

Stage 1

Identify Desired Results

Catchy Title: UV Detectives

Theme/Topic of Lesson: UV Rays, sunscreen effectiveness

Time Commitment: one class period

Subject Area(s):

Health - Disease

Science - Environmental

Science - Physical sciences

Grade Level(s): 6,7,8

Standards Alignment:

Class Challenge Question: How can we "measure" invisible UV rays and protective qualities of sunscreen products to block the UV rays?

Overview:

More than one million people each year are diagnosed with skin cancer, the most common kind of cancer. The most common cause of skin cancer is excessive exposure to ultraviolet (UV) radiation, either from the sun or from indoor tanning equipment. UV radiation can also lead to other health problems such as premature wrinkles, eye problems, and immune system disorders.

In this lesson, students become UV detectives. Using UV sensitive beads, students test protective qualities of various levels of sunscreen and sunglasses. Since we can't see the invisible UV rays, the UV beads (which change colors when exposed to UV radiation) help students to see how quickly they are exposed to UV rays, as well as what levels of SPF are most effective in blocking the rays.

This lesson is intended to be used as a follow-up lesson to Amie's Story from [EnviroMysteries: Inside Stories](#), but can also be used as a stand-alone lesson or in conjunction with other related skin cancer lessons found on Thinkport. A basic understanding of UV Radiation (where it comes from and how it affects us) is required. These concepts are covered in Amie's Story.

Stage 2

Determine Acceptable Evidence

Learning Objectives:

The Students will:

- understand that invisible UV rays can be harmful
- explore effects of UV radiation on objects that react UV rays
- understand what products are most effective in blocking UV rays
- make predictions about how objects will react to artificial UV rays (lights used in tanning salons)

- develop an understanding of the UV index

Assessment

Grade the UV Detectives Student Worksheet for completion for a total of 50 points.

Part I - 30 points

Part II - 5 points

Part III - 15 points (5 points per answer)

Stage 3

Plan Learning Experiences

Resources

<p>Other Technology</p>	<p>Skin Cancer and Tanning 101</p> <p>This pdf document is one of the reference materials provided in Amie's story from EnviroMysteries: Inside Stories. The document contains information about kinds of skin cancer, kinds of UV radiation, different skin types, what tanning really is, a comparison between indoor and outdoor tanning and more. You will need to have Adobe Acrobat installed on your computer to open the files. You can download the free plug-in on Adobe's web site.</p> <p>http://enviromysteries.thinkport.org/insidestories/printables/cancerwebsite.pdf</p>
<p>Internet Sites</p>	<p>Understanding the UV index Information about different types of UV rays and useful chart that can help students understand the UV index and how to protect themselves at various levels.</p> <p>http://www.healthunit.org/sunsafety/uv.htm#UV%20Index</p> <p>Weather Network Students can check the UV index daily based on zip code. Look to the right of the temperature after inputting zip code. The "stay healthy" tab gives more information about UV index and dangers.</p> <p>http://www.weather.com</p> <p>The Skin Cancer Foundation The Skin Cancer Foundation website has information about skin cancer, its prevention by means of sun protection, and the need for early detection and prompt, effective treatment.</p> <p>http://www.skincancer.org/</p> <p>Skin Cancer Basics This site, part of the Why Files site from the University of Wisconsin Board of Regents, is an excellent introduction to the various types of UV radiation and the types of Skin Cancer. It also has some interesting information on data about the effectiveness of sunscreen that would be</p>

interesting to discuss after doing the UV bead experiment.

http://whyfiles.org/173skin_cancer/2.html

Materials

Per class

- UV Detectives standards ([View](#))

as determined by instructor

- UV Beads - \$6.95 for a pack of 250
Educational Innovations, Inc.
800-912-7474
www.teachersource.com

or [Steve Spangler Science](#)
- Various levels of sunscreen:
 - SPF 4, 8, 15, 30, 50
 - New, one to two years old, more than two years old
- Different types of sunglasses:
 - cheap kids' sunglasses found at a dollar store
 - low, medium and high quality sunglasses, as available
- 100 very small Ziploc bags
- Sharpie markers or pens for recording sunscreen levels on Ziploc bags

Per Student

- UV Detectives Student Worksheet ([View](#))

Vocabulary

- **UV Index** - Measure of the sun's UVA and UVB rays. The higher the number, the stronger the sun's rays and greater risk of skin damage.
- **SPF** - Sun Protection Factor (see further explanation below)

Procedures

This one-day lesson is intended to be used as a follow-up lesson to Amie's Story from EnviroMysteries: Inside Stories, however it can be completed as a stand-alone science lesson.

