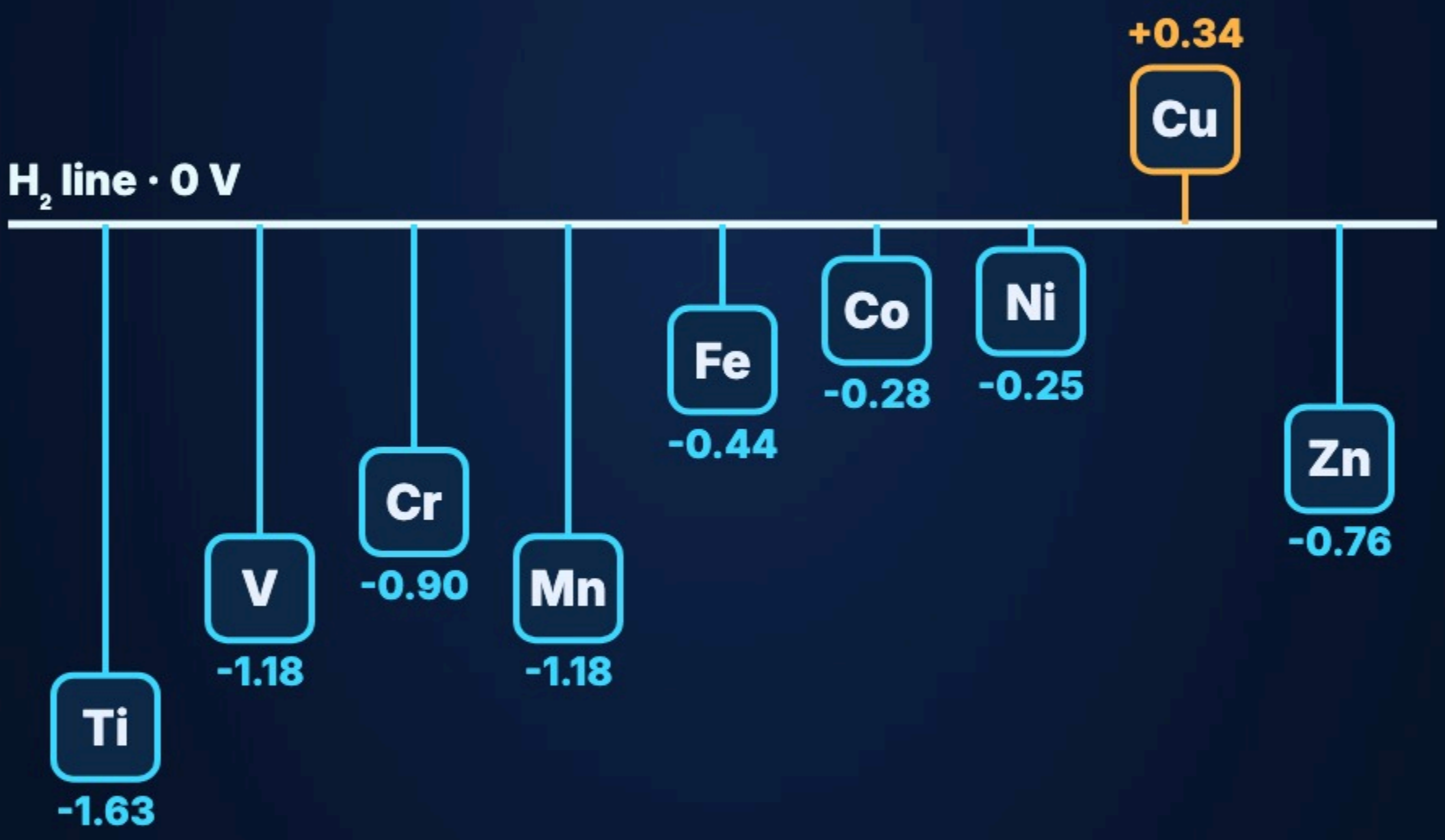
