



Introducing Solar Energy: Hypothesizing on Why Solar Beads Change Color

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DESCRIPTION: The purpose of this activity is to introduce the idea that sunlight is energy and that this energy can be absorbed, converted into heat, or even cause a chemical reaction to occur. This lesson is also an introduction to the process of science, involving observation, hypothesis, testing, introducing evidence and respectfully listening to differences of opinion.

GRADE LEVEL(S): 3, 4, 5

SUBJECT AREA(S): Science, solar energy, energy, wavelengths of light

ACTIVITY LENGTH: 30 minutes

LEARNING GOAL(S):

- Students will be introduced to the vocabulary of observation, hypothesis, and evidence.
- Students will use the process of science discourse where people respectfully listen and disagree with each other's ideas.

STANDARDS MET:

- CCSS.ELA-Literacy.SL.4.1.b. Follow agreed-upon rules for discussions and carry out assigned roles.
- CCSS.ELA-Literacy.SL.4.1.c. Pose and respond to specific questions to clarify or follow up on information, and make comments that contribute to the discussion and link to the remarks of others.
- CCSS.ELA-Literacy.SL.4.1.d. Review the key ideas expressed and explain their own ideas and understanding in light of the discussion.

Next Generation Science Standards:

- 4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents

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Student Background:

This lesson is intended to serve as an introduction to solar energy, so students should require little to no content area background information to begin.

Educator Background:

Visible Light

The electromagnetic energy we can see with the naked eye is called visible light. Visible light is generally composed of multiple colors occurring simultaneously. Every color has a different wavelength. The longest wavelengths are reds and the shortest are violets. All of the colors mixed together make white light. We see many colors because most substances absorb some wavelengths of light and reflect others. We see the colors that are reflected by the substances. A rose looks red because it is reflecting the red light waves and absorbing the oranges, yellows, blues, greens and violets. A blue bird looks blue because it is reflecting the blue light waves and absorbing the others. The dirt looks brown because it is reflecting several light waves that together look brown and absorbing other light waves.

Electromagnetic Energy can be Absorbed and Used

Light waves can also enter a substance and change into other forms of energy. When we are in the sun, some of the light waves enter our skin and turn into heat. Most substances reflect some frequencies of light and absorb others. We can use the energy in light to make heat in many ways. We can color things black to absorb the light waves. We can use mirrors to reflect large amounts of light waves onto an object that absorbs them and turns them into heat. We can use this heat to warm houses and water or to cook food. We can also use light energy to generate electricity. Solar photovoltaic cells can absorb light waves and turn the light energy into electricity.

The solar beads require higher energy light with shorter wavelengths in order to change, which means that the reaction will occur only in the presence of light from the top of the visible light spectrum and from the ultraviolet spectrum. Note that the beads will not change under most kinds of artificial lighting (including fluorescents), but will change under certain full-spectrum bulbs. Since the beads react primarily to higher energy light, materials that block ultraviolet rays will be more effective at preventing the reaction.

Science Kit Materials List:

- Solar Beads (1-4 per student)

Other Materials List:

- Cups to hold the beads at table group
- Rulers
- String

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Vocabulary:

- Observation – something that can be determined with your five senses
 - Hypothesis – an idea that might explaining a set of observations
 - Evidence – observational clues that support a hypothesis or do not support a hypothesis
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Lesson Details:

Activity plan:

- At the beginning of the day, preferably first thing in the morning, instruct students to cut a 6-inch length of string, and put the beads on them and watch them throughout the day.
- Write the word “**observation**” on the board and discuss that an observation is something you can notice with your senses.
- Write “**hypothesis**” on the board and share that a hypothesis is an idea that you think is true. Hypotheses explain why something is happening. **Evidence** consists of the clues you observe that seem to support your hypothesis or do not support your hypothesis.
- Tell the students that their job is to investigate what happens to the beads throughout the day and to explain why it is happening. They don’t have to write anything down, but they need to be prepared to share their observations and ideas and to listen to other students ideas.
- Tell the students that at several points during the day, you will stop to record their observations and hypotheses about the beads and what has happened with them.
- At two or more points during the day, encourage students to share their observations, as well as their hypotheses about what is happening. As they share, prompt the students by asking how they might test those hypotheses.
- **If you are doing a full unit**, discussing the reason the beads change color can be reserved for another lesson. As the discussion of the students’ hypotheses progresses, the teacher can point out that their ideas involve different forms of energy and make a list of the forms mentioned on a chart (e.g. light, heat).

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