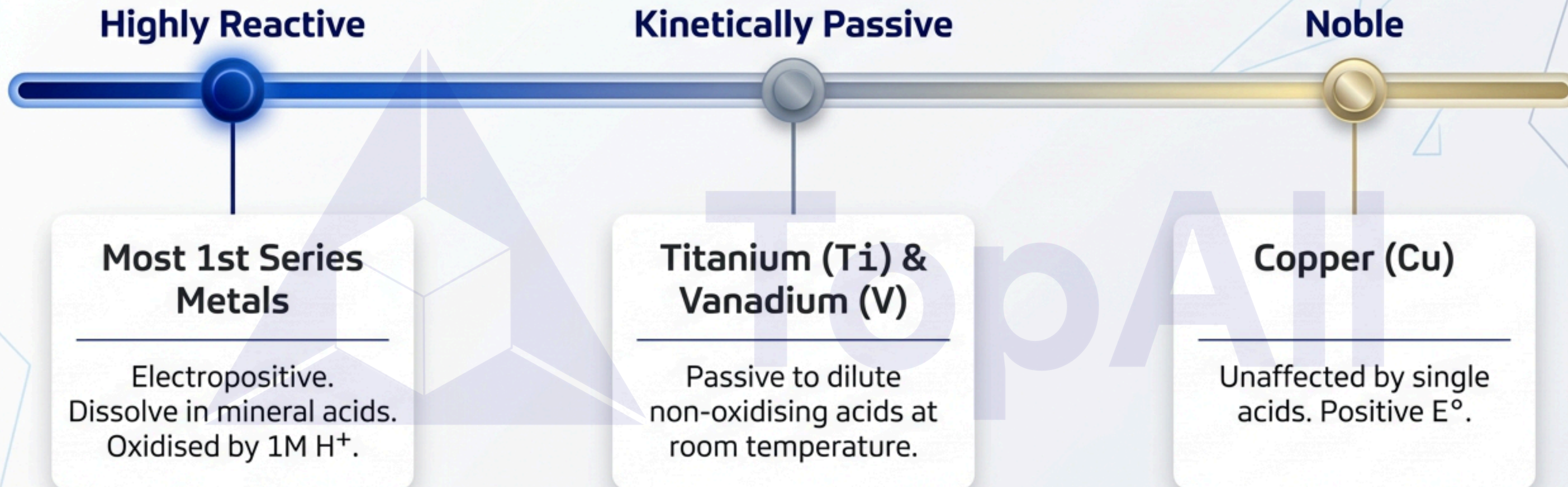


UNIT 4: THE D- AND F-BLOCK ELEMENTS

4.3.8 Chemical Reactivity and E° Values

Decoding standard electrode potentials, stability trends,
and noble metal anomalies in transition elements.

The Transition Metal Reactivity Spectrum



Macro Trend: There is a decreasing tendency to form divalent cations (M^{2+}) across the 3d series.

Unpacking the E° Value (M^{2+}/M)

Sublimation / Atomization Enthalpy

$$\Delta_{\text{sub}}H^\circ$$

Ionization Enthalpy

$$IE_1 + IE_2$$

Hydration Enthalpy

$$\Delta_{\text{hyd}}H^\circ$$



$$\Sigma \Delta H \rightarrow E^\circ (M^{2+}/M)$$



The trend of less negative E° values across the series is driven primarily by the **steady increase in the sum of 1st and 2nd Ionization Enthalpies.**



