



LESSON PLAN: SENSING ENERGY

This activity will address the following questions:
 What types of energy does the Sun produce?
 How can we sense different types of solar radiation?

PREPARATION

Assemble the needed materials [e.g. in the center of each table, on each student's desk, etc.]

WARM-UP & PRE-ASSESSMENT

The warm-up show begins a process that develops understanding of solar radiation. At this age level, we are interested in exploring three aspects of energy from the Sun – light, heat, and UV. There are other activities in this module that can be used to develop more ideas about the sun's energy. Since the kids may know about the light, we begin here.

To reveal children's ideas about light, ask them to think of everything they know about light from everyday experiences. Prompt with questions as needed:

- Think of as many things as possible that give off light.
- Using my senses other than sight, how else might I sense that a light bulb is turned on?

Materials

- Five or six Ultra-violet Detection Beads* per child
- lamps, overhead projector, a grow-light for plants
- 9 empty, opaque film canisters per group
- Colored filters
- a white piece of cloth
- a black piece of cloth
- a baseball cap
- water
- paper clips
- plastic wrap
- a paintbrush or sponge
- Sunglasses
- Sunblock lotion
sunscreen (spf 5 or 8, and 30)
- Flashlight
- UV eyeglasses





Teaching Tip

Give the children the opportunity to explain their ideas by asking them to draw and write down their explanations.

PROCEDURES

Part 1

1. Provide each student with a few of the Ultra-violet light Detection Beads. Explain that they have a detection tool in their hand that will turn color when a special kind of energy is present.

Teaching Tip

Individual beads may be hard for some students to hold. String the beads and secure them with a knot if necessary.

2. Have the students move around the room, looking at the color of their beads, placed under different sources of light (e.g. lamps, overhead projector, a grow-light for plants) Note that fluorescent lighting will not change the beads' color. As the students move towards the window they should notice that their beads will begin to change color. Take them outside if possible; it need not be a bright sunny day.

3. Class discussion: Prompt students with the following questions to help them develop an explanation for the changes they are seeing in the UV beads.

- What do you notice about the beads? (They should say a change in color)
- What color were they before? What color are they now?
- Are all the beads changing color? If not why not? If so, why do you think?

Teaching Tip

It is important for the students' to explore their ideas. Allow the students time to explore their beads and develop their own mini-investigations.

Some students may think that it is the Sun's light that is changing the color of the bead. Other may think that it is the Sun's heat. Encourage the students to think of different ways of testing their ideas.

Part 2

1. Find an area in full sunlight.
2. Arrange the students into groups of 3-4 and distribute materials.
3. Have each group of students put three UV beads in each film canister (You will not be using the lids unless you want to prevent the beads from escaping during the walk to the outdoors. Remove lids once outside. Different coverings will be tested in this experiment
4. Instruct students to test the following nine scenarios (if it is difficult to do all 9 tests at the one time, break the experiment into a couple of separate sessions):
 - Canister 1. (control) Set it on a desk or the ground with nothing over it.
 - Canister 2. Lay a white piece of cloth over it.
 - Canister 3. Lay a black piece of cloth over it.
 - Canister 4. Put sunglasses over this canister.
 - Canister 5. Put a baseball cap over this canister.
 - Canister 6. Fill this canister with water. String the beads on a paper clip so that they will sink.
 - Canister 7. Cover this canister with plastic wrap.
 - Canister 8. Cover this canister with plastic wrap and then apply a coat of sunscreen (spf 5 or 8) to the plastic with a paintbrush or sponge.
 - Canister 9. Repeat the instructions for the previous canister using an spf 30 sunscreen.



5. Tell students to let their canister sit for five minutes in the sunlight- either outdoors or in a sunny window.

6. While waiting for the results to appear, conduct a whole group discussion to have the students predict what might happen in each of the canisters. Prompt with questions if necessary, such as:
 - What do you think will happen to your beads? Why?
 - Will the same thing happen to everyone else's beads?
 - What colors do you predict they will become? What makes you say that?

7. After five minutes, have students check the canisters one at a time and record the results on Worksheet 1. Before checking they will need to move the canister to the shade and look quickly. The response time of the beads is very rapid. If the beads are not examined in the shade immediately and if the students look too slowly, the results will not be valid.

Teaching Tip

Ensure that all students have observed the beads in their group. Only one student need fill out the worksheet, however. Others may also do so if you prefer.





DISCUSSION & REFLECTION

The point of this exploration is to think further about the Sun's energy.

Have each group discuss their observations amongst themselves for two or three minutes, and perhaps choose a spokesperson for the entire class discussion, if necessary.

Bring the groups together, and discuss the basic findings, and what caused them. Prompt with questions such as:

- The beads in which canisters changed color?
- Did they all change into the same colors?
- Why do you suppose that certain beads changed color and not others?
- Look at the results from the different canisters, and compare two, now three canisters.

What do you notice? What is different from each canister? For example, is white cloth different from black cloth in changing the amount of UV radiation that reaches the beads?

What can you conclude about which materials best blocked ultra-violet radiation?

LESSON ADAPTATIONS

For students who know about other planets, ask them to speculate about how much of the Sun's power reaches them. Ask about visible light, heat, and UV radiation. You may want to mention here the other forms of solar energy discussed in the Science Overview (including gamma, X-rays, infrared and radio waves).

Prompt with study questions or research topics such as:

- How would the Sun's energy be different on different planets such as Mercury or Pluto?
- What features about the other planets make them different from Earth? Why are those features important when we think about light, heat, and UV radiation?

To make this lesson more relevant to students' knowledge of biology in the early grades:

- Explain how insects use their ability to sense ultra-violet radiation. Butterflies and bees see ultraviolet light as a distinct color that makes certain markings on flowers very vivid to them and guides them to the nectar tubes.



CURRICULUM CONNECTIONS

- *Health:* Invite the school nurse or dermatologist to talk with students about the importance of using sunscreen to protect their skin from ultra-violet light.

ASSESSMENT

Ultra-violet beads offer third and fourth graders a fine opportunity to develop a scientific investigation or fair test. Ask your students to design their own test to show how the beads respond under different conditions.

The following list outlines some useful expectations on how to assess such investigations.

Exemplary:

- Students plan controlled investigations of predictions with a rationale based on scientific thinking.
- Students repeat procedures to confirm observations.
- Students apply measurement to represent their ideas.
- Students select appropriate charts and graphs to record and then interpret their findings.
- Students make conclusions that relate their findings to scientific thinking and propose further questions for investigation.

Emerging

- Students make predictions that guide the formation of fair testing procedures.
- Students defend their procedures and rationale for selecting them.
- Students carry out fair tests, knowing why they are fair.
- Students select and make appropriate measurements.
- Students complete a chart or graph to record and help interpret their findings.
- Students draw conclusions and attempt to relate their findings to scientific thinking.

Formative

- Students describe what they expect to happen when something is changed and supporting that idea with some scientific thinking.
- Students use suitable equipment to make and record adequate and relevant observations.
- Students record what they find and compare it to what they expected.
- Students make appropriate measurements.





INTERNET RESOURCES & REFERENCES

UV Detection beads can be purchased from Educational Innovations Inc. (1-888-912-7474)
or on- line www.teachersource.com.

