

The “Blue Bottle”: An Oxidation

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Target audience: K-6 grade

Adapted from:

<http://chemistry.about.com/od/chemistrydemonstrations/ss/bluebottle.htm>

(1) Supplies

Acros #414240250	Methylene blue	25g	\$20
Acros #383040010	Sodium hydroxide	1kg	\$17
Aldrich #25307-3	D-glucose	500g	\$14.70

(2) Procedure

- Dissolve 5.0 g glucose in 150 mL water
- Dissolve 5.0 g NaOH in 150 mL water
- Make a 0.1% methylene blue solution in water
- Combine 10 mL each of glucose and NaOH solutions and 1.0 mL methylene blue solution in a 50 mL falcon tube
- Cap the tube, and shake it to distribute the dye, giving a blue solution
- Set aside and the liquid will gradually become colorless, except for the very top of the liquid where it is in constant contact with the air.
- Shake or swirl to restore the blue color; repeat

(3) Explanation

In this oxidation/reduction reaction, the aldehyde of glucose is oxidized by oxygen in the alkaline solution to form gluconic acid. Methylene blue speeds up this reaction, acting as an oxygen transfer agent. In the process the dye is reduced to leucomethylene blue, a colorless molecule. Replenishing the oxygen in the reaction, by swirling the flask, causes leucomethylene blue to be re-oxidized and the solution again becomes blue.

To make this more accessible to young students, compare this reaction to iron rusting, which is also an oxidation reaction. Point out that rusting is not a reversible reaction, while this “blue bottle” reaction is.

Figure follows on following page.

Oxidation

- *What is a physical change?*

When the **properties** - but not the **molecules** - of a material change.



- *What is a chemical reaction?*

When 2 or more molecules interact and a **chemical** change happens.

⇒ **RUST** is a type of chemical reaction called an **OXIDATION** reaction. It involves **oxygen**



- The "blue bottle" is a **Reversible Oxidation** reaction:

