

Studying the Sun



Target Grade Levels

Third - Fifth

Time

Five hours, including building model solar cars (4 hrs)

Materials

- one sheet of notebook paper
- a piece of aluminum foil
- scissors
- white glue
- scrap of wood
- magnifying glass
- large cooking pot with glass lid
- rack
- 8"x10" reflectors (cardboard)
- pot holder
- brownie mix
- thermometer
- large sheet of paper listing selected cultures chosen from: solar-centerstanford.edu/folklore.html.
- large sheet of paper with the displaying the assessment questions

Knowledge and Skills (TEKS)

- Science:
 - Demonstrate safe practices;
 - Make wise choices in conservation;
 - Observe and measure;
 - Interpret information to construct explanations from evidence;
 - Problem solve to make informed decisions; and
 - Collect and analyze using tools;
 - Identify the sun as the major source of energy.
- Language Arts:
 - Communicate valid conclusions.
- Math:
 - Construct simple graphs, tables, maps and charts to organize and evaluate information.

Overview

Students will read and discuss how the sun produces heat, which can be used to do many things that require energy. Students will make and collect data from several projects that are outlined in the fact sheet, including making a reflector, cooking with a solar oven, and drying fruit with the sun's help. Students will explore, through folklore research, the sun's role as a part of many cultures.

Background Information

The sun's rays are made up of photons. They are the smallest pieces of light that exist. Photons travel from the sun across space at a little over 186,000 miles per second. They keep moving until they hit something. If there is nothing in the way, they hit things on earth.

Everything in the universe—you, your school, the food you eat—is made up of tiny molecules.

When a photon hits a molecule, it gives it a shove. The molecule moves faster and heat is produced. The faster molecules move, the more heat they produce.

Procedure

1) Vocabulary

- | | |
|--------------------|-------------|
| a) photon | d) hydrogen |
| b) molecules | e) helium |
| c) nuclear reactor | |

2) Activities

a) Assess Current Level of Knowledge

- i) Have the students read and follow the directions for making a reflector provided in the Heat From the Sun fact sheet. This should take about 10 minutes.
- ii) Then take the students outside and allow them to experiment with turning the reflector to focus and intensify the rays from the sun.

- iii) Ask the students why the sun's rays are causing heat. Accept the students' responses as they experiment with their reflectors.
- b) Class Instruction
Review the information on photons and molecules presented in the fact sheet to the class. Review the definitions from the key vocabulary list and have the students write the words and definitions in their science notebooks.
- c) Cooperative Group Work
 - i) Divide the class into pairs. Display the large sheet of paper with the ten questions and let the groups pick which question they would like to research. All the answers can be found through the following web site: www.howstuffworks.com/sun.html. Another excellent site at a lower reading level is www.starchild.gsfc.nasa.gov/docs/starchild/solar-systemlevel2/sun.html. The students will learn a great deal about the sun from searching these sites for their answers. Links are included as well. The time needed for this part of the lesson will depend upon availability of computers. The teacher might go through the menus on the sites and talk about where the students will find the answers to specific questions, if the students need this assistance (20-30 minutes, depending on students' skill levels).
 - ii) Have the groups report their findings and record the information on the paper with the questions. Have the students record this information, questions and answers, in their science notebooks.
- d) Literature Link – Solar Folklore
 - i) For centuries, humans have attempted to explain the sun in terms of their own worldviews. The sun can has been described as a god, a demon, a mischievous spirit, an omnipotent creator or a ruthless taker of life. Whatever role it plays, most cultures have recognized the significance of the sun as the prime controller of all life on earth. Display the choice sheet for “Solar Folktales” and allow groups to choose their culture or assign a culture to each group. Students can do a web search at www.solar-center.stanford.edu/folklore.html to find their culture. Allow students to choose the title of the folktale, download it, and read the tale.
 - ii) Groups should write a short, informational and creative summary of the tale to be presented to the class.
 - iii) Each student should create a small, simple line drawing on his or her scrap of wood to represent his or her folktale or the culture from which it originated. This will be used later in the lesson.
 - iv) Have the groups present their summaries to the class and add information to the Solar Folktales paper.

