

SCIENCE IS FUN

University of Wisconsin Foundation
Board of Directors Dinner
April 25, 2002

COOL LIGHT

An Investigation of Chemiluminescence

Many chemical reactions produce both light and heat. A burning candle is such a reaction. When a candle is lit, its flame both glows and becomes hot. It is much less common for a chemical reaction to produce light without heat. The light from such reactions is called cool light, because it is created without heat. Reactions that produce light without heat are called chemiluminescent reactions. Perhaps the most familiar chemiluminescent reactions are those that occur in living organisms. Fireflies produce light without heat by a chemiluminescent reaction. Chemiluminescent reactions that occur in living organisms are called bioluminescent reactions.

In this activity you will examine a commercial chemiluminescent chemical reaction. The reaction occurs inside a Lightstick. Lightsticks are available at many sporting goods stores, camping supply stores, and hardware stores. Amusement parks and carnivals often have them in the shape of bracelets and necklaces.

Open the wrapper and remove the Lightstick

Describe the Lightstick. What does it look like? What color is it?
How big is it? Is anything inside the Lightstick?

Follow the directions on the wrapper to activate the Lightstick

Bend the Lightstick just enough to break the thin glass tube inside the Lightstick. Shake the Lightstick to mix its contents.

Observe the Lightstick in a darkened room

Describe the appearance of the Lightstick. What is the color of the glow? Does the glow come from the entire Lightstick or only from the liquid inside the Lightstick?

Immerse the Lightstick in a glass of ice water for five minutes

Does chilling the Lightstick affect its glow? What happens to the glow?

Immerse the Lightstick in a glass of warm water for five minutes

Do not use boiling water or place the lightstick in the oven; the plastic shell can melt!

What happens to the glow when the Lightstick is warmed? Summarize how temperature affects the glow of the Lightstick.

Put the glowing Lightstick in the freezer for at least 24 hours

Does the Lightstick continue to glow while it is in the freezer?

Remove the Lightstick from the freezer and allow it to warm to room temperature

Does the glow come back when the Lightstick returns to room temperature?

Observe your Lightstick periodically during the day

How does the glow change with time? How long does it take for the glow to disappear? Where did you keep the Lightstick? What was the approximate temperature of the Lightstick? What could be done to preserve the glow of the Lightstick?

In this activity you observed the effect of temperature on the glow of a Lightstick. This effect is a result of the effect of temperature on the rate of the chemical reaction that produces the glow. Like all chemical reactions, the reaction that produces the glow is slower at lower temperatures and faster at higher temperatures. In a Lightstick, the faster the reaction the brighter the glow. When the reaction in a Lightstick occurs at a faster rate, it will use up the reactants inside more quickly than when the reaction occurs more slowly. Can you devise an experiment that would test this statement?

WISCONSIN INITIATIVE FOR SCIENCE LITERACY

Our democratic society has become increasingly dependent on science and technology. It is essential for the well being of our society that all citizens develop an appreciation of science, the benefits of technology, and the potential risks associated with advances in both; that is, that citizens gain "science literacy."

Science literacy does not imply detailed knowledge of chemistry or physics or biology, but rather a broad understanding and appreciation of what science is capable of achieving and equally important, what science cannot accomplish. Science literacy will enable the public to make informed choices and to reject shams, quackery, unproven conjecture, and to avoid being bamboozled into making foolish decisions.

The Wisconsin Initiative for Science Literacy is a new program with two goals to promote literacy in science, mathematics, and technology among the general public, and to attract future generations to careers as the researchers, entrepreneurs, and teachers on whom the Nation's continuing economic health and national security will depend. Societal progress in addressing critical issues occurs by having both a skilled, creative, and productive workforce and a citizenry able to judge the risks and to enjoy the benefits of advances in science and technology. The Initiative seeks to boost opportunities for educational success for *all* students, especially those from under-represented groups, and to empower adults to participate responsibly in our cherished democratic institutions. The Initiative aims to enhance the development of talent for careers in science and in science teaching and to advance the level of appreciation of science among the non-practitioners who are beneficiaries of advances in science. The Initiative will explore and bridge links between science, the arts, and the humanities.

The Initiative is directed by Professor Bassam Z. Shakhashiri of the University of Wisconsin-Madison Chemistry Department. Programs will draw on the concepts developed by Dr. Shakhashiri during many years of innovative work in science education and through his extensive experience as a faculty member at the University, his work with the UW-Madison Institute for Chemical Education, and his six years as the chief education officer of the National Science Foundation. His very successful programs have included research and development in chemistry demonstrations, the annual Holiday Lecture, the Chemical Demonstrations Book Series,

communicating science on radio and television, the “Science is Fun” Web site, the Conversations in Science Series, and the newly launched “Science in the City” program.

The Initiative is headquartered at the University of Wisconsin-Madison. Support is being sought from individuals, business and civic groups, and private and government sources. Support for this program will have a direct and continuing impact on our Nation’s ability to maintain its leadership in the sciences and technology.

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