

August 2009 – Solar Energy

The sun gives off lots of light and heat. When the light and heat are used to power things, it is called solar energy.

Solar Science Projects

Absorb or Reflect?

Have you ever heard that hot air rises? That's true! The moving of warm and cold air causes *currents*. Air currents are what cause different kinds of weather, like thunderstorms! We can't see the moving air, but do you think colored water might act the same way? Do this experiment to find out! **Make sure you have an adult help you with the hot water and the knife.**

What You Will Need:

- 2 clear glass pie plates or bowls
- 1 sheet of black construction paper
- 1 sheet of white construction paper
- 2 ice cubes
- A sunny spot outside

What To Do:

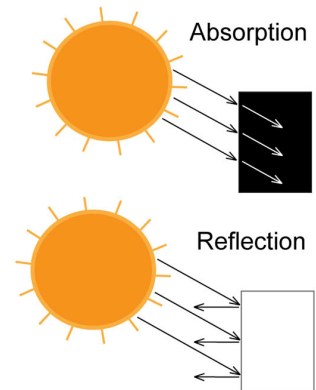
1. Place the sheets of black and white paper on a driveway or sidewalk in the sun. (The papers should not be touching each other. Your hand should fit in the space between them.)
2. Set a pie plate on top of each sheet of paper and put an ice cube in the middle of each pie plate.
3. After 5 minutes, check on the ice cubes to see which one has melted the most.
4. If they haven't melted much, check again in 5 more minutes. Keep checking until the ice in one of the pie plates has completely melted. It could take more than 30 minutes for the ice to melt all the way, depending on how hot it is where you live.
5. Which ice cube melted faster - the one on the white paper or the black paper? Feel the sheets of paper. Which one feels warmest? Touch the dishes too, just be careful because the glass can get pretty hot!



What's Happening?

The ice in the dish with black paper under it should have melted first. Both pieces probably started to melt at about the same time, but the one on black probably melted completely into a puddle of water first. Why did it melt before the one on the white paper?

First you need to know that rays of light from the sun also bring heat - that's why it gets hot on a sunny summer day, why the paper and the dishes felt warm after being in the sun, and why the ice melted! Light and heat from the sun are called solar energy. Here's why the piece of ice in the black dish melted first: Ice melts when it gets warmer than freezing. White reflects light and heat, so most of the sun's rays (full of light and heat) bounced off of the white paper and it stayed cooler for longer. Black absorbs or soaks up light, sort of the same way a sponge soaks up water. It absorbed most of the sun's rays that hit it, making it get hotter faster. Look at the pictures to see how **reflection** and **absorption** work.



Glass also absorbs heat, so even if you had not put any paper under the dishes, the ice still would have melted from being in the hot sun in glass dishes. Both ice cubes probably would have finished melting at about the same time without the black or white paper, though. The black paper absorbed even more of the sun's energy (light and heat) than the glass dish, making the ice melt faster. The white paper reflected most of the sun's energy that hit it, keeping the dish and the ice in it cooler for longer so it took longer to melt. After the ice had melted, the paper and the dishes probably felt very warm (except for in the spot where the ice was keeping it cool). In fact, the dish on top of the black paper probably even felt hot when you touched it! Can you explain why? (Hint: it's the same reason that the ice melted!)

Sun Prints

You can make fun pictures by using the sun's power to make the color fade from construction paper! This project uses repositionable glue, which you can find in most stores that sell office or school supplies. (Elmer's and Scotch brands both make this type of glue.) You could also do the project by setting objects on your paper and laying it flat in the sun instead of using the special glue.

