The NASA "Why?" Files
The Case of the Electrical Mystery

Segment 2

As the tree house detectives continue trying to solve the case, they learn that electricity is a form of energy. They also learn that in a standard circuit, electricity comes from the flow of electrons. There are several ways to force the charges to flow. Some sources that provide energy to generate electricity are these: chemical, hydro, solar, mechanical, wind, water, nuclear fission, and the burning of natural gas, coal, and oil. The tree house detectives are intrigued and want to learn more about hydroelectric power. They send an e-mail to a power plant in Niagara Falls; through a teleconference, they learn how a hydroelectric power plant creates and distributes electricity. At the same time, KSNN issues a report that electrical power has been restored to most customers; however, the power continues to be out across the street. The detectives are baffled. They decide that they must do more research!

Objectives

Students will
- learn about various sources of power for the production of electricity such as chemical, hydro, solar, mechanical, wind, water, natural gas, coal, oil, and nuclear fission.
- learn the components of a hydroelectric power plant.
- understand how power is produced at a hydroelectric power plant.
- learn how the United States and Canada cooperate to share the Niagara River as a resource while preserving the beauty of Niagara Falls.
- compute the amount of water that flows over Niagara Falls during tourist season.
- learn possible causes for power outages.

Vocabulary

anemometer - an instrument for measuring and indicating the force of speed of the wind

battery - two or more dry cells that are connected and use chemicals to generate and store a direct current of electricity

chemical energy - a form of energy in which chemical compounds interact to create electricity

circuit - unbroken path of an electrical conductor that allows electrical current to flow from the power source and back again

current - moving electrical charges

electric eel - a long fish with organs capable of producing a powerful electric discharge

energy - the ability to make something happen or do work

forebay - a canal that water flows into from a river and where the water is held until it is used by a hydroelectric power plant to produce electricity

generator - a device that uses a moving magnetic field and a coiled conductor to produce alternating electric current

hydroelectric - using water to produce electricity

kilowatt - a unit used to measure large amounts of electricity —1,000 watts

mechanical energy - energy associated with motion

nuclear fission - splitting of an atom's nucleus into two smaller parts of approximate equal mass, during which nuclear energy is released

overload - to load too heavily; an excessive load

reservoir - a place where water is collected and stored for use

solar cell - a type of generator that produces electricity whenever sunlight shines on it

solar energy - energy given off by the Sun

treaty - an agreement between two groups, such as two nations

turbines - a paddle wheel in an engine that rotates by the introduction of steam, water, or wind and which, in turn, produces mechanical energy

variable - a factor that is being tested in an experiment

wind energy - energy that is created by wind

Video Component (15 min)

Before Viewing

1. Briefly summarize and discuss the events in segment 1 with the students.
2. Review the K-W-L chart (p. 11) that the class created earlier. Add items in the third column, "What have we **learned**?" Identify things to add to the "What do we **want** to find out" list?
3. Ask the students to predict why the power went out and what they think the tree house detectives will investigate next.

After Viewing

1. Discuss the questions asked in Segment 2 at the end of the video.
   - How will learning about the power plant help the tree house detectives solve their case?
   - Are they right to revise their hypothesis?
   - What do you think is wrong with Dr. D's train?
2. In small groups, have the students research how electricity is generated in their area. Contact your local utility company for information or perform a web search for other utility companies in your state/region. Many have extensive education/public outreach programs offering printed information and speakers that will visit your classroom.
3. Review the vocabulary used in the segment and ask the students to use the words to write and illustrate the definitions in their own words.
4. Choose from the activities in this packet and on the web site to reinforce the concepts being emphasized.
5. Continue working with the K-W-L chart to reinforce the investigative steps the tree house detectives are taking to solve the problem. Point out that the detectives frequently stop to summarize what they know and discuss what they need to know. They also revise their hypothesis if necessary.
6. As a class, hypothesize possible causes of the break in electricity between the power source and the houses across the street.

