Life on planet Earth is a complicated and well-organized set of processes. Animals are designed to breathe oxygen and plants are designed to produce oxygen. Photosynthesis is the means by which we get the oxygen we need for life. Light striking a plant pigment known as chlorophyll initiates a complex series of reactions, many of which involve redox processes complete with movement of electrons. In this series of reactions, water is converted to oxygen gas, and we have something to sustain our lives.

Oxidizing and Reducing Agents

The reaction below is a redox reaction that produces zinc sulfide:

\[
\text{Zn} + \text{S} \rightarrow \text{ZnS}
\]

The half-reactions can be written:

\[
\begin{align}
&\text{Oxidation:} \: \text{Zn} \rightarrow \text{Zn}^{2+} + 2 \text{e}^- \\
&\text{Reduction:} \: \text{S} + 2 \text{e}^- \rightarrow \text{S}^{2-}
\end{align}
\]

In the reaction above, zinc is being oxidized by losing electrons. However, there must be another substance present that gains those electrons and in this case that is the sulfur. In other words, the sulfur is causing the zinc to be oxidized. Sulfur is called the oxidizing agent. The zinc causes the sulfur to gain electrons and become reduced and so the zinc is called the reducing agent. The oxidizing agent is a substance that causes oxidation by accepting electrons. The reducing agent is a substance that causes reduction by losing electrons. The simplest way to think of this is that the oxidizing agent is the substance that is reduced, while the reducing agent is the substance that is oxidized. The example below shows how to analyze a redox reaction.

Example 22.3.1

When chlorine gas is bubbled into a solution of sodium bromide, a reaction occurs which produces aqueous sodium chloride and bromine. Determine what is being oxidized and what is being reduced. Identify the oxidizing and reducing agents.

\[
\text{Cl}_2 (g) + 2 \text{NaBr}(aq) \rightarrow 2 \text{NaCl}(aq) + \text{Br}_2 (l)
\]

Solution:

Step 1: Plan the problem.

Break the reaction down into a net ionic equation and then into half-reactions. The substance that loses electrons is being oxidized and is the reducing agent. The substance that gains electrons is being reduced and is the oxidizing agent.

Step 2: Solve.

\[
\begin{align}
&\text{Cl}_2 (g) \rightarrow \text{Cl}_2 (aq) + 2 \text{e}^- \\
&2 \text{Na}^+(aq) + 2 \text{Br}^- (aq) \rightarrow 2 \text{Na}^+(aq) + 2 \text{Cl}^- (aq)
\end{align}
\]
\[
\begin{align}
\text{Oxidation:} & \quad \ce{Cl_2} (g) + 2 \ce{e^-} \rightarrow 2 \ce{Cl^-} (aq) \\
\text{Reduction:} & \quad 2 \ce{Br^-} (aq) \rightarrow \ce{Br_2} (l) + 2 \ce{e^-}
\end{align}
\]

The \(\ce{Cl_2}\) is being reduced and is the oxidizing agent. The \(\ce{Br^-}\) is being oxidized and is the reducing agent.

Summary

-氧化和还原剂被描述。
-氧化剂和还原剂的示例被显示。

Contributors

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