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Using Heat from the Sun

The Science of Global Atmospheric Change: Activity 8

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BioEd Online

Using Heat from the Sun

This objectives of this activity are aligned with the National Science Education Standards, specifically those related to Science as Inquiry and Physical Science. "Using Heat from the Sun" uses guided inquiry to build students' awareness of the sun's importance as the ultimate source of almost all energy on Earth. Students will conduct a discovery activity that allows them to observe how energy from sunlight can heat water. They will measure liquids, make observations, predictions and comparisons, and draw conclusions based on their investigation.

The following science concepts are addressed in this activity.

- Some energy given off by the sun can be felt as heat.
- Heat from the sun can be used as a source of energy.

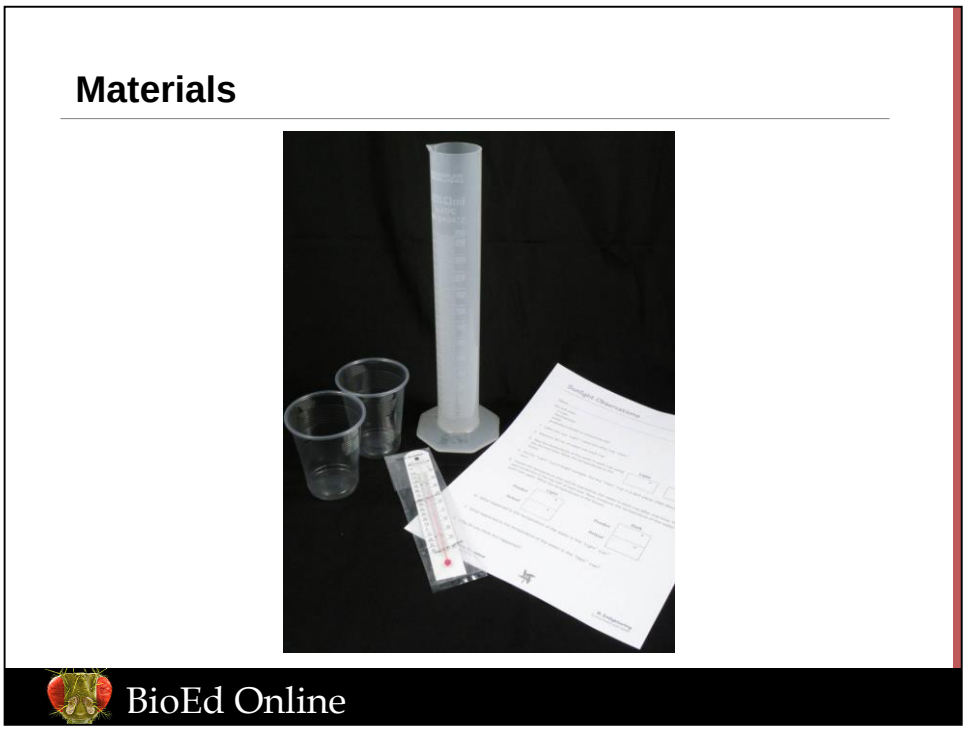
Student Worksheets
Student pages in the teacher's guide are provided in English and in Spanish.

Reference

Moreno N., and B. Tharp. (2011). *The Science of Global Atmospheric Change Teacher's Guide.* Third edition. Baylor College of Medicine. ISBN: 978-1-888997-76-7.
Development of this student activity was supported, in part, by grant numbers R25 ES06932 and R2510698 from the National Institute of Environmental Health Sciences of the National Institutes of Health to Baylor College of Medicine.

Image Reference
Photo of solar panels © Fernando Tomás CC-BY-SA 2.0.
http://commons.wikimedia.org/wiki/File:Solar_Panels.jpg

Key Words
lesson, experiment, skin, sun, sunscreen, sunburn, ozone, heat,



Materials

Have students conduct the activity in groups of 2-4.

