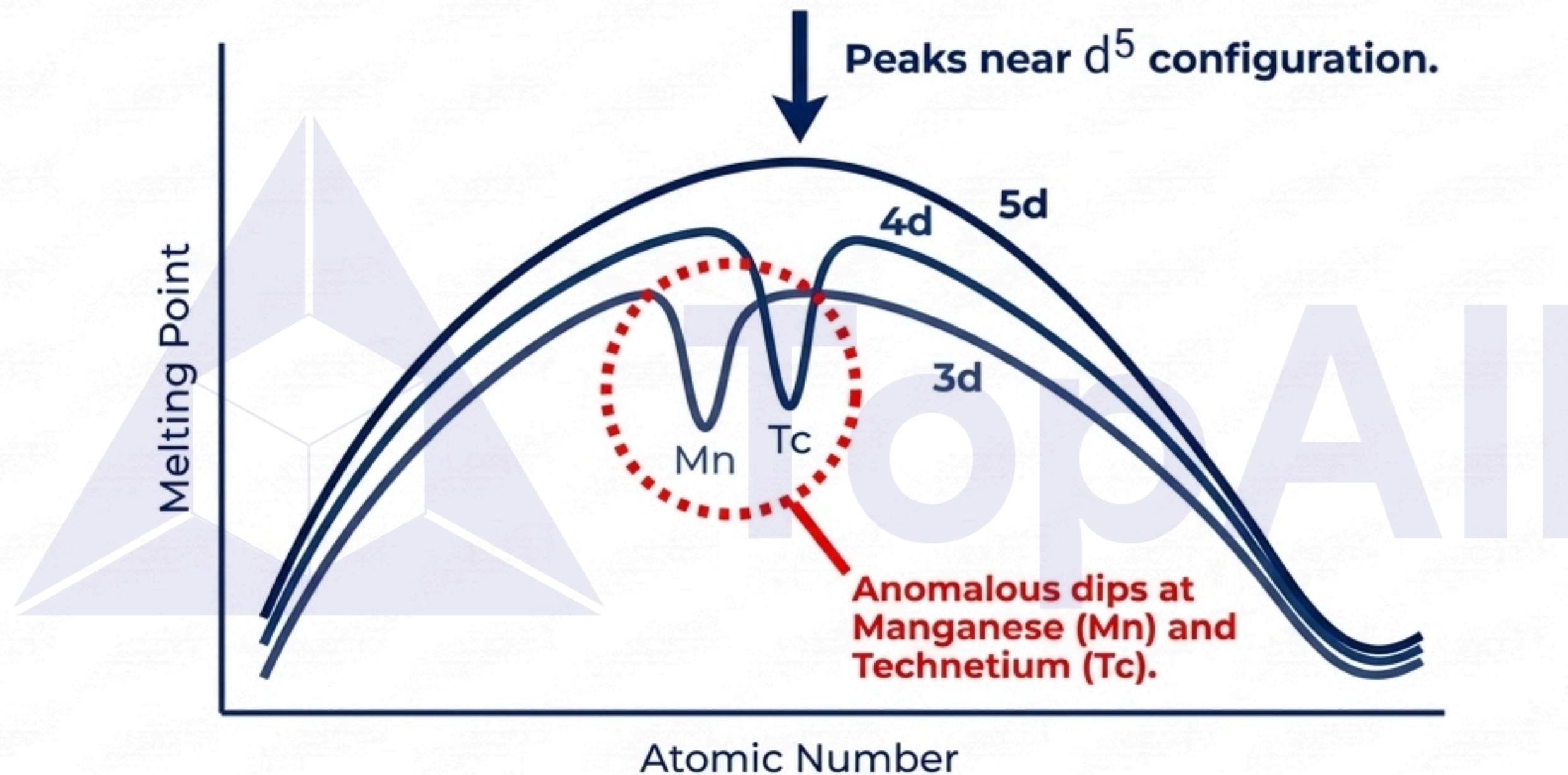
Enthalpy of Atomisation ($\Delta_a H^\ominus$)

Energy required to break the metal lattice into individual atoms.

Metallic Bonding

Interatomic interactions driven by both ns and (n-1)d electrons.

The Melting Point Curve



Exception: Zn, Cd, Hg are volatile and have abnormally low melting points due to their stable d^{10} configuration.