What You Will Need:

- dark colors of construction paper
- solid objects with interesting shapes that you can trace around (leaves, buttons, coins, and plastic toys work well)
- pencil
- scissors
- repositionable glue (Optional. Made by Elmer's or Scotch brands and available where office or school supplies are sold.)
- a window that gets lots of sunlight
- tape

What To Do:

1. Trace around your objects on construction paper and cut out each shape. Or, you can draw your own shapes and cut them out. Be creative! You could even draw letters to spell your name.
2. Arrange the paper shapes onto a new sheet of dark-colored construction paper to make a nice design.
3. Use the repositionable glue to stick each shape to your picture. Don't use much glue though, or it will be hard to peel your shapes off later.
4. Turn the shapes towards the window and tape the corners of your picture to the window to hold it in place.
5. Leave your picture in the window for a couple days or until you notice that the color of the construction paper has started to fade (compare it to a new piece of the same color of paper to see if it has changed).
6. When it is quite a bit lighter than it was when you started (it might take up to a week to get light enough; it depends on how many sunny days you have!), untape the picture from the window and peel off the shapes; they should come off pretty easily, just do it slowly to make sure your picture doesn't tear.

What's Happening?

Have you ever left an art project made from construction paper in the sun for too long? If so, you probably noticed that the color started to fade and the paper ended up a lot lighter than it once was. In this project, you covered parts of the paper with paper shapes, then when you left your picture in the sunlight, it started to fade. Since the shapes blocked sunlight from hitting the parts of the paper that they covered, you could see the original color of the paper after you peeled off the shapes! The extra layer of paper from the shapes protected those parts of the paper from the sun's rays that faded the color from the rest of the sheet of paper.

Sunlight contains ultraviolet (or UV) rays - the same rays that will give you a sunburn if you are in the sun for too long without sunscreen on. Those rays cause chemical reactions in the dye that gives construction paper its color. When the paper absorbs the rays of light, a chemical reaction breaks down the dyes so they aren't as bright. You can learn more about chemical reactions [here](#). UV rays can lighten a lot of things. Some people's hair turns a lighter color when they are in a lot of sunlight. Hanging white laundry outside in the sun to dry can make it look whiter also.

Fun Facts

- The country of Germany (which is a very cloudy place) uses the most solar energy of any country in the world!
- Enough sunlight falls to the earth in one hour to provide all of the energy used throughout the world in one year. However, we do not have an efficient enough way to collect and use all of that energy.

Silly Science

- What did the solar cells say to their boss?
 - *We need rays!*

- How do we know that wind power is popular?
 - *Because it has so many fans!*

Way Cool Websites

- Find out ways you can save energy in your house with the [Energy Elf game](#).
- Print out this [solar energy coloring book](#) and have fun coloring pictures of ways the sun's energy can be used!

Teacher Tidbits

About the Sun

The sun is the biggest, brightest, and hottest source of light available to us on the earth. It is in the center of our solar system and all the other planets, including Earth, spin around it. Read our newsletter about the [solar system](#) to learn more.

Did you know that the sun is actually a star? The outside of the sun (its surface) is covered with very hot gases. The different gases mix together and cause reactions that are called **nuclear reactions**. Nuclear reactions create a lot of energy, which makes the sun very hot. The heat creates a lot of light too. Did you know that the sun is so bright that it will damage your eyes if you look directly at it? The light from the sun can also hurt your skin. Have you ever had a sunburn? Although sun rays can hurt our bodies if we aren't careful, nothing would be able to live on the earth without the energy we get from the sun in the forms of heat and light. Plants use energy from the sun to make food, then animals and humans eat plants for food. Without the sun, Earth would be too cold for anyone or anything to live.

The sun is 93 million miles away from Earth. If it were possible to drive from here to there, it would take over 150 years driving at 70 miles per hour (about the same speed you would travel on a highway)! However, light travels very fast and can get from the sun to the earth in about 8 minutes! Here is a [close-up picture of the Sun](#) from NASA.

What Is Solar Energy?

Solar energy is light and heat that comes from the sun. *Solar* means sun and *energy* is what we need in order to do things. We use energy to do things like eat breakfast and play outside. Energy is also in things around us, like light and heat. The sun shines in the day, giving us light. It also makes the earth warmer, giving us heat. You can learn more about energy [here](#). Solar energy is known as **renewable energy**, which means that it can never run out.

The rays of light and beams of heat from the sun contain energy that can be changed into electricity through a device called a solar cell or solar panel. Solar cells are made of a material that absorbs energy from the sun. Once it is inside of the cell, the energy breaks up into electrons and protons. Electrons have a negative charge and protons have a positive charge. All the negative charges are attracted to one side of the solar cell and the positive charges are attracted to the other side. When the solar cell is connected through wires to a light bulb or other object, it works like a battery and electrons flow through the wire and bringing electrical energy to a light bulb that makes it light up.