Materials per Student Group

- 2 cups, 9-oz clear plastic
- Graduated cylinder, 100-mL size (or metric measuring cup)
- Student thermometer, plastic
- Copy of “Sunlight Observations” page

Note: If you are teaching this activity during the winter, you will need to conduct it indoors, in a sunny window. When the weather is warm, students may conduct the experiment outside.

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Image Reference:

Photo by Christopher Burnett © Baylor College of Medicine.

Key Words
materials list, materials needed,

Since Safety Considerations

Students always must think about safety when conducting science investigations. This slide may be used to review safety with your class prior to beginning the activity.

Safety first!

Also, keep the following points in mind.

- Always follow your district school safety guidelines.
- Have a clear understanding of the investigation in advance. Practice any investigation with which you are not familiar before conducting it with the class.
- Make sure the appropriate safety equipment, such as safety goggles, is available.
- Continually monitor the area where the investigation is being conducted.

References

1.Dean R., M. Dean, and L. Motz. (2003). *Safety in the Elementary Science Classroom*. National Science Teachers Association.

2.Moreno N., and B. Tharp. (2011). *The Science of Global Atmospheric Change Teacher's Guide*. Third edition. Baylor College of Medicine. ISBN: 978-1-888997-76-7.

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Key Words

science, classroom, safety, lab, laboratory, rules, safety signs,

Where Does Heat Come From?

To focus student's attention, begin the activity by asking, *How do we get hot water into our homes? Does the water come pre-headed, or do we have to heat it?* Lead a class discussion about different energy sources, such as electricity or gas, commonly used to heat water for homes.

Follow by asking, *What if we didn't have any electricity or fuel to burn? Are there any other ways to heat water?* Help students to understand the importance of the sun as a source of heat and other energy on Earth.

Ask, *How can we find out if the sun provides energy to heat water?* Tell students they will be conducting an investigation to answer this question.

Reference

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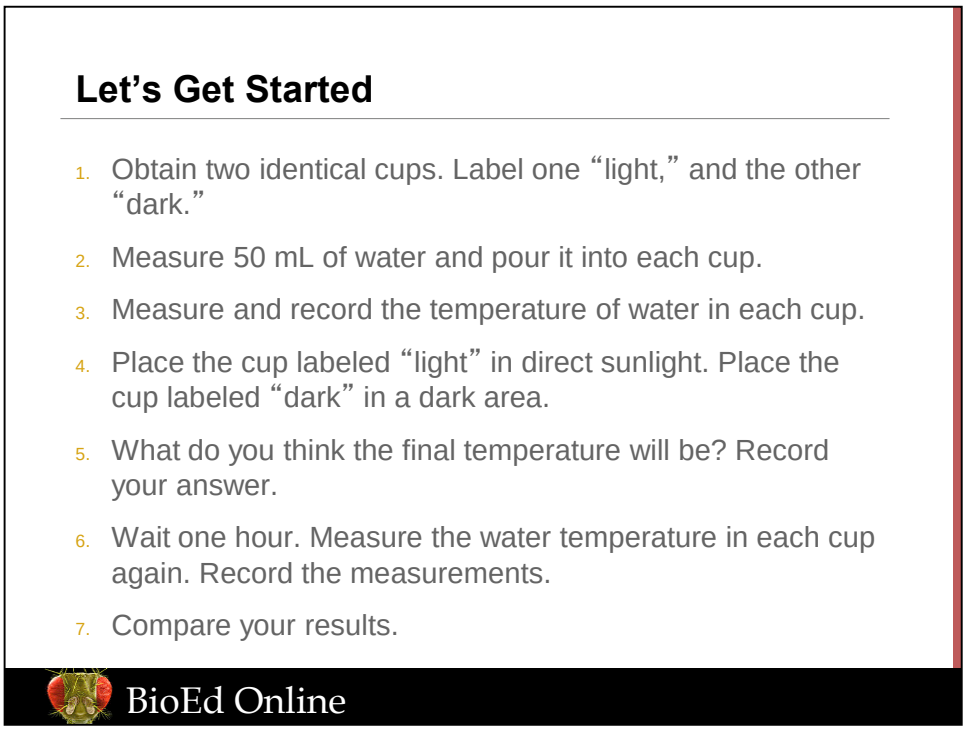
Image Reference

