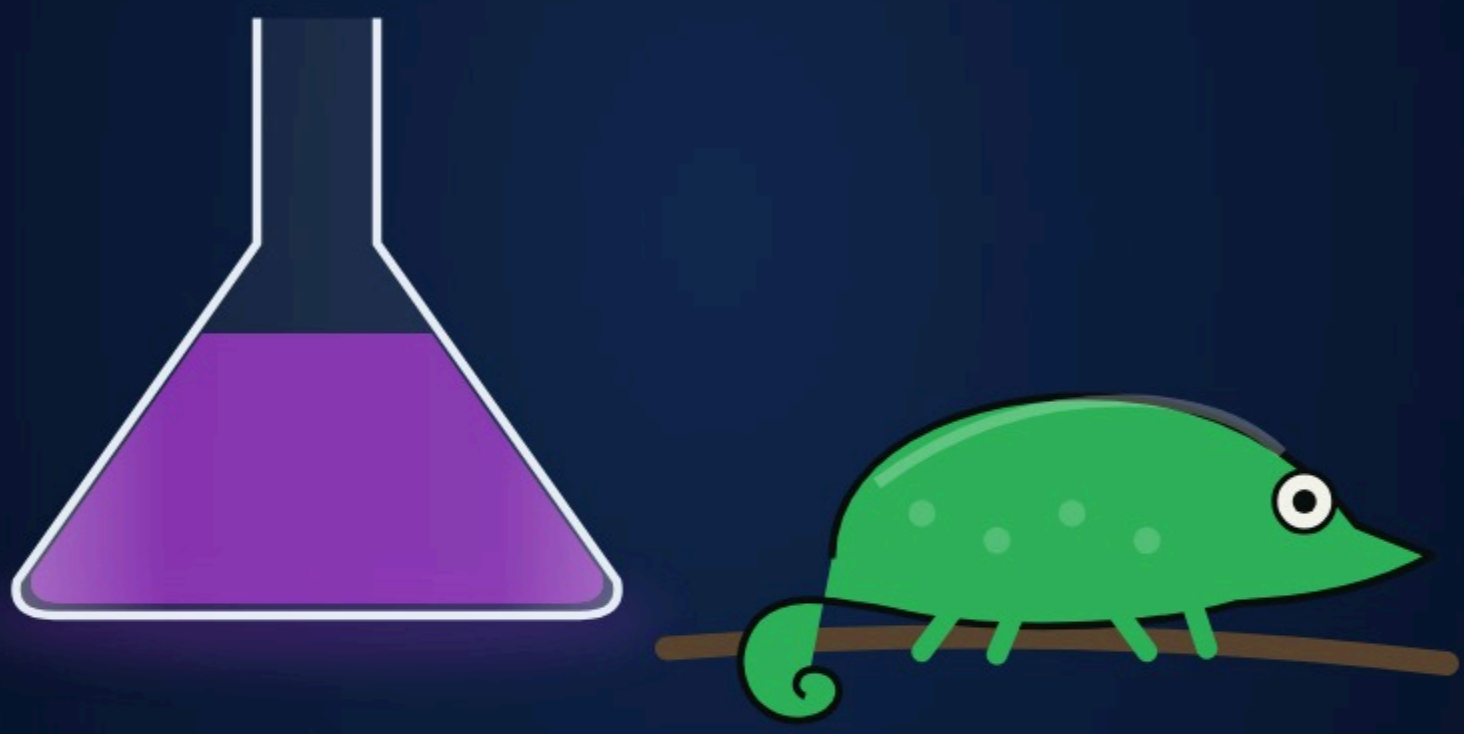
The mineral chameleon



green → purple

Over 350 years ago **Glauber** melted a black rock (MnO_2) with alkali.

In water the green turned purple: the **mineral chameleon**.