What Can Solar Energy Be Used For?



Solar energy can be used for a lot of things. Electricity from solar panels can be used to make things work, like traffic lights and lights in a home or outdoors. It can also heat water in a home, run air conditioners, radios, flashlights, and chargers for electronics like cell phones or cameras, and more. The sun's heat energy can be used for lots of things too, even without solar panels! It can be used to cook food using a solar cooker, like [this oven](#) made from a pizza box! The sun's light can be used during the day. For example you can open the blinds and curtains on windows to let natural light come inside instead of turning on lights. That way your family will also save money by not using as much electricity. Can you think of other ways you can use sun's energy to do things? Here are some ideas:

- Inside a greenhouse to keep the temperature warm enough for plants to grow all year, even in the winter! (Think about this: on a hot summer day, when a car is parked in the sun for awhile, the inside of the car gets very hot because the car absorbs heat from the sun and everything warms up. That is the same way a greenhouse works.)
- To dry clothes on a clothesline.
- To warm up water to give a dog a bath outside.
- To heat up the water in a swimming pool.
- You can even use the sun's heat to make salt water drinkable! [This project](#) shows you how.

Here are some good things about solar power:

- It can never be used up. This means that it is **renewable energy**.
- After a solar panel is paid for, solar energy is free!
- It can be used in places where electricity is not available, like far away from cities, up in mountains, or even on boats in the ocean!
- It does not release anything into the air. Some kinds of energy release things that are harmful to the environment, people, and animals.
- Solar panels last a long time, usually about 30-40 years!

These are some problems with solar power:

- Solar panels cost a lot. They are expensive to make and keep because they are made of glass and fragile minerals that can break easily, costing money to fix.
- It is only available when the sun is around - that means it won't work when it's cloudy or at nighttime!
- It takes lots of space to hold the large solar panels that are needed to make enough electricity to keep large things, like your house, running smoothly.

Science Words

Reflection - when light or heat hits an object and bounces back in the opposite direction.

Absorption - when light or heat is collected or soaked up by an object.

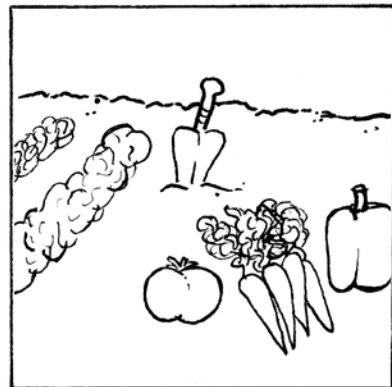
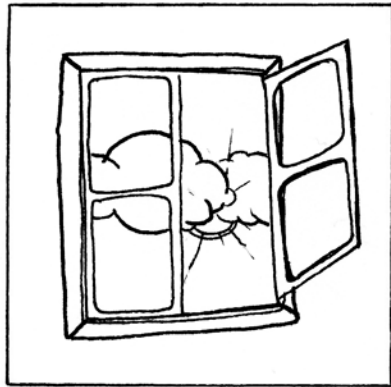
Nuclear reactions - reactions that take place between hot gases on the sun. These reactions release energy.

Solar energy - light and heat that comes from the sun and can be used to do work.

Renewable energy - a source of energy that can never be used up or run out. Energy that comes from the sun, water, or wind are examples.

Printable Worksheet

Print out the next page on a sheet of heavy paper or cardstock. Kids can color the pictures and cut out the squares to make a matching game. Half of the squares show a way to use solar energy as an alternative to the picture shown on the other squares. Place all the squares face down and take turns flipping two over per turn to find the ones that go together. Talk about ways to save energy from other sources by using the sun's power.



Match the pictures to see how solar energy can be used instead of other types of energy.

1. Cut out each square
2. Turn all the squares over, so you can't see the pictures
3. Flip two squares over at a time, to try and make a match!
(example: the light bulb, and sunny window are a match, because they both give light)