Photo courtesy of the U.S. Department of Energy, Office of Scientific and Technical Information. Public domain.
http://www.osti.gov/home/sites/www.osti.gov.home/files/images/fig2heatpumps_0.png

Key Words

heat, sun, hot, hot water, energy, temperature, heating, heat,



Let's Get Started

In this activity, students will conduct a discovery activity in which they observe how energy from sunlight can heat water. They will measure liquids, make predictions, observations and comparisons, and draw conclusions based on their investigation. Students will discover that the sun is the ultimate source of almost all energy on Earth, and that we can harness the sun's power directly as a source of energy.

Have Materials Managers collect the materials for their groups. Then, instruct each group to complete the following steps.

1.Label two identical cups – one as "light" and one as "dark."

2.Measure 50 mL of water into each cup.

3.Measure the temperature of the water in each cup, and record those temperatures on the student sheets.

4.Place the cup labeled "light" in direct sunlight (outside or on a window sill inside the classroom). Place the cup labeled "dark" in a dark area of the classroom, away from any heating vents or radiators.

5.Each student should predict what he or she thinks the final temperature of the water in each cup will be, and write his/her predictions in the appropriate spaces on the "Sunlight Observations" sheet.

6.If possible, students should wait at least one hour, and then measure the temperature both cups once again.

7.Record follow-up temperature observations in the appropriate spaces on the student sheet.

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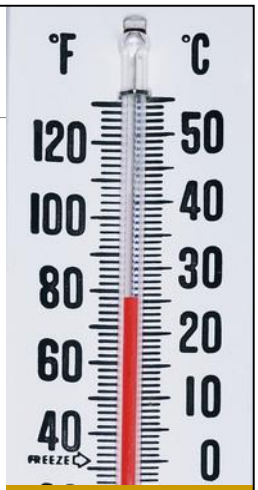
Key Words

heat, sun, hot, sunlight, heat, heating, temperature,

Let's Talk About It

- What happened to the temperature of the water in the "light" cup?
- What about the temperature of the water in the "dark" cup?
- What temperature did you record for the water in each cup?
- Which cup held warmer water?
- Was your initial prediction correct?
- Why did the water in the cup that was placed in sunlight get warmer?



Thermometers can measure temperature in Fahrenheit and Celsius.

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Let's Talk About It

In this activity, students observe that energy from the sun can heat water. Sunlight passes through the atmosphere and warms Earth's surface, along with the living things on it. The sun is the ultimate source of almost all energy on Earth.

Ask, *What happened to the water in the cup that you placed in the sun? Did it become warmer or colder, or stay the same temperature? What about the water in the cup you left in the dark?*

Follow by asking, *What temperature did you record for the water in each cup? At the end of the investigation, which cup held warmer water? Was your initial prediction correct?*

Finally, ask students why they think the water in the cup exposed to sunlight got warmer. Help them to understand that energy from the sun warmed the water.