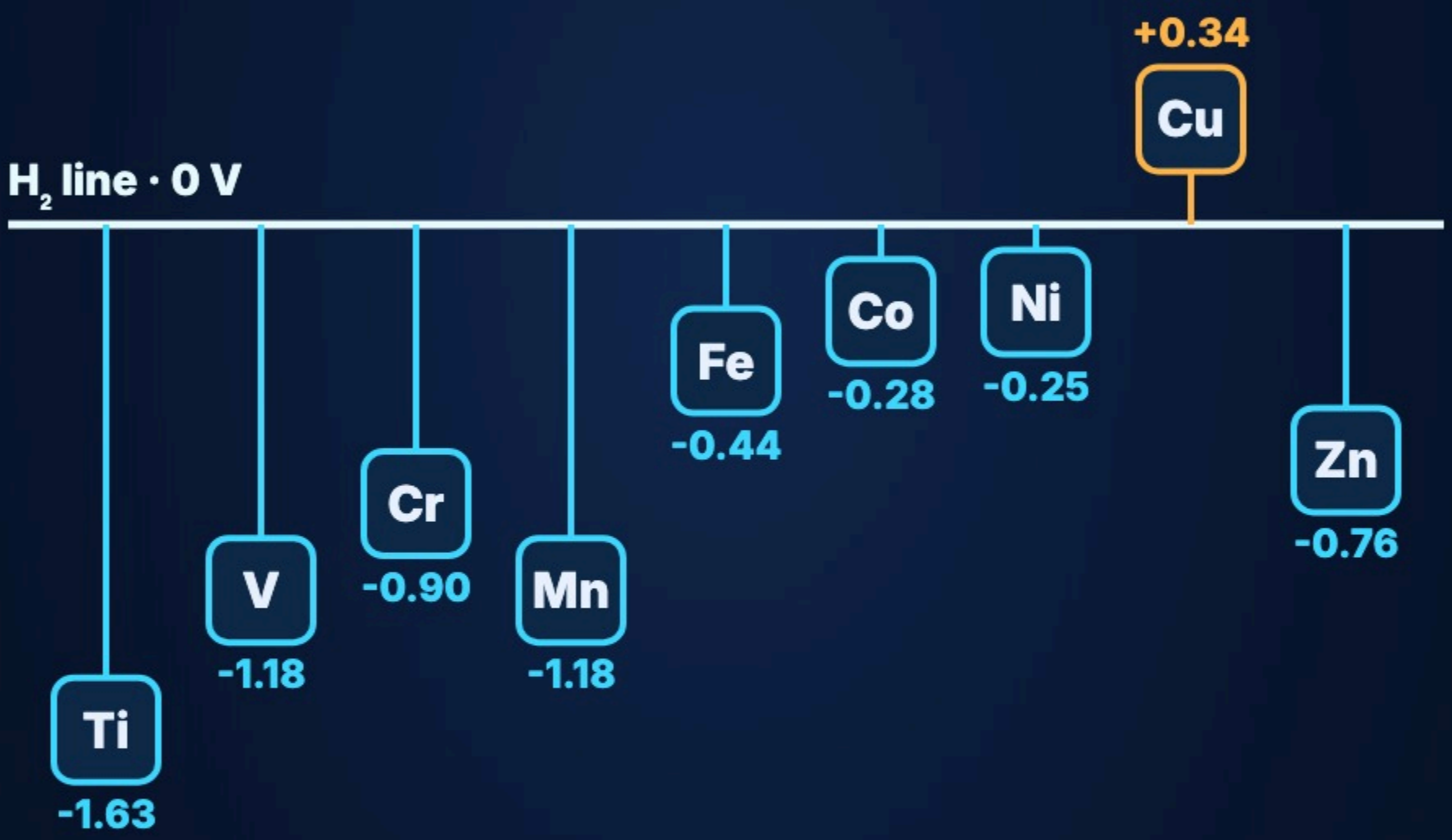
Why does copper stay silent in acid?