Step 1: fusion

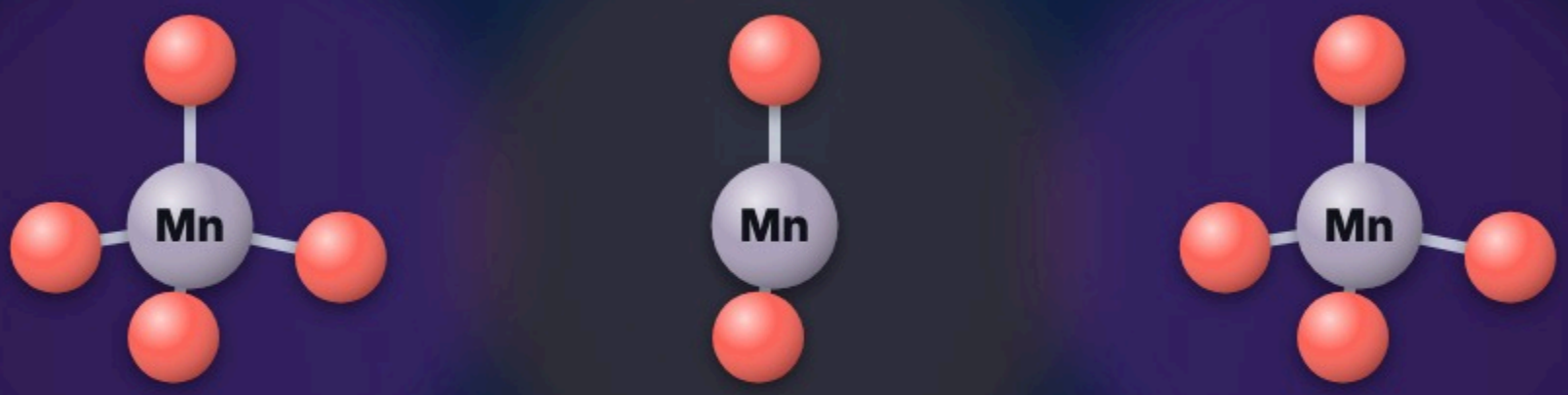


K_2MnO_4
Mn +6

MnO_2 + KOH + an oxidiser (KNO_3 or air), fused → **dark green K_2MnO_4**.

$2MnO_2 + 4KOH + O_2 \rightarrow 2K_2MnO_4 + 2H_2O$ (Mn **+4** → **+6**).

Step 2: disproportionation



MnO_4^- +7 MnO_2 +4 MnO_4^- +7

$$3MnO_4^{2-} + 4H^+ \rightarrow 2MnO_4^- + MnO_2 + 2H_2O$$

Two go **up** (+6 → +7), one goes **down** (+6 → +4): **disproportionation**.

In industry: electrolysis

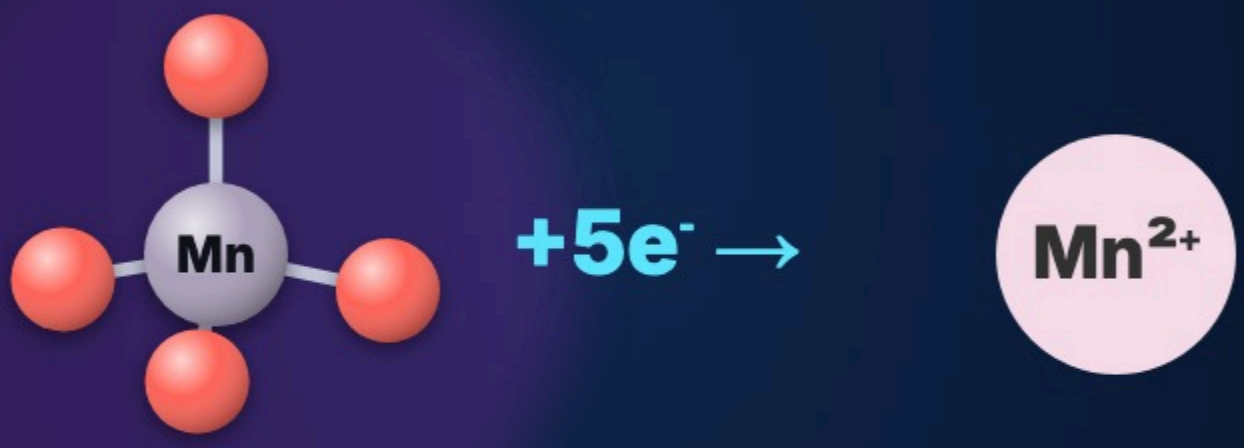


$MnO_4^{2-} \rightarrow MnO_4^- + e^-$ (at the anode)

Commercially, manganate is **oxidised electrolytically** to permanganate.

In the lab: Mn^{2+} + peroxodisulphate → MnO_4^-.

