Chemical Concept Demonstrated

- Reversible oxidation-reduction reactions

Demonstration

- KOH is dissolved in water.
- Dextrose (glucose) is dissolved in this solution and methylene blue is added.

Observations

When the indicator is initially added to the solution, the solution turns blue. The color gradually fades and becomes colorless. The color reappears when the flask is vigorously shaken. The color then begins to fade again.

Explanations (including important chemical equations)

The color change results from the reversible oxidation-reduction reaction of the methylene blue indicator. In alkaline solutions, glucose is oxidized to D-gluconic acid or alpha-D-gluconolactone

\[
\text{HOCH}_2\text{(CHOH)}_4\text{CHO} + 3 \text{OH}^- \rightarrow \text{HOCH}_2\text{(CHOH)}_4\text{CO}_2 + 2 \text{H}_2\text{O} + 2 \text{e}^-
\]

In the course of this reaction, methylene blue is reduced from the blue (oxidized) form to the colorless (reduced) form.

Shaking the flask dissolves \(\text{O}_2\) in the solution, which oxidizes the indicator back to the blue (oxidized) form.

Contributors

- Dr. George Bodner ([Perdue University](http://www.perdue.edu))