Zinc fizzes in dilute HCl; copper does nothing.

The d- and f-Block Elements · NCERT 4.3.5–4.3.6

E°: the scoreboard

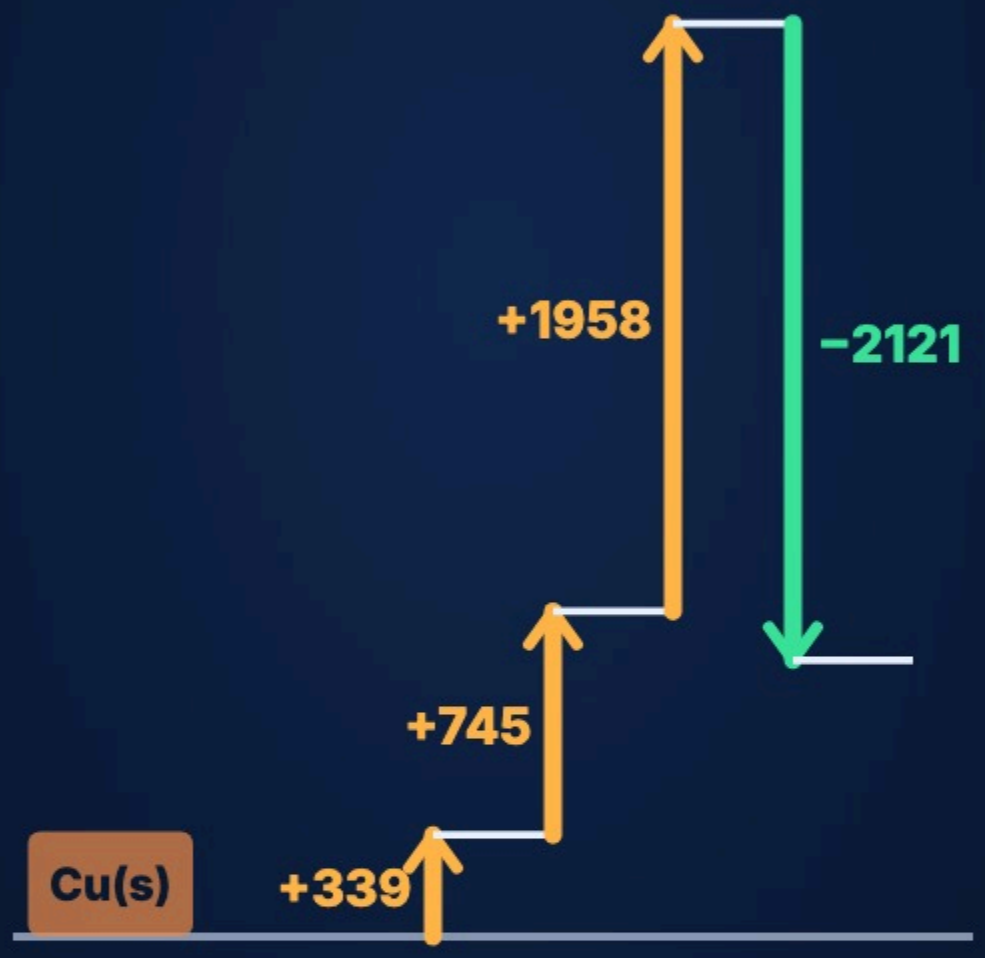


More negative E° = M^{2+} forms more easily.

Below the H_2 line: metal turns H^+ into **H_2**.

Copper alone is above: +0.34 V, no H_2.

The energy bill: M(s) → M^{2+}(aq)



Cost: atomisation (+339) and ionisation, IE_1 + IE_2 (+2703).

Back: hydration, water surrounds the ion (−2121).

Net = ΔaH + IE_1 + IE_2 + $\Delta hydH$ = 921

Zinc vs copper (kJ/mol)

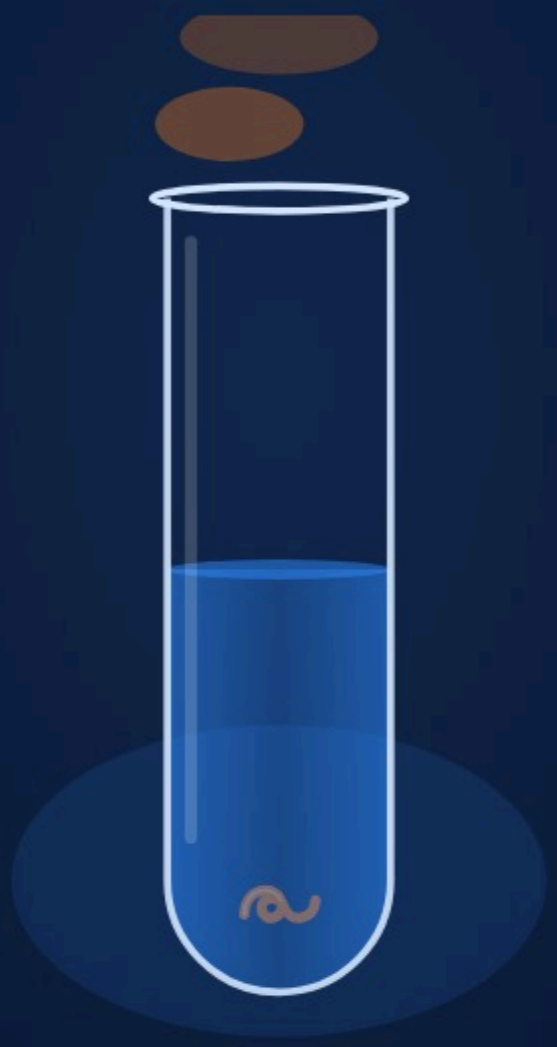


Zn: 130 + 906 + 1734 − 2059 = **711**

Cu: 339 + 745 + 1958 − 2121 = **921**

Copper's costs are higher than hydration can repay → **positive E°**. (NCERT Table 4.4)

Myth check



Oxidising acids (nitric, hot conc. sulphuric) do dissolve copper: blue Cu^{2+}, brown NO_2.