In acid: 5 electrons

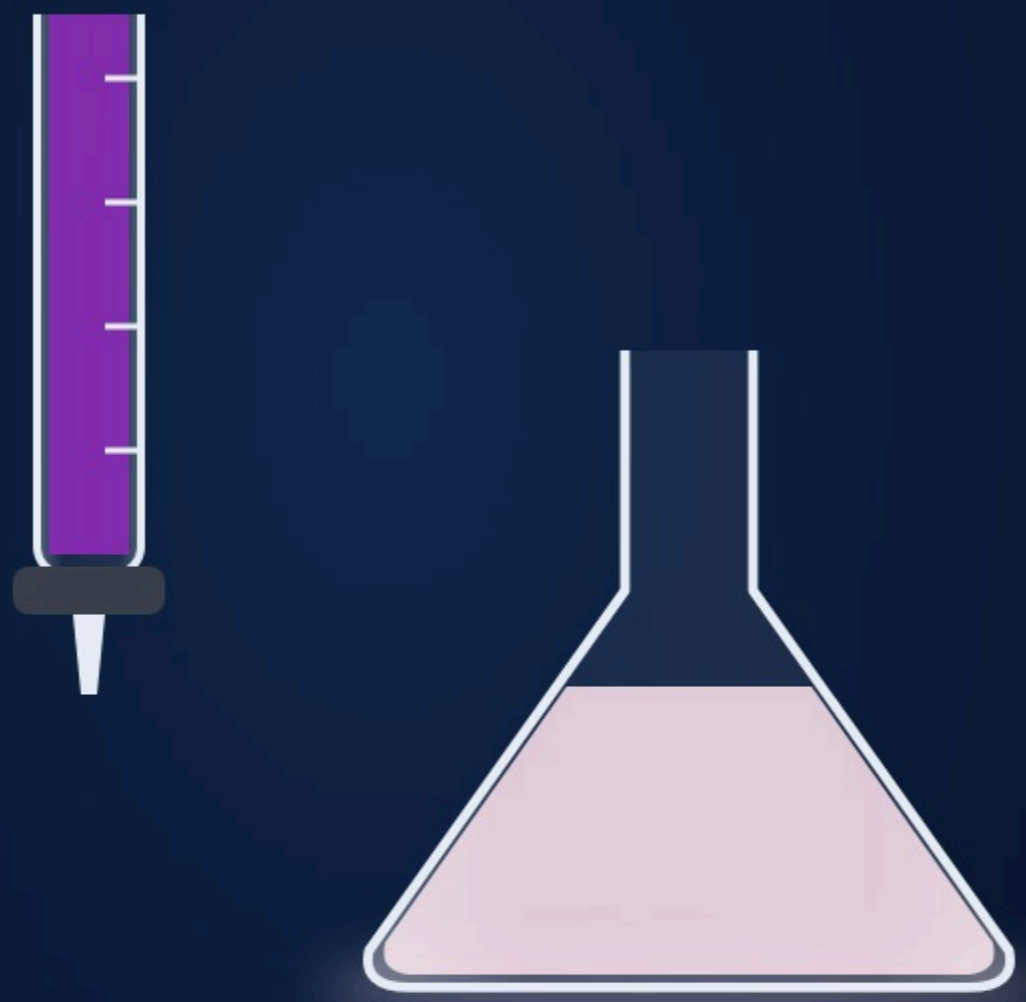


$$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$$

Mn **+7** → **+2** (E° = 1.52 V); purple → **almost colourless**.

Oxidises Fe^{2+}, I^-, oxalate, H_2S, SO_3^{2-}, NO_2^- in acid.

Its own indicator



pale pink

Purple drops **vanish** in Fe^{2+}; one extra drop leaves a **pale pink** colour.

That pink is the **end point**: no indicator needed.

In neutral: 3 electrons



acid: Mn^{2+} neutral: MnO_2

$MnO_4^- + 2H_2O + 3e^- \rightarrow MnO_2 + 4OH^-$ ($E° = 0.59$ V): **brown MnO_2**.

The **medium** decides the product.

Remember

$MnO_2 + KOH$, fuse $\rightarrow MnO_4^{2-}$ (green, +6)

$\rightarrow MnO_4^-$ (purple, +7)

acid: $5e^- \rightarrow Mn^{2+}$

neutral: $3e^- \rightarrow MnO_2$



Manganate green, permanganate purple; $5e^-$ in acid, $3e^-$ in neutral.

Your turn: one MnO_4^- (in acid) oxidises how many Fe^{2+}?