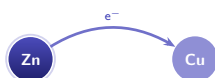


Electrochemistry

A-Level Chemistry ■ Topic 6

A-Level Chemistry



Electrochemistry

What we will cover

- 1 Oxidation number
- 2 Redox & OIL RIG
- 3 Balancing redox equations
- 4 Disproportionation
- 5 Oxidising & reducing agents



redox pushes electrons round

1

Oxidation number and redox

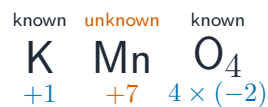
Electrochemistry

↳ Oxidation number and redox

Oxidation number

The **oxidation number** 氧化数 shows electrons lost or gained vs the free element.

- element = 0; simple ion = its charge
- H = +1, O = -2, F = -1
- they sum to 0 (or the ion's charge)



they sum to 0: (+1) + Mn + (-8) = 0, so Mn = +7

Electrochemistry

↳ Oxidation number and redox

Redox and OIL RIG

oxidation: loses $2e^-$
(oxidation number ↑)

reduction: gains $2e^-$
(oxidation number ↓)



$2e^-$ transferred
Zn is the **reducing agent**
 Cu^{2+} is the **oxidising agent**

A **redox** 氧化还原 reaction transfers electrons:

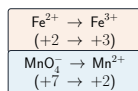
- **oxidation** 氧化 is loss (number up)
- **reduction** 还原 is gain (number down)

Remember **OIL RIG**; they always happen together.

Electrochemistry

↳ Oxidation number and redox

Balancing redox equations



oxidised: rises 1 (×5)

reduced: falls 5 (×1)

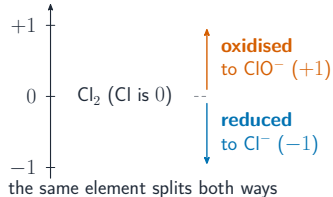
5 electrons lost = 5 gained ⇒ ratio $5\text{Fe}^{2+} : 1\text{MnO}_4^-$

Use oxidation-number changes:

The total **rise** in oxidation number must equal the total **fall** (every electron lost is gained) – this fixes the ratio.

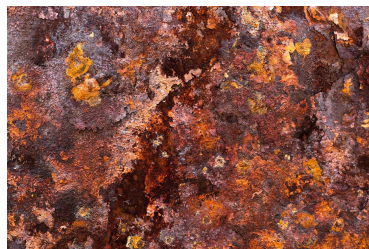
Disproportionation

oxidation number



Disproportionation 歧化 is when the **same** element is both oxidised and reduced at once. Chlorine (0) $\rightarrow$ ClO^- (+1) and Cl^- (-1) in cold water.

Oxidising and reducing agents



- an **oxidising agent** 氧化剂 takes electrons – it is itself **reduced**
- a **reducing agent** 还原剂 gives electrons – it is itself **oxidised**

Rusting is the oxidation of iron by oxygen.

Exam tips

- Apply the oxidation-number rules in order: O is **-2 except** in peroxides (-1); H is **+1 except** in metal hydrides (-1).
- In a redox equation the **total increase equals the total decrease** in oxidation number – use this to fix the ratio, then balance O with H_2O and H with H^+ .
- An **oxidising agent is itself reduced**; name both what is oxidised/reduced *and* the agent for full marks.
- **Disproportionation** is the same element both oxidised and reduced – show both oxidation-number changes.

2 Recap

Worked example – oxidation number

Find the oxidation number of sulfur in SO_4^{2-} .

- Let the oxidation number of S be x . Each O is -2.
- The numbers must add up to the **ion's charge**, -2:
- $x + 4(-2) = -2$
- $x = -2 + 8 = +6$.

Oxidation numbers sum to the **charge** (0 for a neutral compound). O is -2 and H is +1 – except in peroxides and metal hydrides.

Topic 6 – key takeaways

1 Oxidation number

electrons lost/gained vs the element

2 OIL RIG

oxidation is loss; reduction is gain

3 Balancing

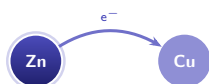
total rise = total fall

4 Agents

oxidising agent is reduced;
reducing agent oxidised

Check yourself

- 1 Oxidation number of Mn in KMnO_4 ?
- 2 Does oxidation lose or gain electrons?
- 3 What is it called when one element is both oxidised and reduced?
- 4 An oxidising agent is itself what?



Answers 1. +7 2. loses electrons 3. disproportionation 4. reduced