

Sunscreen Lab

Brief Description

Using prior knowledge from previous lessons, students will gain a better understanding of “Exposure” through this Sunscreen Lab. Upon completion of the lesson, students will evaluate what they learned, what questions they still have, and how will they apply this exercise to their personal health choices.

Duration of the lesson: 55 minutes

Learning Objectives

Students will be able to:

- EALR 2.1: Understand the dimensions and indicators of health.
- EALR 2.3: Understands the concepts of prevention and control of disease.
- EALR 2.4: Acquires skills to live safely and reduce health risks.
- EALR 3.1: Understands how family, culture and environmental factors affect personal health.

Materials

- 3 Black Lights. Long fluorescent lights and fluorescent black light bulbs
- 2 x 4’s to create base for UV light (option: use sunlight instead of black lights)
- Lotion and 3 sunscreens, SPF 15, 30, and 50, but not higher than 50
- Optional: laminated posterboard or construction paper on which to dispense sunscreens
- Clear, glow-in-the-dark clear UV “pony” beads
- Small clear plastic containers with lids, like a ring box
- Small piece of black poster board
- Fine point dry erase marker
- Student Worksheet/Recording Sheet
- Teacher kit contains materials packaged for 13 student groups

Instructional Activities

Engage:

- Students will predict the differences between the various SPF levels. They will discuss their own personal use of sunscreen and SPF level.
- Ask students to reflect on the following questions:
 - *Have you ever had a sunburn?*

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- *Have you ever had a sunburn which caused blisters or peeling?*
- *Do you use sunscreen? How often?*
- *Do pay attention to SPF levels?*

Procedure:

- Divide the class into pairs or groups of 3. Give each student group one Ziploc bag containing 5 sealed plastic boxes of UV beads and a dry erase marker.
- Explain that the beads in the boxes change color in UV light. Students will apply lotion and various sunscreen SPFs to the lid of the boxes, to simulate sunscreen on the skin. The objective is to see whether and how effectively lotion and various SPFs prevent the UV beads from being exposed to UV light.
- Using the Student Worksheet/Recording Sheet, have students discuss and record their predictions for the control, lotion and various sunscreens.
- Students should use the marker to label the boxes, to keep track of what they apply to each box:
 - Control
 - Lotion
 - SPF 15
 - SPF 30
 - SPF 50
- Student groups take the boxes to the sunscreen supply station. To make this step go faster, ahead of the activity dispense lotion and sunscreens onto laminated cardboard or construction paper. Label the lotion/sunscreen PDFs. Easy cleanup!
- One of the students should apply an even layer of lotion and each of the 3 sunscreens (as thick as he or she would apply sunscreen to their skin) to the lids of 4 boxes. Each lid should have an equal amount of lotion. Nothing is applied to the control box.
- Students should place the 5 plastic boxes on their black poster board. It would be helpful to place them in the order of the bullets above. Each student group then places their poster board under the black light or outside light or sunlight for approximately 1 minute. Notice how the beads change colors. Remove the cardboard from the UV light and quickly turn the boxes over to view the beads through the clear surface (no lotion or sunscreen on that surface). Observe the color variation through the bottom of the box. Do it quickly as the color fades in a few seconds.

Explain: Students will record their results on their Recording Sheet.

- *Were your predictions correct?*
- *What does this say about sunscreen protecting from exposure to UV rays?*
- *Since sunburn is associated with skin cancer, how could you lower your risk of cancer caused by UV exposure from excessive sun?*
- *If you took your beads outside and it's cloudy, did they change color? If yes, do you think your skin is exposed to UV on cloudy days?*

As a class, students will compare and contrast their predictions and conclusions. Teacher will refer to the Environmental Health slide show, if shown, to clarify vocabulary and any other questions that came up in the experiment.

Evaluate:

- Upon completion, students will revisit other lessons and background materials used in conjunction with the sunscreen lab and summarize what they learned.
- Were their questions answered?

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- What do they still want to know?

Finally, students will write a 1 page, MLA – Formatted Essay on the unit answering the following:

- How will this activity/unit impact your choices and behaviors in regard to your health?
- Will you make a conscious decision to alter your purchases? Why or why not?
- What information had the greatest impact? Explain.

Resources

- *Fast Facts: Protecting Yourself from UV Exposure.* Included in curriculum
- Environmental Working Group has research-based guidance about sunscreen brands and SPFs based on the ingredients: <http://www.ewg.org/2014sunscreen/>
- *Here's the rub on US sunscreens.* Article from Seattle Times, July 5, 2014
http://seattletimes.com/html/nationworld/2024002269_sunscreensfdaxml.html
- 5 things worth knowing about nanoparticles and sunscreen. 4 min video by Risk Bites, University of Michigan Risk Science Center
<https://www.youtube.com/watch?v=VV0cCg4clMw&list=UU8cxoTk9M0HdZB3gyJNjEtw>
- How the sun sees you. 3 min video <https://www.youtube.com/watch?v=o9BqrSAHbTc>



Protecting Your Skin from UV Exposure

What does Exposure mean?