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

$$E=mc^2$$



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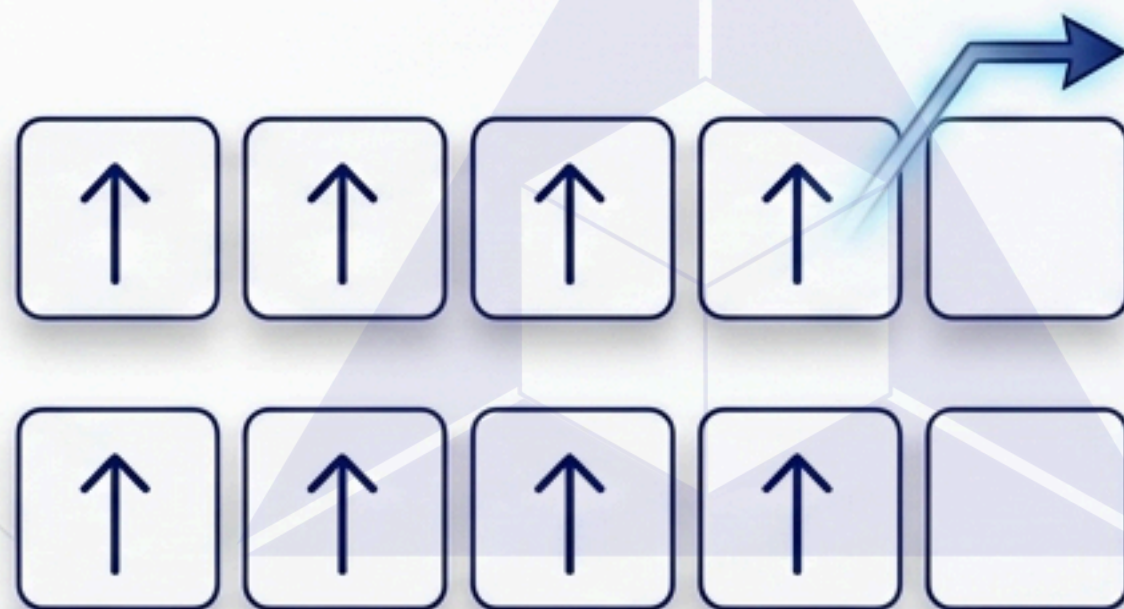
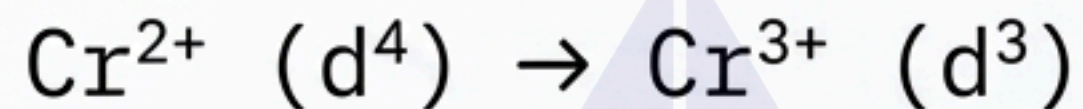
Key Highlights

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- » Push Your Limits with Level-Based Challenges
- » Climb the Leaderboard Among Fellow Aspirants
- » Practice Unlimited MCQs for NEET & JEE
- » Get Clear Explanations, Not Just Marks
- » Track Your Performance Smarter



The d⁴ Dilemma: Reducing vs. Oxidising

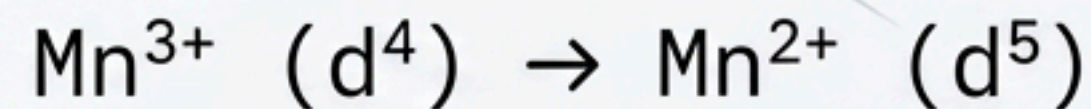
Cr²⁺ (Strong Reducing Agent)



Stable half-filled t_{2g} level.

Action: Liberates H₂ from dilute acids.

Mn³⁺ (Strong Oxidising Agent)



Extra stability of half-filled d-subshell.