3) Review

- a) Many solar myths or folktales regard the sun as a deity or as the origin of all life. In what way does this hold true or might it have seemed true to early humans?
- b) Discuss how solar energy is transformed into chemical energy through photosynthesis. Break down the ingredients of a pizza, which is fuel for the body, to see that their energy originated from the sun. (e.g.: Cheese comes from milk which is made by a cow which eats grass which captured its energy via photosynthesis of the sun's rays.)
- c) Discuss the process of fusion, the way in which the sun produces its energy, and fission, a nuclear power source here on Earth. What are the differences?
- d) Call on students to research and repeat interesting sun facts and the source of information for these facts. Example: Right now, about half of the amount of hydrogen in the core of the Sun has been fused into helium. This took the sun about 4,5 billion years. (www.michielb.nl/sun/kaft.htm)

4) Evaluation

- a) Have the students answer the questions below in complete sentences. Alternatively, the class can answer the questions as a group discussion either instead of a written assignment or as a review before giving it to them as a test.
 - i) The sun is in a vacuum in space. Does the sun actually "burn"?
 - ii) What is the sun made of?
 - iii) What keeps the gas from leaking out in space?
 - iv) The sun's corona is the _____ layer of the sun's atmosphere.
 - v) What is a photon and how does it produce heat?
 - vi) How old is the sun?
 - vii) How much longer is the sun going to burn?
 - viii) Is the sun like other stars?
 - ix) When doing projects with the sun, list three safety tips that should be followed.
 - x) What are red, white, and black dwarves?
- b) Possible answers to assessment questions
 - i) The sun does not burn like wood; it is a huge nuclear reactor.
 - ii) The sun is made of hydrogen and helium.
 - iii) The sun is so massive it creates a gravitational pull that holds the hydrogen and helium around it. Therefore, the gases cannot escape into space.
 - iv) The sun's corona is the outer layer of the sun's atmosphere.
 - v) A photon is the smallest piece of light from the sun's rays. Photons travel through space until they hit a molecule. The impact causes the molecule to move faster. The faster a molecule moves, the more heat it produces.

- vi) The sun is about 4.5 billion years old.
- vii) The sun's life span is probably about 10 billion years, so it will burn about another 5.5 billion years.
- viii) The sun is like other stars in space. It appears bigger because it is closer to us.
- ix) When doing projects involving the sun, you should wear sunscreen, sunglasses, a cap, use pot holders for handling hot objects and ask an adult for help when needed.
- x) Red, white and black dwarves are different stages that stars go through.

5) Extension

a) Homework Activity—Drying Fruit

Have the students copy the instructions from the fact sheet under “Drying fruit with the sun's help” in their science notebook. Assign this project as homework, instructing the students to write down the results to report back at an assigned date and to bring samples of their fruit to class.

b) Culminating Activity—Bake Brownies in a Solar Oven

With the teacher as the director, follow the directions in “Cooking With a Solar Oven” found in the fact sheet and bake brownies, melt s'mores, or make nachos to share. To enhance this activity, an oven thermometer can be used to collect data (time needed will depend on the intensity of the sun).

HEAT FROM THE SUN



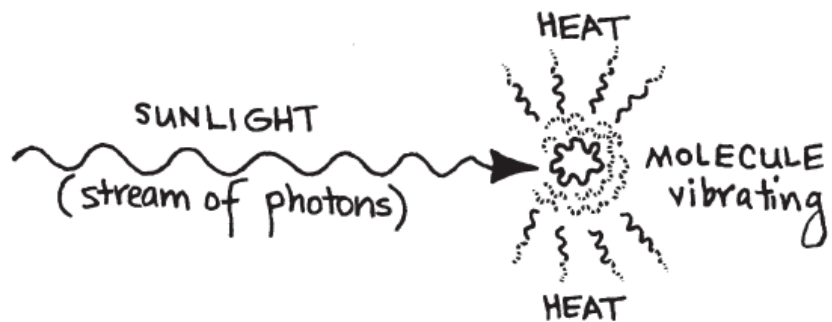
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FACT SHEET 5 A RESOURCE FOR CLASSROOMS AND TEACHERS

Highlights

What can the sun do for you?

- ◆ heat your house
- ◆ cook your food
- ◆ make the plants grow
- ◆ dry your clothes
- ◆ what else can you think of?



HEAT FROM THE SUN The sun's rays warm things by making molecules move around faster.

Photons and Molecules

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Everything in the universe – you, your school, the food you eat – is made up of tiny molecules.