**You've Learned the Theory.
Let's Test Them Now.**

$$E=mc^2$$



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Practice Now



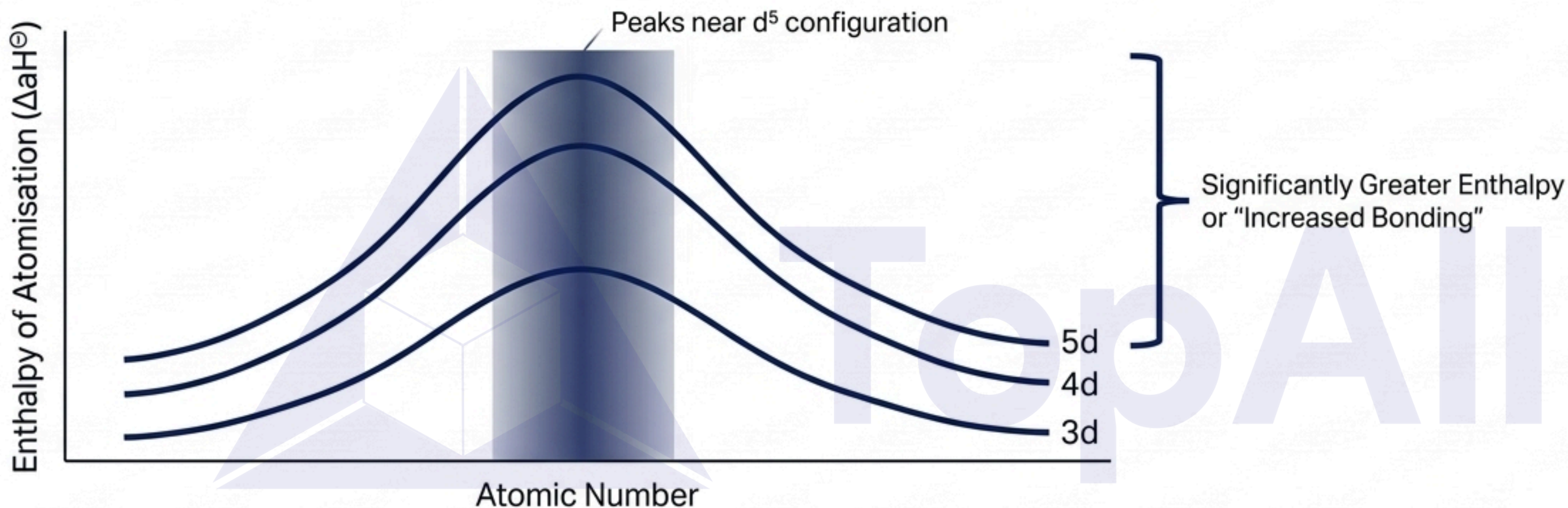
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Key Highlights

- » Free Study Material, Videos & Infographics
- » Push Your Limits with Level-Based Challenges
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Enthalpy of Atomisation Trends



Heavy Metals = Heavy Bonding.

2nd (4d) and 3rd (5d) series have significantly greater enthalpies than the 1st (3d) series. This accounts for the frequent occurrence of metal-metal bonding in heavier transition metals.

More unpaired d electrons = stronger bonding.