Exposure happens when UV radiation from the sun reaches your skin. You are exposed to UV when you are outside on sunny or cloudy days.

UV intensity varies with time of day, season, and latitude. The equator at noon receives much more UV than at noon in Norway. You can still get sunburned on cloudy days because UV rays can bounce off the clouds. This is known as the broken-cloud effect. In fact, one survey found that UV-B increased by 25% on partly cloudy compared to sunny days.

What is UV?

UV is ultraviolet light, a light wave shorter than violet-color light. UV light is divided into 3 wave-lengths:

- UV-A, the most common
- UV-B, the most dangerous
- UV-C, is dangerous but we're not exposed because it is bounced back to space by the Earth's ozone layer

See the Light Spectrum table on the reverse side

The National Weather Service issues the UV Index, a daily forecast of UV intensity. Find it on weather stations, newspapers, or at the US Environmental Protection Agency (EPA) website:

http://www.epa.gov/enviro/facts/uv/uv_query.html

What is Vitamin D?

Vitamin D helps the body absorb calcium and other minerals. The body synthesizes Vitamin D in the skin using UV light. To avoid Vitamin D deficiency and the diseases associated with it, including rickets and osteoporosis, Vitamin D is added to milk and other food staples. Vitamin D can also be taken as a supplement.

Because UV exposure is dangerous, doctors recommend getting Vitamin D from the diet, including from fortified foods, fatty fish such as salmon, and supplements.

Risks & Benefits of UV Exposure

UV is an environmental carcinogen, which means that being exposed to UV light can cause cancer. Unprotected UV exposure causes skin damage, speeds aging and

increases lifetime risk of skin cancer. Sun exposure also causes wrinkles, brown spots, leathering and sagging.

There is no such thing as a healthy tan. Any change in your skin color is a sign of skin damage.

1.3 million people are diagnosed with skin cancer in the US each year, mostly from sun exposure. UV is harmful for anyone, but those with fair skin are at higher risk because they burn more quickly and severely. More Americans have skin cancer than all other cancers combined.

The only benefit of UV exposure is Vitamin D. Five minutes of unprotected UV 2-3 times a week provides all the Vitamin D the body can make. Some UV reaches the skin even when you wear sunscreen.



What is SPF?

SPF stands for Sun Protection Factor. SPF is the fraction of UV-B rays blocked by the sunscreen. In SPF15, 1/15th of the UV-B rays will reach the skin when sunscreen is applied properly. If you get sunburned in 10 minutes without sunscreen, you will prevent sunburn for 150 minutes by wearing an SPF15 sunscreen. SPF15 sunscreen protects from 93% of UV-B, SPF30 protects from 97%, and SPF50 gives 98% protection.

The Food and Drug Administration (FDA), which regulates sunscreens as an over-the-counter drug, does not recommend using sunscreen with SPF higher than 50. FDA says sunscreen higher than SPF50 is misleading because it offers little added protection, gives a false sense of safety, and tempts people to reapply less often or stay in the sun longer.

What about nanoparticles in sunscreen?

Nanoparticles are ultra-fine particles between 1-100 nanometers in diameter. Nano-size titanium dioxide and zinc oxide have been used in some sunscreens since the 1990s. These physical ingredients reflect, scatter and absorb UV rays and don't tend to cause allergic reactions.

The nano-size particles are clear, while older sunscreens used larger particles that appeared white on the skin. Nanoparticles do not pass through healthy skin. Sunscreen with nano-particles protects skin as soon as it is applied while conventional sunscreens must be absorbed.



Risks & Benefits of Using Sunscreen

Sunscreens are more protective against UV-B than UV-A. Avobenzone, titanium dioxide and zinc oxide protect against UV-A. New products that protect against UV-A are used in Europe and are under review by the FDA.

Spray sunscreen should not be inhaled, especially sunscreen with nanoparticles because the small particles can be harmful to the lungs.

Oxybenzone in sunscreen can penetrate the skin and cause an allergic reaction. It can also interfere with normal hormone function. Sunscreen SPFs higher than 50 have higher concentrations of chemicals and are more likely to have these effects.

However, any sunscreen is better for you than being exposed to UV radiation.

How can I protect myself?