When a photon hits a molecule, it gives it a shove. The molecule moves faster and heat is produced. The faster molecules move, the more heat they produce.

Fun in the Sun: Projects you can do

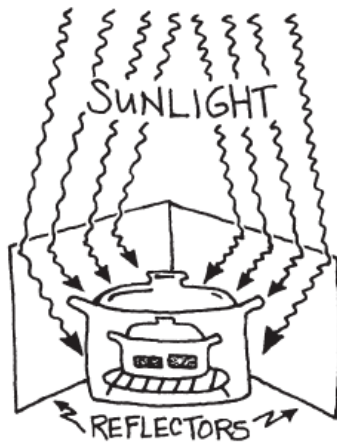


Be safe: With any project involving the sun, be careful not to burn yourself. Wear sunscreen, sunglasses and a cap. Use pot holders for handling hot objects. Ask an adult to help you.

MAKE A REFLECTOR

Materials: a piece of notebook paper; a piece of aluminum foil; scissors; white glue

Cut a piece of notebook paper and a piece of aluminum foil the same size. Brush white glue onto the back of the foil. Smooth it carefully



SOLAR COOKER

Cook for yourself and your friends with the sun.

over the paper. Let it dry. Point the reflector at the sun.

Try curving it around. Feel the heat reflected onto your hands.

COOKING WITH A SOLAR OVEN

Materials: large cooking pot with clear glass lid; smaller black pot with glass lid; rack; reflectors; brownie mix; pot holders

This works best if you do your cooking at noon.

Make two reflectors on stiff cardboard with foil and white glue. (See *Make a Reflector* activity) Set large pot in front of reflectors. Angle the reflectors so they focus the sun's rays on the large pot. Put rack in large pot.

Mix the brownies according to the instructions. Put them into the small cooking pot. Set the

small pot on the rack inside the large pot. Put the lid on the small pot and then the lid on the large pot.

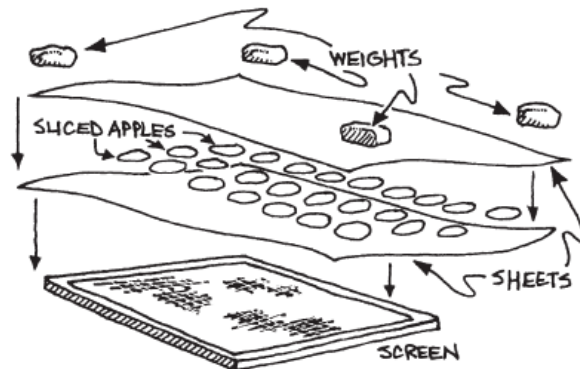
Cook the brownies one and one-half times the cooking time listed on the package.

Try making nachos by melting cheese on tortilla chips this way. Remember to use pot holders and start with food that is as close to room temperature as possible. It will take less time to cook.

DRYING FRUIT WITH THE SUN'S HELP

Materials: a window screen; a clean, dry bed sheet, cut into pieces; one dozen apples

Wash and peel about one dozen apples. Remove the seeds and slice thinly. Sprinkle Fruit Fresh® or powdered vitamin C on both sides so your fruit won't turn brown. Lay one piece of the bed sheet on the screen. Lay the apple slices in a single layer on the bed sheet,



SUN DRIED FRUIT Dry fruit for snacks, just like your grandparents did.



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making sure the pieces don't touch. Cover with the other piece of bed sheet.

Put this in a safe place where animals cannot get to it, like on a table outdoors. Weigh the cloth down with something heavy and clean.

Check the apples every day. When they are dehydrated and light brown, put them in an airtight container. They will keep for a long time and make a great snack.

HEAT FROM CONCENTRATED SUNLIGHT

Materials: a soft lead pencil; a scrap of soft wood (like a 2-inch by 4-inch piece of lumber); and a magnifying glass

Use the pencil to draw a picture on the wood with dark lines. Go outdoors. Hold the design so that it faces the sun. With your pencil drawing as a guide, hold the magnifying glass in front of the drawing so that it focuses the light on the lines you have drawn.

Watch carefully and the wood will start to smoke. Move the magnifying glass around so that the point of light burns a line over your pencil line.

WHAT CAN THE SUN DO FOR YOU? This could be your house and backyard. Draw yourself in your backyard and draw all the things the sun could be doing for you.

