TEACHER QUEST TAMPA BAY PROGRAM

ACTION PLAN

Author: Jessica Scott

Lesson Title: The Emission Spectrums of Common Light Sources

Grade Level: Eighth Grade

Subject Area: Physical Science

Date: July 13, 2010

Summer Work Experience

Ocean Optics began in 1988 with the creation of the pHish Doctor by Mike Morris, which was invented in the shed behind his house. In 1989, Ocean Optics became the first company in history to use a fiber optical sensor to carry light and color to a spectrometer. Since 1992, Ocean Optics, Inc., has been creating and selling high-quality, low-cost products, which are used around the world. Ocean Optics products have been to the Moon, inside active volcanoes, through rain forests and to the top of Mount Everest.

The first couple days were spent taking a crash course in Spectroscopy. This crash course is tons of information with very little comprehension time provided - I was a little lost at first. The next two days were spent working with spectroscopy experiments designed for high school and college science classes. I thoroughly enjoyed working through these experiments because they were straightforward and gave me the chance to work with the SpectraSuite software, which is compatible with all Ocean Optics spectrometers. I investigated the Beer-Lambert Law, tested chemical reaction rates, generated an absorbance spectrum for chlorophyll and investigated the emission spectrum of several light sources. These experiments not only provided specific instructions for using the SpectraSuite software, but offered a new look, for me, at the electromagnetic spectrum and led me into a world of absorbance, transmission and reflectance of light that I never knew existed.

The next day was spent doing reviews of the current Know-Paks, which are sample experimental and informational data that have been generated through feasibility studies. For example, one Know-Pak that I reviewed covered the “Reflectance and Color Measurement Differentiation of White Polyester Paint Blends.” This amazing information showed me just how different white paint can be. From this information, I was directed to find a topic from which to concentrate on for the duration of the externship. The topic that I will be studying, experimenting

on and writing a Know-Pak about is “Identification of Organic Materials using Infrared Spectroscopy.”

My job will consist of doing research on my chosen and approved topic. I have to find other similar experiments as references that way I can show my data using Ocean Optics equipment in a comparable way. This will encompass the majority of my time. I will also be completing a feasibility study with my mentor, Lilian Norris, on the “Bioreflectance of Bird Feathers,” which can determine species, health and mating season of the birds. I will be working in the lab with a variety of spectrometers and the software generated by Ocean Optics specifically to work with their spectrometers, called SpectraSuite. I look forward to assisting my mentor in finishing her feasibility study and also completing my own, along with publishing the results of my testing.

Lesson Plan

Objective(s)

1. The students will understand that wavelength determines the colors of visible light.
2. The students will know that waves vary greatly in character (for example, sound, ultraviolet, infrared, ocean waves.)

Sunshine State Standard

SC.B.1.3.6 ~ the student knows the properties of waves (e.g., frequency, wavelength, and amplitude); that each wave consists of a number of crests and troughs; and the effects of different media on waves.

Materials

Used CD (broken in half)

Cereal box (without bag insert)

Duct tape

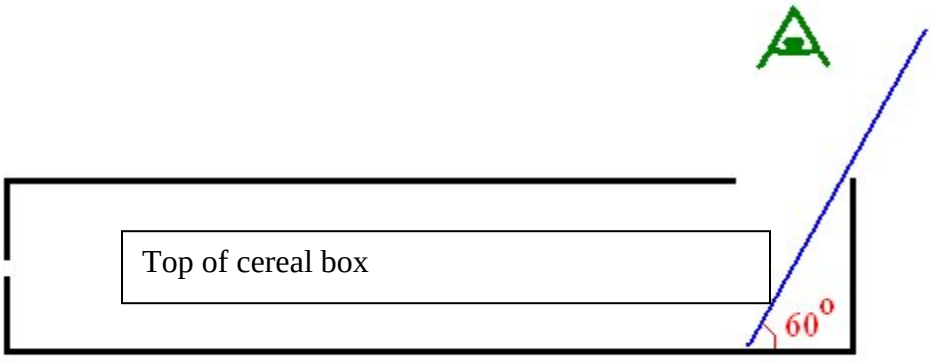
Scissors

Camera (digital preferred)

Instructional Procedures

1. Background knowledge of electromagnetic spectrum, specifically the emission spectrum of visible light. This will be completed using PowerPoint presentations of the information that is provided in the Prentice Hall Physical Science Explorer textbook, which is presented as a lecture with accompanying notes, diagrams and pictures.
2. Students will get into groups of 2-3 people.
3. Each group needs 1 CD, 1 cereal box and 1 camera.
4. Groups will break the CD’s in half.

