**Ultraviolet Radiation Exploration in the Schoolyard**

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| Name: Carol Hall | Date: 7/16/11 |
| Content Area: Physical Science | Grade Level(s): 8th | Topic(s): ultraviolet, radiation, independent and dependent variables, constants, controls |

**Standards (SOL)**

PS.1 (g) Students will plan and conduct investigations in which independent and dependent variables, constants and repeated trials are identified.

PS.9 (c) Students will investigate and understand the nature and technological applications of the Electromagnetic Spectrum; ultraviolet waves.

**Objectives (UKD’s)**

*Students will know that ultraviolet waves are part of the electromagnetic spectrum and have a high energy.*

*Students will understand that UV energy can be dangerous and harm our skin and eyes.*

*Students will investigate how UV levels can be blocked to reduce our exposure to UV radiation.*

*Students will explain the results of the various methods they used to block UV exposure.*

**Materials & Resources**

Content Teaching Academy References: Tim Thomas, Postponing the Field Trip: Scientific Discoveries in your Schoolyard, 6/27/11, 1:15-2:45 pm

Materials: JASON- Infinite Potential, UV beads, boxes, mirrors, sunlight, various blocking materials brought by students or found in classroom

**Safety Considerations**

*Students will work in small groups with objects that will demonstrate the lab objectives. There are no specific dangers with the objects, but small groups must behave appropriately to allow all members to focus on and understand the lab.*

**Engage – Time Estimate \_\_\_\_\_10 minutes\_\_\_**

*Create interest by having the teacher start class wearing sunglasses, a broad rimmed hat and sitting under a beach umbrella. Raise questions as to why we use some of these items. Elicit responses to connect to background knowledge on the dangers of UV radiation.*

**Explore – Time Estimate \_\_\_\_40 minutes\_\_\_\_**

**Detecting Ultraviolet Radiation Lab**

*(Students will be grouped in 2 or 3 persons per group. Students will have 5 UV beads that can be strung on a pipe cleaner per group. The beads change color only in the presence of UV. Students can test this before getting started.)*

*The JASON Project lab can be followed to explore the use of the UV beads. At step 10, groups should think of up to 10 different ways to test the presence of UV and the different ways to block UV.*

**Detecting Ultraviolet Radiation (The JASON Project, Infinite Potential)**

Although Janet Green mostly studies the high-energy particles emitted by the sun, she is also aware of its electromagnetic radiation. Like high-energy particles, electromagnetic waves stream across the vacuum of space. Although an assortment of waves strike Earth’s outer atmosphere, only narrow bands of this energy reach our planet’s surface. Most electromagnetic radiation is absorbed by our atmosphere.

UV radiation contains slightly more energy than can be detected by the human eye. So, although this energy strikes the eye’s photosensitive layer, we do not detect it. This radiation, however, can be sensed by a variety of devices. In this activity, you will use inexpensive plastic indicators, know as UV beads, to detect ultraviolet radiation.

Directions:

1. Place some UV beads in one hand. Close this hand tightly, not allowing light to reach the beads.

2. Walk into a location bathed in direct sunlight.

3. Open your hand. Observe the beads. What happens? How long does it take? Did all the beads react in the same way?

4. Shield the beads again from the direct sunlight. Wait several minutes. Look at the beads now and describe any changes you observe.

5. Close your hand and return into the sunlight. Once again open your hand, exposing the beads to the direct rays of the sun. What did you observe?

6. Turn a box on one side, so that the box opens horizontally.

7. Fasten UV beads in a line at the bottom far edge of a box, separating each from its neighbor by about 2.5cm. They beads can be strung on a pipe cleaner.

8. Transport the box outdoors or into an area with direct sunlight, making sure that sunlight does not stream into the box. Position the box on a flat, horizontal surface so that the opening faces away from direct sunlight.

9. Use the mirrors provided to find out if UV light can be reflected. Does UV behave like visible light?

10. Determine the effectiveness of various items and situations at blocking UV light. Plan how you will test and conduct this investigation. Document your data below, identifying the independent and dependent variables, constants, and control of your investigations. Be prepared to share your data with the whole class.

**Explain -- Time Estimate \_\_\_\_10 minutes\_\_\_\_**

*Student groups will share with the class the different investigations they conducted for step 10. Teacher can facilitate discussion on areas that allow high UV exposure and ways to block UV exposure.*

**Extend -- Time Estimate \_\_\_20 minutes\_\_\_\_\_**

*Students will investigate 2 new ways that they did not already try and add an additional new investigation if time allows.*

**Evaluate -- Time Estimate \_\_\_10 minutes\_\_\_\_\_**

*Teacher will observe the students as they perform their investigations and collect the lab responses. Additional reflection questions can be added to the student response portion of the lab report:*

*1. How can these beads be used to help you protect yourself against UV radiation?*

*2. What additional inquiry investigations using the UV beads might students develop?*

**Plans for Diversity**

*Students of all learning abilities have the opportunity to process and problem solve with this lab. Reading abilities are not essential to excel in this lab. Perseverance is the characteristic most needed for this lab. Many special needs students will do well in these investigations. Encourage all students to work hard together to test their UV beads.*

**Connections**

*PS.9 extends the students understanding of energy*. Energy will come in a variety of forms.

PS.1 investigations will develop an understanding of the nature of science and reinforce skills and techniques of science inquiry.