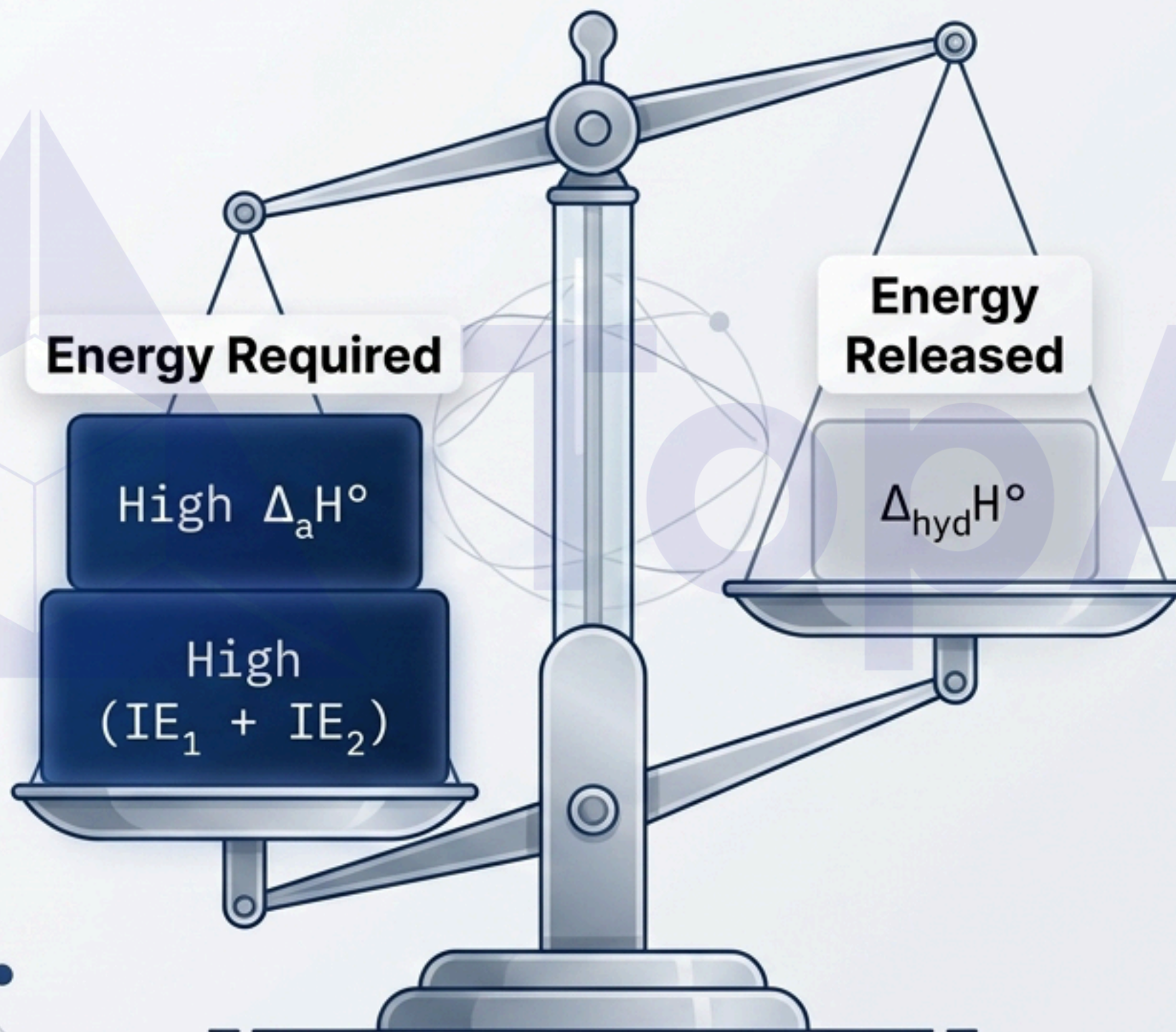
Action: Rapidly accepts electrons in aqueous solution.

The Anomaly of Copper ($E^\circ = +0.34 \text{ V}$)



Inability to liberate H_2

The massive energy required to transform Cu(s) to $\text{Cu}^{2+}(\text{aq})$ is not balanced by its hydration enthalpy.



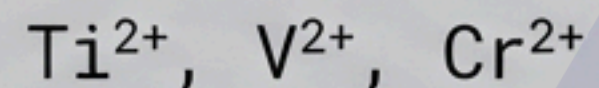
Reactivity Limit

Copper only reacts with strong oxidising acids (e.g., HNO_3 , hot conc. H_2SO_4). The acid is reduced, not the H^+ ion.

Predicting Aqueous Redox Reactions

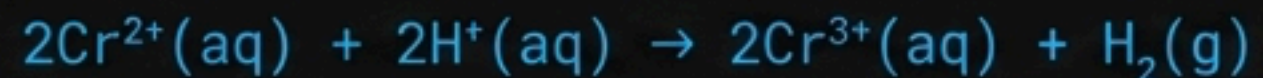


Strong Reducing Agents

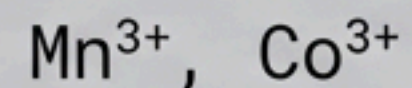


Readily oxidize to +3 state.

Will liberate H_2 gas from dilute mineral acids.



