

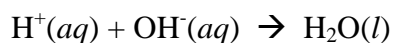
Rules for Balancing REDOX Equations (Half-Reaction Method)

A. Acidic, or Neutral, Solution

1. Divide the “skeleton” equation into two separate reduction and oxidation “half-reactions”.
2. For *each* half-reaction:
 - a. Balance all elements *except* hydrogen and oxygen.
 - b. Balance oxygen by adding water ($\text{H}_2\text{O}(l)$).
 - c. Balance hydrogen by adding $\text{H}^+(aq)$ ion.
 - d. Balance charge by adding electrons.
3. If required, multiply each balanced half-reaction by the smallest whole number necessary to equalize the number of electrons in the two half-reactions.
4. Sum the two half-reactions to obtain the overall equation. If possible, simplify the overall equation by canceling like species.
5. Check that the elements and charges balance on both sides of the equation.

B. Basic Solution

1. Complete steps 1-5 described above for an acidic solution.
2. Add one $\text{OH}^-(aq)$ ion to both sides of the overall equation for every $\text{H}^+(aq)$ ion present. The $\text{H}^+(aq)$ ions on one side combine with the added $\text{OH}^-(aq)$ ions to form $\text{H}_2\text{O}(l)$, and $\text{OH}^-(aq)$ ions appear on the other side of the equation.



3. If possible, simplify the resulting overall equation by canceling like species.
4. Check that the elements and charges balance on both sides of the equation.