

Half-Reactions

A **half-reaction** is one of the two parts of a redox reaction—the oxidation half alone, or the reduction half alone. Half-reactions can be written by following the steps below:

1. Write the chemical formulas for the reactants and products.
2. Balance all atoms, other than O and H .
3. Balance O by adding H_2O .
4. Balance H by adding H^+ .
5. Balance the charge on each side by adding e^- and cancel anything that is the same on both sides.

For basic solutions only.

6. Add OH^- to both sides to equal the number of H^+ present.
7. Combine H^+ and OH^- on the same side to form H_2O . Cancel equal amounts of H_2O from both sides.

Example 1

Nitrous acid can be reduced in an acidic solution to form nitrogen monoxide gas. What is the reduction half-reaction for nitrous acid?

Example 2

Copper metal can be oxidized in a basic solution to form copper(I) oxide. What is the half-reaction for this process?

Half-Reaction Method

Now that we know how to write half-reaction equations, we can use these to determine the balanced redox reaction. To do so, follow the steps below:

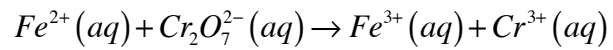
1. Separate the skeleton equation into the start of two half-reaction equations.
2. Balance each half-reaction equation.
3. Multiply each half-reaction equation by simple whole numbers to balance the electrons lost and gained.
4. Add the two half-reaction equations, cancelling the electrons and anything else that is exactly the same on both sides of the equation.

For basic solutions only.

5. Add OH^- to both sides to equal the number of H^+ present.
6. Combine H^+ and OH^- on the same side to form H_2O . Cancel equal amounts of H_2O from both sides.

Example 3

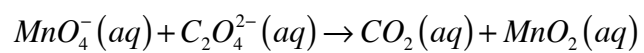
In a chemical analysis, a solution of dichromate ions is reacted with an acidic solution of iron(II) ions. The products formed are iron(III) and chromium(III) ions as shown by the following skeleton equation.



Balance the equation.

Example 4

Permanganate ions and oxalate ions react in a basic solution to produce carbon dioxide and manganese(IV) oxide.



Write the balanced redox equation for this reaction.