



Drexel-SDP GK-12 ACTIVITY

Subject Area(s): Science: Light, Chemistry

Activity Title: Engineering with Light

Grade Level: 5-8

Time Required: 1 hour

Group Size: Groups of 2

Expendable Cost per Group: \$2

Summary:

In this activity we'll try to establish the fundamentals of how light might used as a tool.

Engineering Connection

All major disciplines of engineering are currently interested in microtechnology. Electrical engineers create microchips. Environmental engineers use the techniques to study bacteria. Chemical engineers study the chemistry behind the reactions and develop the photochemicals of the future. Mechanical engineers create tiny moving devices that are much more efficient than previous designs.

Keywords

Photochemistry
Microchips
Photosensitive
Light spectrum
Wavelength

Educational Standards

- Science:
- PA 3.4.7B Know that the sun is a major source of energy that emits wavelengths of visible light, infrared and ultraviolet radiation.
- PA 3.2.C Design an investigation with limited variables to investigate a question.

Pre-Requisite Knowledge

A background in the electromagnetic spectrum may be useful, but not necessary for this lesson. Photosensitive chemicals are responsive to different wavelengths of light, and the idea of how these wavelengths can be produced or filtered may add to the lesson.

Learning Objectives

After this lesson, students should be able to:

- Explain how light may be used as a tool to create patterns.
- Discuss how very small patterns may be made with light.
- Demonstrate how to use light to transfer a pattern.
- Compare their pattern to the patterns that might be imprinted on a CD or DVD.

Materials List

Each group needs:

- One sheet of sunprint paper
- One piece of regular paper.

To share with the entire class:

- Clear plexiglass overlay
- Bright light for exposure. A black light or ultraviolet light will work best, but direct sunshine will also suffice.
- Water bath large enough to submerge an 8 ½ x 11 sheet of paper.

Introduction / Motivation

Many high-tech processes are dependent upon the use of photochemistry. Optical disks such as CD's and DVD's depend on this phenomenon, and the process for making microchips also depends on photochemistry. Photochemistry involves the change of a chemical from one state to another after exposure to light.

Vocabulary / Definitions

Word	Definition
Photochemistry	The chemistry of the effects of light on chemical systems
Spectrum	The colored band of light made when white light passes through a prism
Wavelength	The length of the light wave which determines its color.
Develop	To expose photographic material in order to bring out the picture

Procedure

Before the Activity

Discuss how information might be encoded using light. We interpret variations of light on a printed page by determining the bright and dark patterns on the paper which represent the letters and words. On a CD, microscopic patterns are used in order to encode information. The method used to imprint the information uses photochemistry. Since the wavelengths of light are so small (400-700 nm), features of a similar scale may be encoded. The fundamental photochemistry for encoding CDs is similar in principle to the technique we'll use to transfer patterns to Sunprint paper.

With the Students

1. Have the students cut out patterns of their own choosing in normal non-photosensitive paper. These patterns will later be transferred to the sunprint paper.
2. Cover the Sunprint paper with the cutout patterns.
3. Cover the patterns and Sunprint paper with the Plexiglass sheet.
4. Expose the entire system to ultraviolet light or direct sunlight for the amount of time recommended.
5. After the exposure, develop the Sunprint paper in a water bath.
6. Observe the results.

Image



<http://www.lawrencehallofscience.org>

Investigating Questions

1. What happened to make the change in the Sunprint paper?
2. How small can the patterns be transferred?
3. Why was the water necessary to develop the image?
4. How can this principle be applied to making a CD or DVD?

Activity Extensions

Students may consider ways to make a code that could be transferred to the Sunprint Paper. They can also consider how a CD or DVD might be encoded.

References

<http://www.lawrencehallofscience.org>

Owner

Drexel University GK-12 Program

Contributors

Ed Steager

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