- Stay out of the sun between 10am-4pm
- Stay in the shade
- Wear protective clothing
- Use a "broad spectrum" sunscreen with SPF30-50 to protect from both UV-A and UV-B
- Avoid getting sunburned
- Apply sunscreen thickly, 1 oz. every 2 hours
- Apply conventional sunscreen 20 min. before going in the sun, giving it time to absorb into your skin
- Don't use indoor tanning beds. Exposure to tanning beds before age 30 increases the risk of developing melanoma by 75%
- With less mature skin and higher surface area to body weight, babies should not be exposed to UV or sunscreen. Babies under 6 mo should be covered and kept out of the sun, especially from 10am-4pm

Where to learn more:

Sunscreen: The Burning Facts US Environmental Protection Agency

<http://www.epa.gov/sunwise/doc/sunscreen.pdf>

Environmental Working Group (EWG) Sunscreen Guide

<http://www.ewg.org/2014sunscreen/>

EWG Teen Sunscreen Guide

<http://www.ewg.org/teensunscreen/>

Nanoparticles & Sunscreens. 5 Things Worth Knowing

(4-minute animation from the University of Michigan)

<https://www.youtube.com/watch?v=VV0cCg4clMw&list=UU8cxoTk9M0HdZB3gyJNjEtw>

Experimenting with UV-sensitive Beads, Stanford Solar Center

<http://solar-center.stanford.edu/activities/UV-Bead-Instructions.pdf>

THE LIGHT SPECTRUM

Infrared 1000-700nm*	Visible 390-700nm*	UV-A 400-315nm*	UV-B 315-280nm*	UV-C 280-100nm*
Makes our skin feel warm. Can be seen by snakes	Wavelength seen by our eyes. Includes the colors of the visible spectrum	Invisible. Shorter wavelengths, more energy. Causes skin damage, premature aging, melanoma. Passes through car glass	Causes sunburn, skin cancer, photo-aging, cataracts. Needed for Vitamin D synthesis	Dangerous, but completely absorbed by the ozone layer and doesn't reach earth surface

*nanometer, equals one-billionth of a meter

Student Worksheet - Sunscreen Activity

Name _____ Period _____ Date _____

Procedure:

1. Label the bottom of each bead box with the Sharpie: Control, Lotion, SPF 15, 30, 50
2. Apply lotion and 3 Sunscreen SPF's evenly to the clear lid of 4 bead boxes. Apply as much as you would put on your own skin. Nothing is applied to the Control box lid
3. As a group, complete Q1-3 on the Student Worksheet
4. Place the 5 bead boxes on the black poster board. It will help to put them in the order of your predictions
5. Place the poster board with bead boxes under the black light or in the sunlight for 1 minute
6. Remove the cardboard from the UV light, turn the boxes upside down, and look at the intensity of color of the beads in each box. Do it quickly as the color fades in a few seconds
7. Record your observations on the grid in Q 4 and answer Q 5-9 on the Student Worksheet
8. After the activity, thoroughly clean the lotion and sunscreen off the box lids with a paper towel. Put the 5 boxes and Sharpie pen back in the Ziploc bag. Return the black poster board and don't forget to return the Sharpie.

Before you do the lab, answer Questions 1 - 3:

1. How will you know whether or not the UV beads have been exposed to UV radiation? _____

2. What do you expect to see in each box after you place it under the black light or in the sun? Fill in the grid below with your predictions:

Box #	Box 1	Box 2	Box 3	Box 4	Box 5
Lotion type:					
Prediction:					

3. Explain your predictions: _____

4. Now do the lab and record your observations on this grid:

Box #	Box 1	Box 2	Box 3	Box 4	Box 5
Lotion type:					
Prediction:					

5. Were your results the same or different from your predictions? How? _____

6. How well does sunscreen protect the beads from UV exposure? _____

7. Does the sunscreen SPF make a difference for how much UV radiation exposure the beads receive? _____

8. What does this exercise with UV beads teach us about our skin's exposure to UV radiation? _____

9. What else do you want to know about sunscreen and UV radiation? _____



Sunscreen Activity

Kit Contents:

13 Ziploc bags (for groups of 2-3 students, depending on class size)

Each Ziploc bag contains:

- 5 small boxes of UV beads
- Sharpie pen

4 Ziploc bags containing small bottles of:

- Lotion
- SPF 15 sunscreen
- SPF 30 sunscreen
- SPF 50 sunscreen

(3 groups share the bag of lotions)

Needed:

- UV light or sunlight. See Sunscreen lesson for instructions

Curriculum materials:

- Sunscreen lesson
- Fast Facts about Protecting Your Skin from UV Exposure
- Student worksheet
- Kit contents & resupply list

Resupply list:

- Lotion
- SPF 15 sunscreen
- SPF 30 sunscreen
- SPF 50 sunscreen
- Copies of student worksheet for student pairs