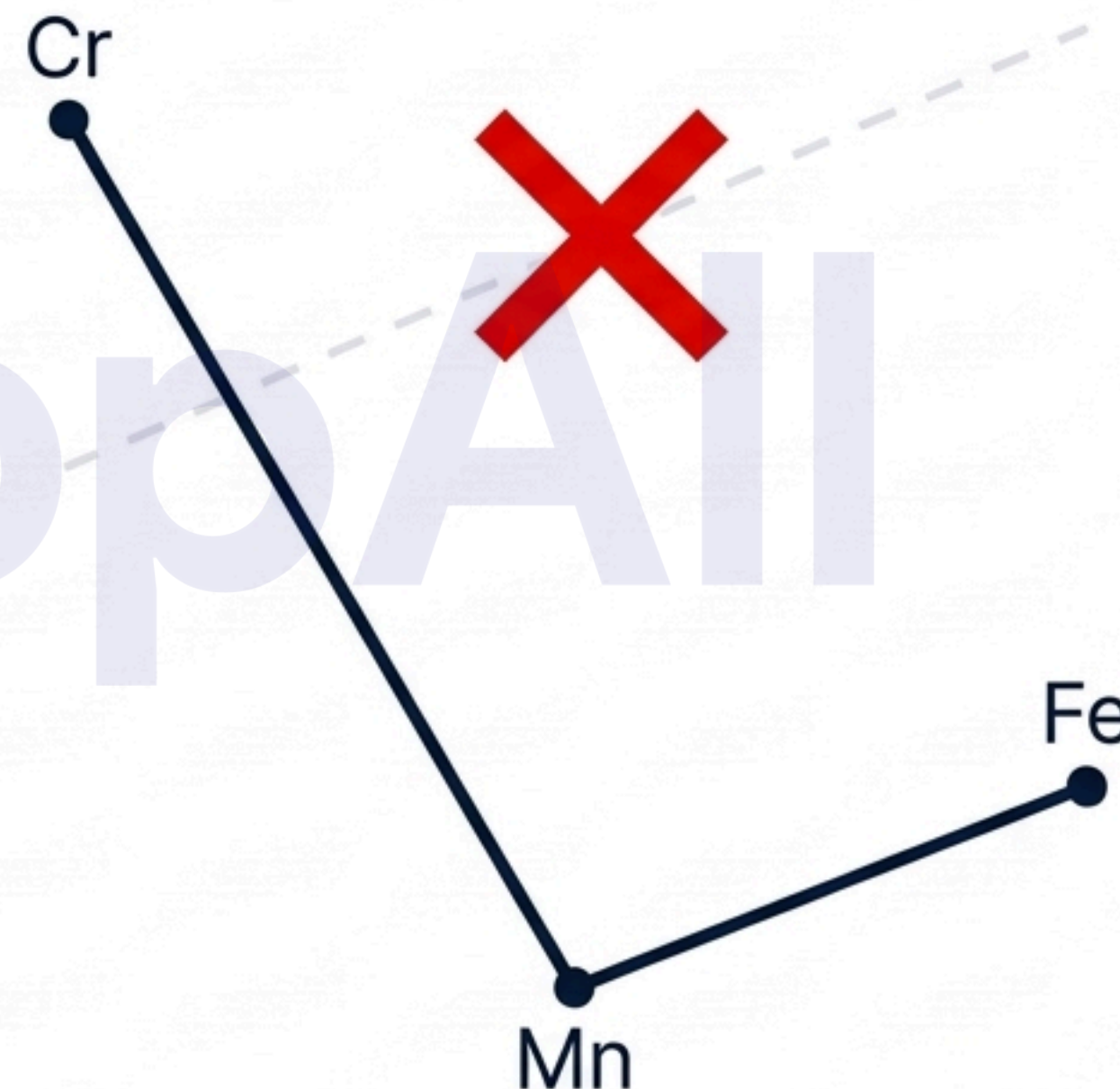
In transition elements, both ns and $(n-1)d$ electrons participate in interatomic metallic bonding. Greater valence electron count up to d^5 results in maximum bonding strength and peaks in physical properties.

Examiner's Favorite: The Mn/Tc Anomaly

Watch for this:

Do not assume melting points climb smoothly to Zinc. The trend rises to a maximum at d^5 but features an anomalous, sharp dip at Manganese (Mn) and Technetium (Tc) before falling regularly.

This is a highly tested edge case.



Why do transition metals of the 5d series have higher enthalpies of atomisation compared to the 3d series?

- A) They possess a perfectly stable d^{10} configuration.
- B) Stronger metal-metal bonding due to greater enthalpy of atomisation. ✓**
- C) Complete absence of unpaired electrons.
- D) Due to the anomalous behavior of Lanthanum.

Concept Check: Metals of the 2nd (4d) and 3rd (5d) series have greater enthalpies of atomisation than the 1st series. This accounts for the much more frequent metal-metal bonding in heavy transition metals.

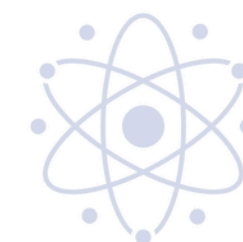
Summary

- Physical properties (melting point, enthalpy of atomisation) peak at the middle of the series (d^5), driven by the maximum number of unpaired electrons facilitating strong interatomic interaction.
- Watch for the structural anomalies: Zn, Cd, Hg are not typical transition metals (low melting points due to d^{10}), and Mn/Tc show unexpected dips in an otherwise rising d^5 trend.



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