

Electrochemistry

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All electrochemical processes involve the transfer of electrons from one substance to another and are therefore redox reactions.

use spontaneous chemical reactions to generate electric current

use electrical current to drive chemical reactions that would otherwise be nonspontaneous

Redox Reactions

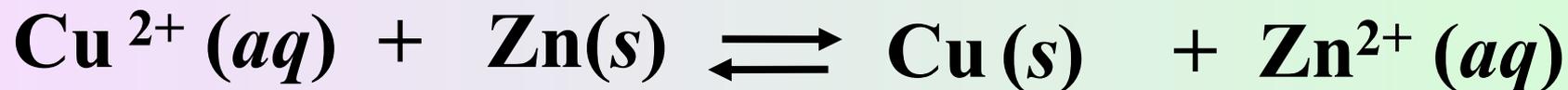
key terms:

oxidizing agent

reducing agent

oxidation number

Consider the oxidation-reduction reaction



Cu²⁺ gains 2 electrons

**oxidation number decreases;
is reduced**

is the oxidizing agent

Zn⁰ loses 2 electrons

**oxidation number increases;
is oxidized**

is the reducing agent

oxidation-reduction reactions

In studying a redox reaction we often think of it as two half reactions.



Balancing Oxidation-Reduction Equations

Half-Reaction Method

Half-Reaction Method in Acid

- 1. Write the unbalanced equation in ionic form.**
- 2. Separate the equation into two half-reactions.**
- 3. Balance each half reaction (except for O and H).**
- 4. In acid solution, balance O by adding H_2O and H by adding H^+**
- 5. Balance the charges by adding electrons.**
- 6. Add the half reactions**
- 7. Check to make sure atoms and charges are balanced**

Example

Balance the following equation for the reaction in acid solution. *



***All species are (aq)**

1. Write the unbalanced equation in ionic form.



2. Separate the equation into two half-reactions



3. Balance each half reaction (except for O and H).

4. In acid solution, balance O by adding H₂O and H by adding H⁺

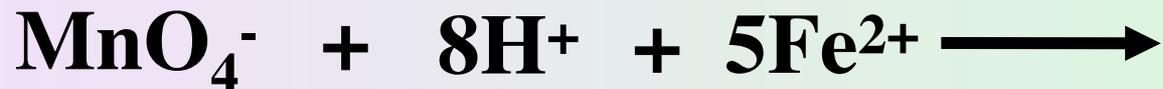
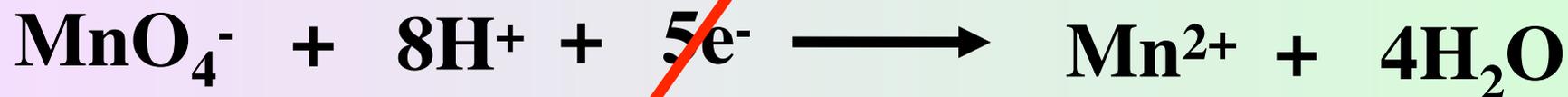


5. Balance the charges by adding electrons.

You need the same number of electrons on both sides of the equation.



6. Add the half reactions



This is the balanced equation

Half-Reaction Method in Base

- 1. Use the half-reaction method as specified for acidic solutions to obtain the final balanced equation *as if H^+ ions were present.***
- 2. Add the number of OH^- ions to both sides of the equation to turn the remaining H^+ ions to H_2O**
- 3. Eliminate waters that appear on both sides of the equation.**

Example

Balance the following equation for the reaction in basic solution. *



*All species are (aq)

Example

Balance the following equation for the reaction in basic solution. *



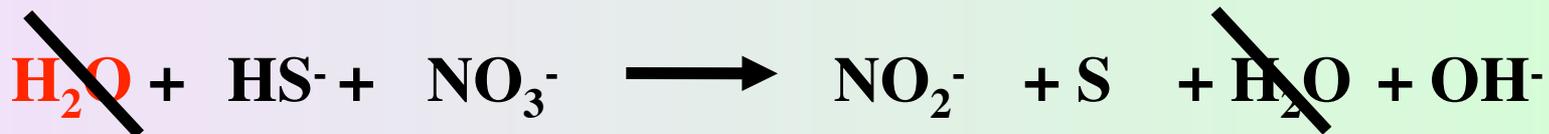
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