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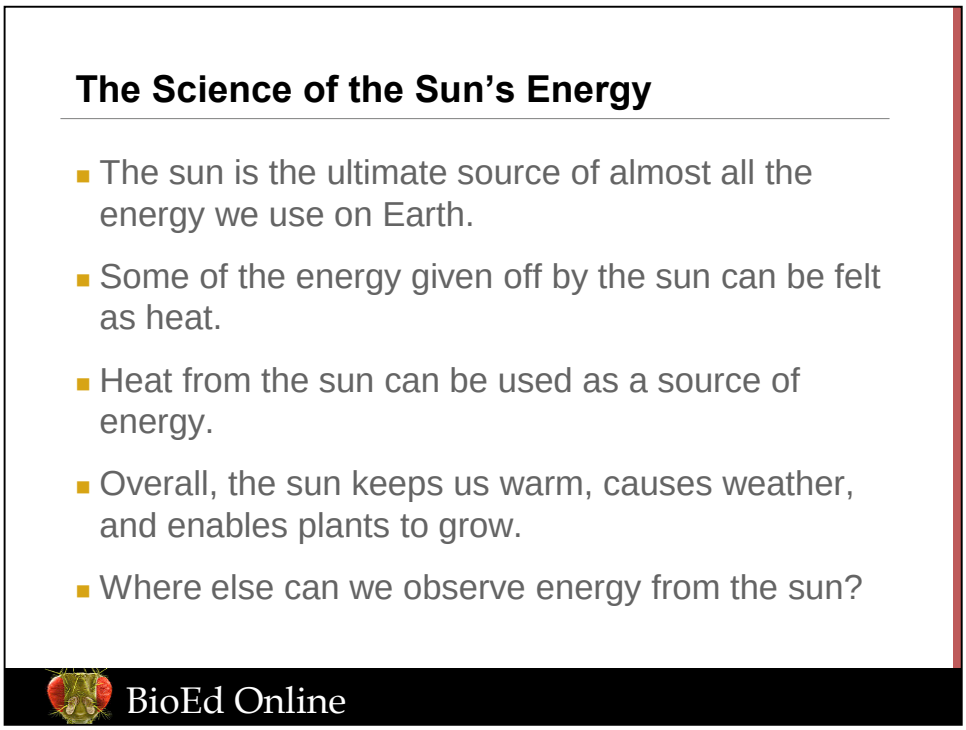
Image Reference
Microsoft Office Clip Art

Key Words
heat, sun, hot, hot water, energy, temperature, heating, light, dark, sunlight,



The Science of Sun's Energy

In this activity, students learned the following properties of global resources.

- **Some energy given off by the sun can be felt as heat.** The sun produces its energy through nuclear fusion, a process that converts hydrogen to helium. The heat produced as a result is transferred from the sun's core and reaches the Earth.

- **Heat from the sun can be used as a source of energy.** Plants use sunlight to create food through a process called photosynthesis. Fossil fuels were formed from partially rotted plants and organisms buried at intense pressures for millions of years. Another example of the sun's energy is the direct heating of solar panels by sunlight to generate electricity. Ask, *Where else we can observe energy from the sun?*

Reference

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Key Words

sun, energy, Earth, heat, energy source, weather, light, sunlight,

Extensions

- Compare how different colored cups absorb heat from sunlight.
- Compare water temperature for cups placed on aluminum foil, on black paper, on the grass, and on concrete.
- Design and/or build a solar water heater.
- Compare the environmental benefits and drawbacks of using solar energy with using electricity to heat water.

Solar panels use sunlight to generate electricity.

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Using Heat from the Sun: Extensions

•Encourage the students to ask additional questions and think of variations for the experiment.

•Have students compare the levels of heat absorption among cups of different colors. Or have them examine the effects on water temperature when they place cups on a reflector made of aluminum foil, on black paper (which absorbs heat), on a grassy surface, and/or on a paved surface.

•Challenge students to design their own solar water heaters. Have them draw their designs and/or build their heaters from recycled materials.

•In the story, *Mr. Slaptail's Curious Contraption*, Mr. Slaptail builds a solar water heater to supply his house with hot water. Ask students, *Do you think that this is a practical use of solar power?* Encourage students to conduct research in the library or on the Internet to learn what they can about houses that use power from the sun for heat, electricity and/or hot water.

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Image Reference

Photo of a solar panel courtesy of Thomas Spring, released into the public domain.
http://en.wikipedia.org/wiki/File:SolarpanelBp.JPG

Key Words

lesson, experiment, extensions, sun, energy, Earth, heat, energy source, weather, light, sunlight, temperature, solar, environment, solar energy, solar power,