Students become UV detectives by using UV sensitive beads to test the protective qualities of various levels of sunscreen and sunglasses.

Prerequisite

The following concepts, which are covered in [Amie's Story](#) are important for students to understand for this lesson:

- Two main types of skin cancer (melanoma and non-melanoma)
- UV Radiation (difference between A, B and C)
- How UV radiation causes skin damage
- How tanning and skin cancer are related

Day 1

Daily Challenge Question: What level of SPF will most effectively block UV rays?

Setup

A week before the lesson:

- Order UV sensitive beads (see Materials Section).
- If desired : Ask students to bring in a pair of sunglasses and to bring in a variety of sunscreen with various SPF levels if you do not have a good variety. Be sure to tell them that they should know the "age" of the sunscreen (new, one to two years old, more than two years old). They can bring in other items as well, such as shirts with advertised sun protective qualities.

Day before the lesson:

- Pre-determine student groups based on class size and number of bead packages you ordered.
- To save time, have about 10-15 beads in each small Ziploc bag. Give student groups 5-7 bags each. Note if Ziploc bags are not available, sunscreen can be applied directly to the beads.
- Make enough copies of the UV Detectives Student Worksheet for each student
- Around the room, set up sunscreen stations. Be sure to clearly mark which sunscreens are new, 1-2 years old, and more than 2 years old.
- If you have a lot of windows in your classroom, cover them with blinds, curtains or black

paper, if possible. Alternatively, you can give out empty bags to coat in sunscreen, and once the bags are coated give out the beads.

- Have a computer connected to an LCD projector and Internet access to show [UV Index](#) and [Weather.com](#)

Teacher Presentation and Motivation:

This lesson allows students to test sunscreens and other sun protective products. The lesson does not go into much detail about either SPF or the types of skin cancer. However, students may want to know more. Below are brief descriptions of the types of skin cancer and the meaning of SPF rating. See the websites listed in the resource sections for more information.

Different Types of Skin Cancer:

- Non-melanoma
 - Basal cell carcinoma
 - most common form of skin cancer
 - not usually life threatening
 - easily diagnosed and treatable if detected early
 - occurs most frequently on the sun-exposed areas of the body: face, ears, neck, scalp, shoulders and back
 - Squamous cell carcinoma
 - second most common form of skin cancer
 - if not treated early can cause disfigurement
 - about 97% are localized and don't spread to other organs
- Melanoma
 - a malignant tumor
 - most serious form of skin cancer
 - if detected early can be cured; if not detected early can spread to other organs and be fatal
 - causes the most of deaths of all skin cancers

SPF ratings (source: Sunscreens Explained from the Skin Cancer Foundation website)

- SPF — or Sun Protection Factor — is a measure of a sunscreen's ability to prevent UVB from damaging the skin.
- If it takes 20 minutes for your unprotected skin to start turning red, using an SPF 15 sunscreen theoretically prevents reddening 15 times longer — about five hours.
- Another way to look at it is in terms of percentages: SPF 15 blocks approximately 93 percent of all incoming UVB rays. SPF 30 blocks 97 percent; and SPF 50 blocks 99 percent.
- These differences may seem negligible, but if you are light-sensitive, or have a history of skin cancer, those extra percentages will make a difference.

Problems with SPF model

- No sunscreen can block all UV rays.
- No sunscreen, regardless of strength, should be expected to stay effective longer than two hours without reapplication.
- "Reddening" of the skin is a reaction to UVB rays alone and tells you little about what UVA damage you may be getting. Plenty of damage can be done without the red flag of sunburn being raised.

