

## Balancing basic redox

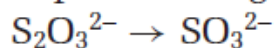
- Step 1** Write an unbalanced half-reaction that shows the formulas of the given reactant(s) and product(s).
- Step 2** Balance any atoms other than oxygen and hydrogen first.
- Step 3** Balance any oxygen and hydrogen atoms as if the conditions are acidic.
- Step 4** Adjust for basic conditions by adding to both sides the same number of hydroxide ions as the number of hydrogen ions already present.
- Step 5** Simplify the half-reaction by combining the hydrogen ions and hydroxide ions on the same side of the equation into water molecules.
- Step 6** Remove any water molecules present on both sides of the half-reaction.
- Step 7** Balance the charges by adding electrons.

## Problem

Write a balanced half-reaction that shows the oxidation of thiosulfate ions,  $\text{S}_2\text{O}_3^{2-}$ , to sulfite ions,  $\text{SO}_3^{2-}$ , in a basic solution.

## Solution

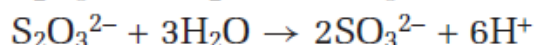
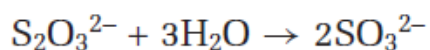
**Step 1** Represent the given reactant and product with correct formulas.



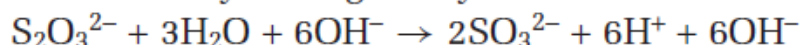
**Step 2** Balance the atoms, beginning with the sulfur atoms.



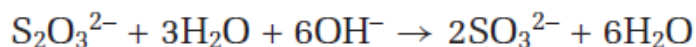
**Step 3** Balance the oxygen and hydrogen atoms as if the solution is acidic.



**Step 4** There are six hydrogen ions present, so adjust for basic conditions by adding six hydroxide ions to each side.



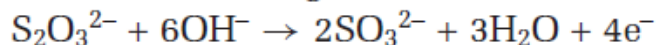
**Step 5** Combine the hydrogen ions and hydroxide ions on the right side into water molecules.



**Step 6** Remove three water molecules from each side.



**Step 7** The atoms are now balanced, but the net charge on the left side is 8-, whereas the net charge on the right side is 4-. Add four electrons to the right side to balance the charges.



1. Balance the redox reaction below under **basic** conditions.



2. Balance this reaction under **basic** conditions. (4)