Careers

electrical engineer
hydroelectric power plant manager
conservationist
wind farm manager
chemist
physicist

Resources

Baker, Wendy, Alexander Parsons, and Andrew Haslam: Electricity. World Book, Incorporated, 1998, ISBN 0716647036

Chapman, Philip and Phil Chapman: *Electricity (The Usborne Young Scientist Series).* EDCP Publications, 1990, ISBN 0860200787

Cole, Joanne and Bruce Degen: *The Magic School Bus and the Electric Field Trip.* Scholastic, Inc., 1998, ISBN 0590446835

Bartholomew, Alan: Electric gadgets and Gizmos: *Battery-Powered Buildable Gadgets That Go!* General Distribution Services, 1998, ISBN 1550744399

Web Sites

Energy Ed Education Event's "Electric Motor"
This site features the creation of an electric motor and explains how it works.
http://www.energyed.ergon.com.au/activiti/4/experime.htm

Howard R. Swearer Center for Public Service
The public service outreach program provides lessons on various topics. The Circuits Lesson is featured.
http://www.brown.edu/Departments/Swearer_Center/Projects/PSO/Circuits.shtml

An Inside Look at Electricity
Web66: A K12 World Wide Web Project designed this site to help introduce technology into the classroom. Students did this project and published their findings on the web for those who are interested in learning more about electricity and Ben Franklin.
http://web66.coled.umn.edu/hillside/franklin/jummy/Project.html

Wind Farms of the World
Take a tour of selected wind farms around the world. The wind power plants in the tour are located in California, India, the United Kingdom and Continental Europe.
http://rotor.fb12.tu-berlin.de/windfarm.html

NASA "Why?" Files Web Site
Official web site of the NASA "Why?" Files. Student, teacher, and parent friendly.
http://whyfiles.larc.nasa.gov

Activities and Worksheets

In the Guide

On the Web

You can find the following activities on the Web at http://whyfiles.larc.nasa.gov.

To There and Back
Calculate the distance to Niagara Falls from your hometown.

Solar Cooker
Build a solar cooker and make lunch!

Fruity Energy

Purpose

Students will build a battery from fruit, test various fruits for conductivity, and compare the amount of energy they each produce.

SAFETY If no copper electrode is used, hydrogen gas is given off as a byproduct of the reactions taking place; therefore, be careful not to perform this experiment near heat sources or open flames.

Materials (per group)

several varieties of fruit (lemon, orange, apple, pear, kiwi, and grape)

one 3-cm X 0.5-cm piece of zinc metal (zinc electrode)

one 3-cm X 0.5-cm piece of copper metal (copper electrode)

two 30-cm pieces of insulated copper wire

small lamp such as a penlight or flashlight bulb (LED displays work great)

lamp holder

2 paper clips

wire strippers

Procedure

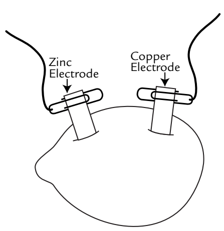


Diagram 1

1. Stick zinc electrode into fruit.
2. Place the copper electrode on the opposite side of the zinc electrode.
3. Place a paper clip on each of the electrodes. See diagram 1.
4. Strip about 2 cm of insulation from each piece of wire on both ends.
5. Attach one end of a wire to the paper clip on the zinc electrode.
6. Attach one end of the other wire to the paper clip on the copper electrode.
7. Insert bulb into the bulb holder.
8. Wrap the other ends of each copper wire around the posts of the bulb holder.
9. Observe the brightness of the bulb and record observations in science journal or in data chart.
10. Repeat with other fruits and compare the brightness of the bulbs.

NOTE One way to compare brightness more accurately than by a subjective opinion is to place a sheet of paper in front of the bulb and keep adding paper until the light can no longer be seen. Then compare how many sheets of paper it took for each fruit.

11. In your science journal create a chart like the one on the right.

Type of Fruit	Brightness/Number of Papers	Comments or Other Observations
Lemon		
Orange		
Apple		
Pear		
Kiwi		
Grape		

Conclusion

1. Define the term acidic.
2. Can fruits be acidic?
3. What do the fruits that lit the bulb have in common?
4. Why did only some of the fruits light the bulb?
5. How did the brightness of the bulb differ among fruits? Why?
6. What other fruits or vegetables would light a bulb?

Extensions

For further extensions with this activity, try the following:

1. Ask the students to discover if tomatoes will work and reason why or why not.
2. Compare the size of fruits and vegetables to the length of time that the bulb stays lit.
3. Have the students test the fruits and vegetables for pH levels and compare the pH levels to the amount of electricity generated.

Teacher Background

Fruits do not store electricity like batteries. You can use the chemical properties of certain fruits and vegetables to generate electricity. A lemon, for example, can be made to power a very small electrical device due to its high acidic content. By placing the zinc and copper electrodes into the lemon, you are able to draw electrical power from the lemon through an external circuit and do work. A lemon is equivalent to a calculator battery. The chemistry of a lemon cell is that zinc is an active metal that reacts readily with acid. A transfer of electrons takes place between the zinc and the acid. The copper electrode is used to draw power from the lemon cell by helping to channel the electrons through the external circuit. This sort of cell will work for any fruit or vegetable with some acid content. For a more detailed explanation on the chemistry of fruit batteries go to http://www.madsci.org/experiments/archive/889917606.Ch.html

Battery Tester

Purpose

Students will be able to create a tester to test batteries.