Before the lesson review concepts from [skin cancer and tanning](#) from Amie's story:

- different types of UV rays
- how they can cause skin damage
- dangers of tanning
- different types of skin cancer (see above as well)

Introduce the lesson by discussing with students how they protect themselves from the sun. Accept any reasonable answers, and then question students their opinions about different types of sunscreen (brand, SPF rating, age, etc.). Ask students why they have these opinions.

Activity #1

Show students a bag of UV beads. Explain that the beads have a chemical substance that changes color when exposed to UV radiation (sunlight). Demonstrate either at a classroom window, or if you have time, take a walk outside. **Modification:** Instead of telling the students what the beads do, take students outside with the beads on a sunny day and exposure them to both sunlight and under a shady tree. Discuss or hypothesize what causes the beads to change color.

Note: the beads will change color in reaction to both UVA and UVB rays. UVA rays can penetrate glass and deeper into skin. This type of radiation is now getting more attention as a potential cause of skin cancer despite the fact that it doesn't cause skin to tan or burn. UVB rays(which causes tanning and burning) doesn't usually penetrate glass so you don't get tan indoors. The filtering of UVB rays by glass will affect the intensity of the color change of the beads (another possible experimental variable if desired).

Distribute UV detective student worksheets and bead packets and tell students that for the rest of the class period they will hypothesize and test various SPF levels and protective qualities of sunglasses (you can also use different fabrics, including the shirts that are advertised as having sun protective qualities).

Direct students through the following procedures:

- Mark each item (bag, sunglasses, etc.) with a number and record number and product name and information in the table of Part I of UV Detectives Student Worksheet. Fill in your prediction about the effect of that product and sunlight on bead color.
- Apply a small amount of sunscreen to each of the bead bags (or directly on the beads), or place sunglasses or other item over the bead bag.
- Place the beads in the sunlight (outside is best; if that is not possible place beads next to the well lit window)
- Record results

Modification: Teacher can pre-apply the sunscreen to the bags or beads. Do not tell students which beads have which level of sunscreen. Based on the beads reaction to the sunlight, have students hypothesize the level of sunscreen applied to each set of beads. Note that the beads will change and change back rapidly, so you cannot do the experiment in advance..

Activity #2 - Class Discussion

Discuss the following:

- *Sunscreen manufacturers suggest that you throw away old sun screen because it doesn't block the harmful UV light. Do your results support this?*
- *Did you notice any difference in brands of sunscreen with the same SPF levels?*
- *Experts recommend avoiding exposure to the sun between the hours of 11:00 a.m. and 4:00 p.m. Why is this? How might the beads change earlier or later in the day?*

Focus for Media Interaction

Students will learn about UV Index and how to find UV index in their area. They will also learn about protective measures they can take based on UV index. They will complete Part II of their worksheet during this activity.

Viewing Activities

- Ask if any of the students know what the UV index is. (It is a *measure* of sun's UVA and UVB rays. The higher the number, the stronger the sun's rays and the greater risk of potential skin damage.)
- Show the [UV Index site](#).
- Bring up [Weather.com](#) and type in your zip code. Show students how to find the UV index.

Post-Viewing Activities

Reinforce the importance of knowing the UV index when planning on spending a lot of time in

the sun. Recap the results of the experiment with the UV beads and review the best forms of protection when the UV index is high.

Wrap Up:

If you are giving the beads to students to take home, suggest that they "measure" UV light coming through car windows. Is there a difference between UV rays coming through windshields versus side windows? Discuss their findings the next day. Note: most car manufacturers block UV rays in front windows, but not in side windows.

Have students complete Part III of the worksheet for homework.

Enrichment Options

Community Connection

Have a dermatologist come to the class to discuss skin damage and why it's important for young people to protect themselves early.

Parent-Home Connection

Have students educate their parents about the importance of using sunscreen.

Stage 4

Teacher Reflection

As a reflective practitioner, make notes about what worked well, and what aspects of the lesson could be improved.

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