



## The Reappearing Pumpkin Chemical Demonstration Kit

### Introduction

A slight variation of the classic "Blue Bottle Experiment" allows a pumpkin face to disappear and then reappear over and over again.

### Chemical Concepts

- Oxidation-reduction
- Reaction kinetics

### Background

The classic blue bottle experiment has been described and used for many chemical education purposes. The reaction in the blue bottle experiment is an oxidation-reduction reaction. The bottle contains sodium hydroxide, glucose, water, and an indicator (methylene blue). Glucose is a reducing agent and in an alkaline solution will reduce methylene blue to its colorless form. Shaking the bottle allows the oxygen in the air to oxidize the methylene blue to its blue form (Equation 1). Upon standing it is reduced back to its colorless form as shown in Equation 2:



Equation 1—Shaking



Equation 2—Standing



- MB = reduced form methylene blue (colorless)
- MB<sub>ox</sub> = oxidized form methylene blue (blue)
- C<sub>6</sub>H<sub>12</sub>O<sub>6</sub> = glucose
- X<sup>-</sup> = oxidation products of glucose: arabinonic, formic, oxalic, and erythronic acids

In the demonstration, the dark blue color due to the oxidized form of methylene blue is used to mask the appearance of the pumpkin face. Yellow food coloring is added to the solution so the reaction now oscillates between an orange and a dark bluish color. When the methylene blue is reduced back to its colorless state, the pumpkin face "magically" reappears.

### Materials (for each demonstration)

Sodium hydroxide solution, NaOH, 6 M, 42 mL\*

Glucose, C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>, 10 g\*

Yellow food coloring, 10–20 drops\*

Methylene blue, 1 mL\*

Flask, 1000-mL (Florence or volumetric, round)

\*Materials included in kit.

Blue or black marker

Beaker, 1000-mL

Distilled water, 1000-mL

Stirring rod

Rubber stopper to fit flask

### Safety Precautions

Sodium hydroxide is a corrosive solid, may cause skin burns, and is very dangerous to the eyes. Methylene blue is slightly toxic. Wear chemical splash goggles, chemical-resistant gloves, and a chemical-resistant apron. Please review current Material Safety Data Sheets for additional safety, handling, and disposal information.

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