Identifying Redox Reactions

Essential Question

How can you tell if a reaction is redox?

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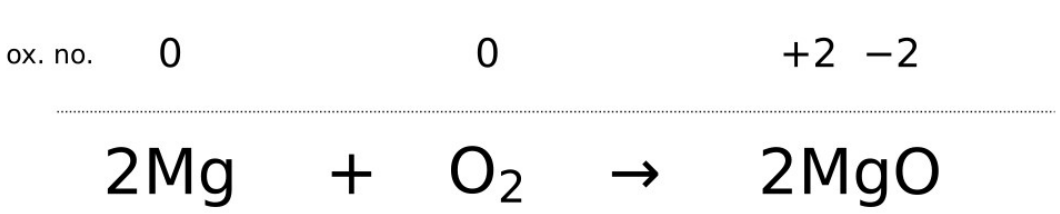
The Redox Test

- Redox = at least one oxidation number changes
- Assign oxidation numbers to every atom on both sides
- Compare each element left to right

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Up or Down?

- Number goes up: oxidized (lost e^-)
- Number goes down: reduced (gained e^-)
- Coefficients don't change oxidation numbers



Mg: 0 → +2 (up): oxidized, the reducing agent

O: 0 → −2 (down): reduced, the oxidizing agent

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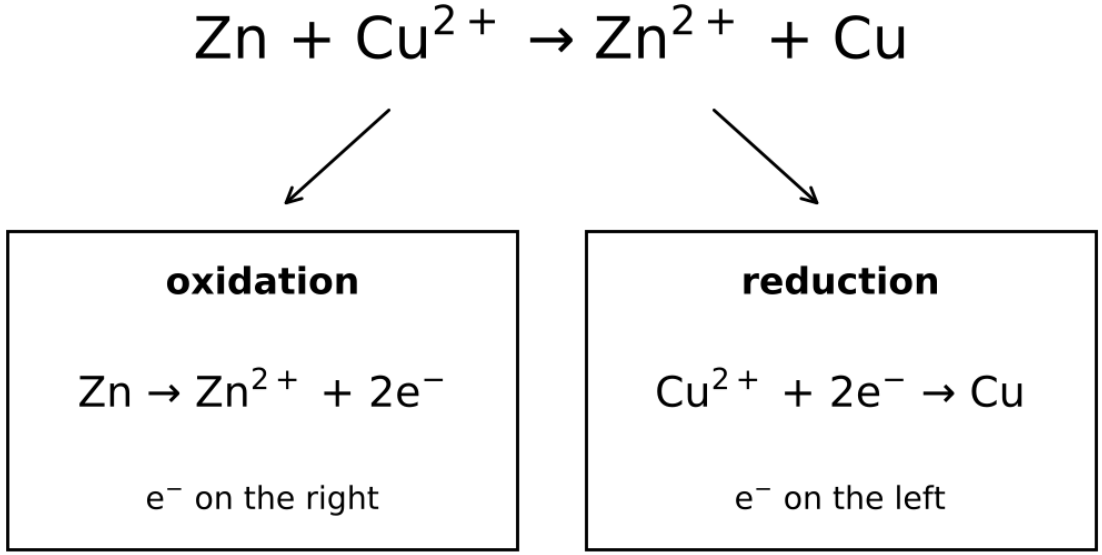
Oxidizing and Reducing Agents

- Oxidizing agent: the substance that is reduced
- Reducing agent: the substance that is oxidized
- In $2Mg + O_2 \rightarrow 2MgO$, O_2 is the oxidizing agent and Mg is the reducing agent

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Half-Reactions

- Shows just the oxidation or just the reduction
- e^- on the right = oxidation
- e^- on the left = reduction



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Not Every Atom Changes

- $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$
- S stays +6 and O stays −2
- Sulfate is a spectator ion
- Usually one element goes up and one goes down

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Identifying Redox Reactions

Reaction Types

- A free element on either side: usually redox
- The oxidation number test is the real proof

Always redox	Not redox
single replacement	double replacement
combustion	acid-base
synthesis from elements	
decomposition into elements	

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A Reaction That Is Not Redox

- $NaOH + HCl \rightarrow NaCl + H_2O$
- No oxidation number changes
- A proton (H^+) moves from the acid to the base
- Acid-base: protons move. Redox: electrons move.

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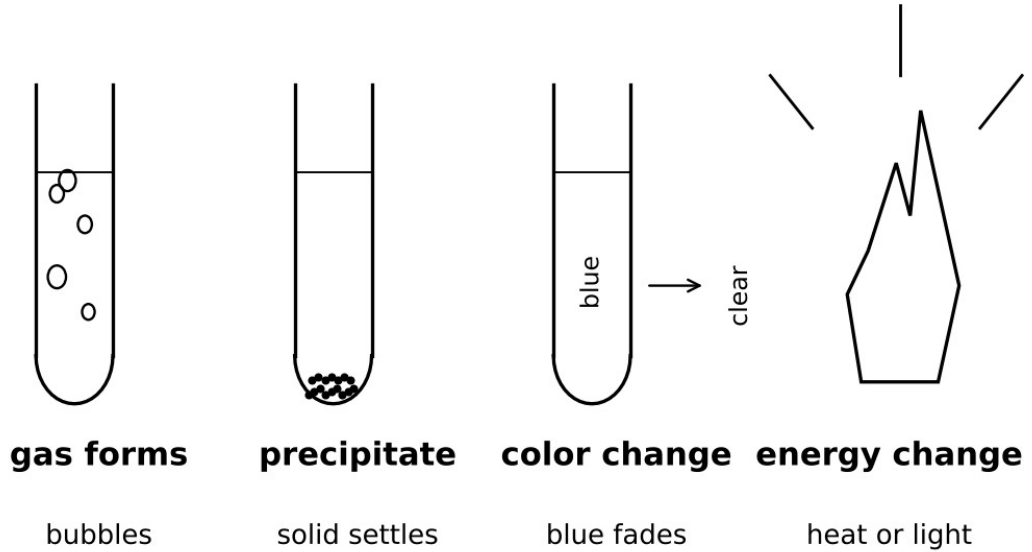
Steps to Identify Redox

- 1. Assign oxidation numbers to every atom
- 2. Find the elements that change
- 3. Up = oxidized, down = reduced
- 4. No change = not redox

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Evidence of a Chemical Reaction

- Chemical change: a new substance forms
- Physical change: same substance (melting ice)
- Signs: gas, precipitate, color change, energy change



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Evidence Is Not Proof

- Every reaction transfers energy: released as heat or light, or absorbed
- Boiling water bubbles, but it is still water
- A sign shows a reaction happened, not what kind

Sign	Example
gas forms	zinc in hydrochloric acid
precipitate	$AgNO_3$ + NaCl → white AgCl
color change	blue $CuSO_4$ fades with zinc
energy change	burning magnesium: light and heat

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Example: Oxidized or Reduced?

Which element is oxidized? Which is reduced? $2Al + 3Cl_2 \rightarrow 2AlCl_3$

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Example: Iron Ore

Which element is oxidized? Which is reduced? $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

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Example: Redox or Not?

Is this a redox reaction? Explain. $AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$

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Example: Half-Reactions

Write the oxidation and reduction half-reactions. $Zn + 2Ag^{+} \rightarrow Zn^{2+} + 2Ag$

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Identifying Redox Reactions

Big Ideas

- Redox: an oxidation number changes
- Up = oxidized, down = reduced
- Oxidizing agent is reduced; reducing agent is oxidized
- Double replacement and acid-base: not redox
- Gas, precipitate, color or energy change: evidence of a reaction

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