



Exploring Ultraviolet Radiation

NS 696 V: Weather and Climate for Educators

AP Environmental Science
Grades 11-12

Standards:

1.1, 2.7, 4.15

Also AP Topics IA, VIB1, VIIA

AP Environmental Science Course Description found at http://apcentral.collegeboard.com/apc/public/courses/teachers_corner/2128.html

Materials Needed:

- UV Beads, mounted on cardboard, perhaps in a fun pattern
 - Available from:
 - www.stevespanglerscience.com/product/1350
 - www.teachersource.com/
 - www.uvsolbeads.com/
 - As well as scientific supply (Carolina, Wards, etc)
- UV flashlight
 - Available from:
 - www.brightguy.com/uv-flashlight.php
 - www.uvflashlights.com/
 - <http://www.teachersource.com/LightAndColor/Ultraviolet/LongWaveUVFlashlight.aspx>
- Other lights of various types (incandescent, fluorescent, heat lamps)
- Other materials as necessary for experiments
 - For example:
 - Sunscreen at various SPF's
 - Sunglasses
 - UV window film or access to windows with UV coating (ie car or home windows)
 - Petrie dishes
 - Etc

Background Information Assumed:

The students in AP Environmental Science (APES) will have previously studied the atmosphere and have a knowledge of the radiation emitted from the sun.

Objectives:

- Students will be able to describe the effect of UV radiation on molecules and why a color change occurs in the beads.
- Students will design an experiment to test available protection against UV radiation (sunscreen, sunglasses, window film, clothing, etc).

Theory:

Due to the small wavelength of UV light, the photon energy is higher than visible light and can break the bonds of molecules. This energy has several environmental applications; bees use UV light to find particular flowers, UV light can be used for sterilization, and UV light can cause the pigmentation of skin to darken or burn. The effect of UV damage on skin is a human health hazard which is one of the topics of APES. Since the Sun's energy does not reach the Earth evenly, there are areas that receive higher amounts of UV radiation (high altitudes and latitudes near the equator).

UV Bead Lesson

Engage:

(Ideally this would be done in groups, but could be a teacher demo if supplies were limited.)

UV bead cards and a UV flashlight are given to students who then explore what happens to the beads for a couple of minutes. Students are then asked to brainstorm within their groups the answer to "What might be causing the beads to change colors?". After a minute or two students are given other types of light and asked to revise or add to their brainstorms. Teacher should help to guide the students to conclude that it is the type of light causing the change. If allowed, students can and should take the cards outside! This should help them to arrive at the conclusion that it is UV light causing the change (not IR as the heat lamp did not cause the change).

Explore, Explain, Evaluate:

Students will design an experiment to test UV protection items using Scientific Design. For instance, students may choose to test how long different SPF's protect from UV radiation. *One way to do this is to place beads in a petrie dish and smear a coating of the sunscreen on the lid.*

- Hypothesis must be *testable*
- Research must include discussion of UV in terms of *energy* and *how* the beads work, as well as effect of UV on human health.
- Data should include a chart at minimum. A graph of data is preferred, if applicable to experiment.
- Analysis must describe data.
- Conclusion must tie research, data collected, analysis made, and hypothesis.

Extend:

Students research positive environmental effects of UV (ie bacteria irradiation, animal use).

Lesson generated by Megan McDaniel