But no H_2: the acid itself is reduced.

Stable d^5 and d^{10} bend E°



Mn^{2+} d^5



Zn^{2+} d^{10}

Mn and Zn are more negative than the trend: their M^{2+} ions are stable (half-filled d^5, full d^{10}), so their bill is smaller.

$E°(M^{3+}/M^{2+})$: who wants an electron?

Mn^{3+} d^4



$+ e^- \rightarrow d^5$ ★ (+1.57 V)

Fe^{3+} d^5

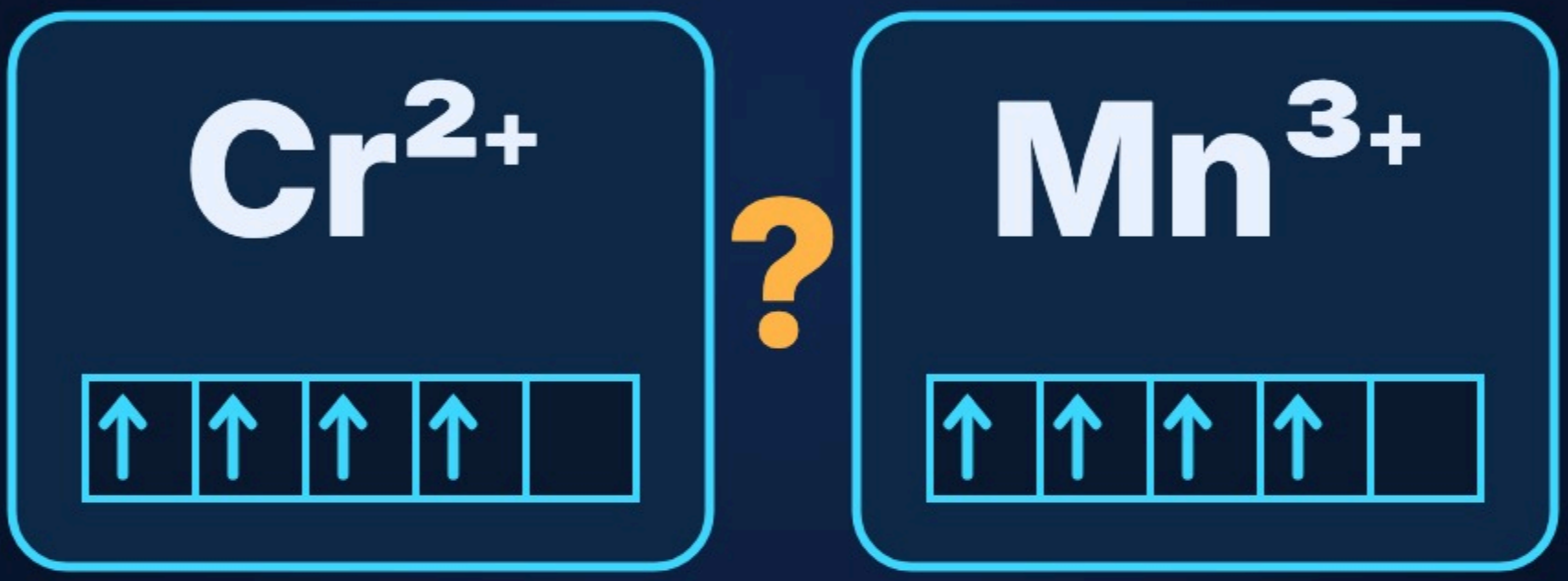


already stable (+0.77 V)

Mn^{3+} gains a stable d^5: a strong oxidising agent.

Fe^{3+} is already d^5: only +0.77 V. (Co^{3+}, +1.97 V, also oxidises strongly.)

Quick check



Both are d^4. Which is reducing, which oxidising?

Hint: which change gives a more stable d set?