5. Draw a 60 degree angle on the upper right corner of the cereal box (line must be 15-20 cm long.) Do the same on the back of the box in the same corner. Using scissors, cut along the lines you have drawn. You will also need to cut a 10 cm x 10 cm square out of the top of the cereal box, connecting the two slits you have cut. The CD (rounded-edge first) will slide into this slot you have created. Make sure the back of the CD is facing up and is relatively scratch-free.



6. On the opposite side of the cereal box (the front side), draw a rectangle that is 5cm long and 5 mm wide. Using scissors cut that (small) rectangle out- be very careful to not make the slit bigger.

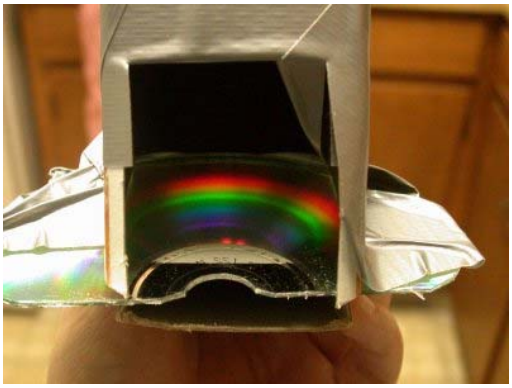
7. Using duct tape, seal the CD into the box and seal the front slit as seen in the picture on the previous page.
8. You spectroscope is now ready to be used - make sure you have your camera!
9. Students will choose six (minimum) light sources from which to record the emission spectra data. The emission spectra will be photographed and presented on a poster or as a PowerPoint presentation.

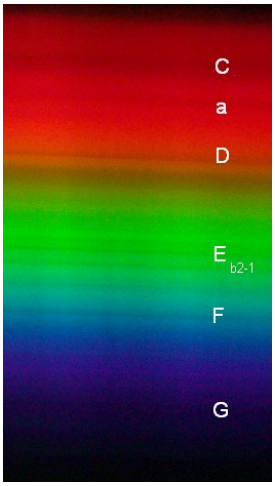
    a) Describe each emission spectrum.
    b) What colors do you see?
    c) Why might you see some colors and not others?
    d) Compare/contrast each of your emission spectra.

10. The class will compare spectra from common light sources and discuss any variations.

    a) Find a group who used at least one of the same light sources as you did.
    b) Compare the emission spectrum collected by each group.
    c) What are the similarities?
    d) What are the differences?
    e) Why are there similarities?
    f) Why are there differences?
    g) Explain how the differences could have occurred.

11. Groups will be assessed on the construction of the spectroscope, the variety of light sources chosen and the descriptions/presentations of the emission spectra collected.
12. Sample emission spectra:





Integration of Summer Work Experience/Follow-up Activities
I will share a PowerPoint presentation showing my activities and completed project to my students. This PowerPoint will include photos and descriptions of my job at Ocean Optics. My plan is to have my mentor, Lilian Norris, attend the Great American Teach-In to speak to my students about spectroscopy from a professional point-of-view.

Assessment Instruments
I will provide the students with a rubric listing all requirements for the project when they start the experiment so that they know on what they will be graded. The spectroscope will be graded, as

will the presentation and the quality of the information presented. There will also be a unit test to further reflect on the experiment and to test knowledge retained.

Comments

What a wonderful opportunity I have been provided by TRDA and Ocean Optics! I cannot thank Diane Matthews enough for her organization of the Teacher Quest program here in the Tampa Bay area. I also am very thankful for Gary Manche and Lilian Anderson at Ocean Optics, for being terrific liaisons and mentors. I look forward to possibly taking advantage of this opportunity again!