

Redox reactions – half equations

Lesson 2

All redox reactions can be divided into two equations called **half equations**, representing the reduction and oxidation processes of the overall redox reaction.

The following rules apply to writing half equations

- 1) Balance the equation for all elements other than H or O
- 2) Balance for oxygen by adding water to the side deficient in oxygen.
- 3) Balance for hydrogen by adding H⁺ to the side deficient in H
- 4) Balance for charge by adding electrons to the most positive side.

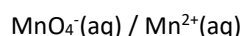
Example Write a half equation for the reduction of Cr₂O₇²⁻(aq) → Cr³⁺(aq) in an acid solution

- 1) Balance the equation for all elements other than H or O
Cr₂O₇²⁻(aq) → 2Cr³⁺(aq)
- 2) Balance for oxygen by adding water to the side deficient in oxygen.
Cr₂O₇²⁻(aq) → 2Cr³⁺(aq) + 7H₂O(l)
- 3) Balance for hydrogen by adding H⁺ to the side deficient in H
Cr₂O₇²⁻(aq) + 14H⁺(aq) → 2Cr³⁺(aq) + 7H₂O(l)
- 4) Balance for charge by adding electrons to the most positive side.
Cr₂O₇²⁻(aq) + 14H⁺(aq) + 6e → 2Cr³⁺(aq) + 7H₂O(l)

1) Write the half equations that occur in an acid solution for:

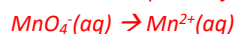
- a) MnO₄⁻(aq) / Mn²⁺(aq)
- b) CH₃OH(aq) / HCOOH(aq)
- c) SO₄²⁻(aq) / SO₂(g)
- d) NO₃⁻(aq) / N₂O₂(g)

2) Write the half equations that occur in an alkaline solution for the reactions shown below. [Click](#) to revise how to change the half equation taking place in an acid solution to one taking place in alkaline solution. The first one is done for you.

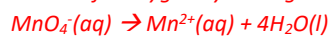


Balance the equation as normal for an acid solution.

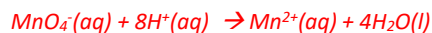
Balance the equation for all elements other than H or O



Balance for oxygen by adding water to the side deficient in oxygen.



Balance for hydrogen by adding H⁺ to the side deficient in H

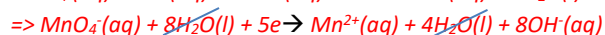


Balance for charge by adding electrons to the most positive side.



Extra steps

Replace H⁺ by adding an equivalent number of OH⁻ ions to both sides and then eliminate water molecules as they appear on both sides.



- a) Cr₂O₇²⁻(aq) / Cr³⁺(aq)
- b) SO₄²⁻(aq) / SO₂(g)
- c) NO₃⁻(aq) / N₂O₂(g)