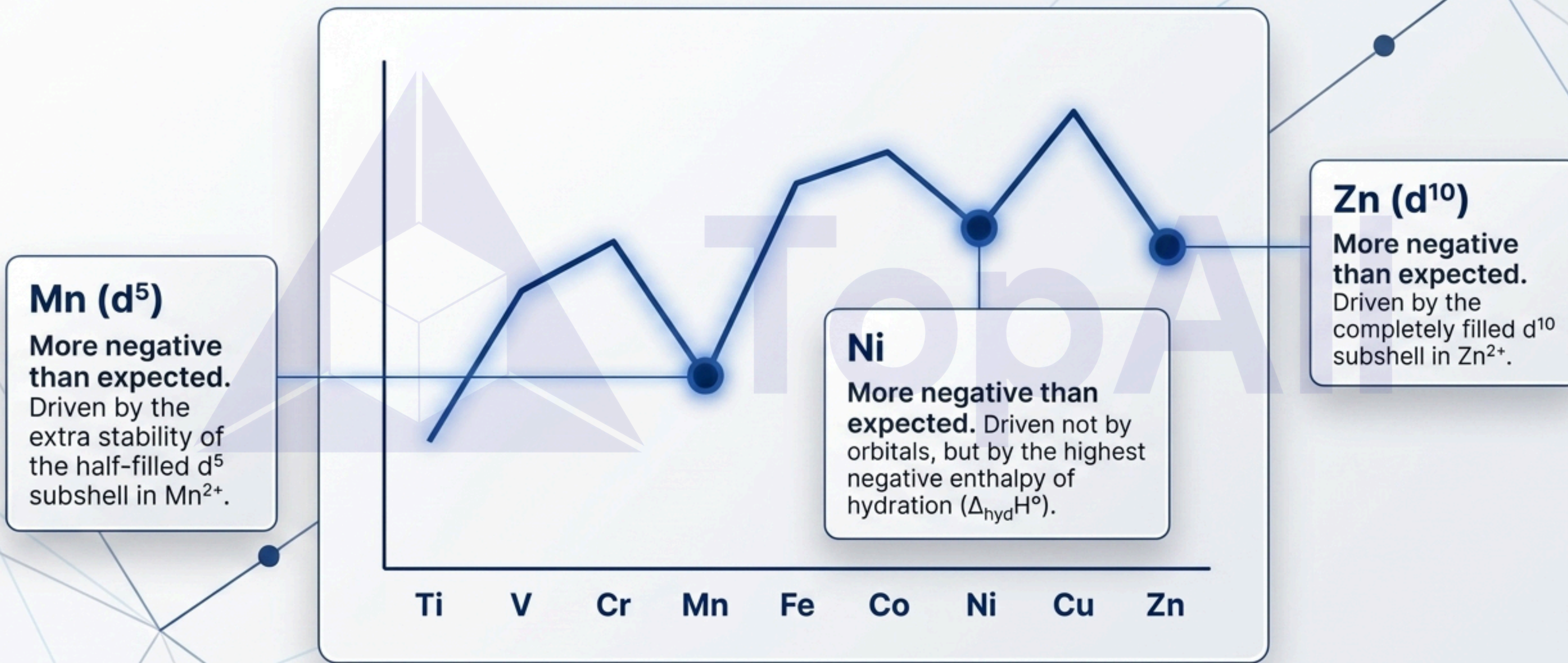
Strong Oxidising Agents



Driven by immense stability of +2 state.

Rapidly accept electrons in aqueous solutions.

3d Series E° Trend & Notable Exceptions



NEET/JEE Quick Revision Matrix



Stability



Mn^{2+} compounds are significantly more stable against oxidation to +3 than Fe^{2+} because the d^5 configuration is vastly superior to d^4 .

Noble Gas Configuration



Scandium (Sc^{3+}) uniquely achieves maximum stability by completely emptying its d-orbital to reach a noble gas configuration (d^0).

Copper's Secret



$E^\circ = +0.34\text{V}$. Will NOT dissolve in HCl . Will dissolve in HNO_3 (due to nitrate reduction).

Strongest Oxidizers



Mn^{3+} and Co^{3+} are the strongest oxidising agents in the 3d series in aqueous solutions.



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