Materials (per group)

- 12-cm square of balsa wood
- 2 pieces of **insulated** copper wire 20 cm each
- 9-cm X 5-cm piece of cardboard cut in shape as shown **(see diagram 1)**
- small compass
- enough **uninsulated** copper wire to wrap around compass 15-20 times
- 2 alligator clips
- 2 paper clips
- 2 screws with washers
- screwdriver
- wire stripper
- various batteries any size

Procedure

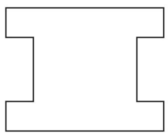


Diagram 1

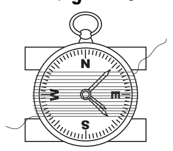


Diagram 2

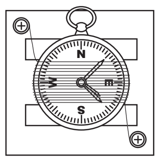


Diagram 4

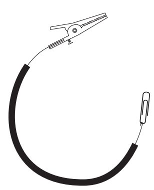


Diagram 6

1. Place the compass on the cardboard as shown in diagram 2. Using the **uninsulated** copper wire, lash compass to the cardboard 15-20 times, leaving 5 cm of wire on each end.
2. Screw one of the screws in a corner of the balsa wood. Screw the second screw in the diagonal corner. Attach washers to the back of the screws to hold them in place. See diagram 3.

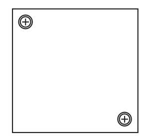


Diagram 3

3. On a flat surface, place the compass on the balsa wood with compass face up.
4. Attach one end of the copper wire that is wrapped around the compass to the top screw and then attach the other end to the bottom screw. See diagram 4.
5. Strip 5 cm of insulation from each end of the two insulated copper wires. See diagram 5.

Diagram 5

6. Attach one end of one of the insulated wires to an alligator clip and the other end to the paper clip. See diagram 6.
7. Repeat with the other insulated wire, alligator clip, and paper clip.
8. To test the battery, place paper clips on the positive and negative terminals of the battery and then clip alligator clips to the screws on battery tester. See diagram 7.
9. Note movement of compass needle.
11. Record observations in science journal.
12. Continue to test other batteries and compare the amount of movement for each.

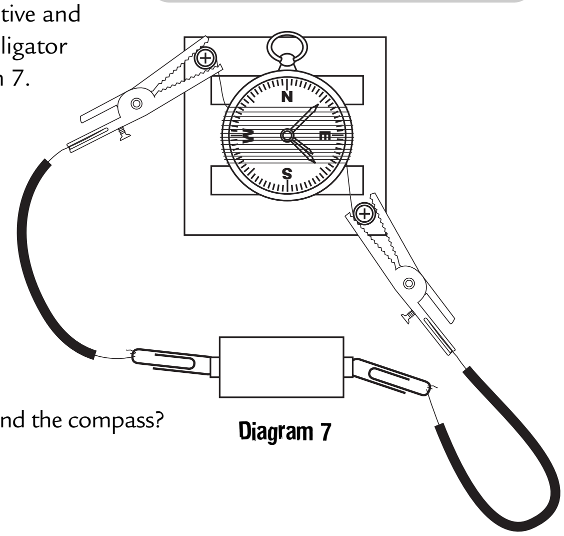


Diagram 7

Conclusion

1. How much of a difference was there in compass needle movement between batteries?
2. Why was there a difference? What are some factors that could cause a difference?
3. Why does the compass needle move?
4. Why was it necessary to wrap the copper wire around the compass?

Extension

Have the students make an electromagnet.

Teacher Background

A battery is a called a dry cell. It consists of a zinc can that contains a moist, paste-like mixture of chemicals. In the center is a solid carbon rod. As a chemical reaction takes place between the zinc and the paste, electrons are released. From the zinc part of the cell is a negative terminal that picks up the electrons as they are created. The carbon rod has a positive terminal that has a shortage of electrons, and this difference in the number of electrons creates an electron pressure that pumps the electrons.

If a wire is connected to each terminal, the electrons flow from the negative terminal through the wire to the positive terminal. As the chemical reaction continues, the electrons are pumped back to the negative terminal of the dry cell. A steady flow of current is created. An electric current flowing through the coil wire produces a magnetic field which acts in a single direction. It is the magnetic field that is created by the flowing current in the wire wrapped around the compass that makes the compass needle move because the coil acts like a permanent magnet. The strength of the magnetic field flowing around a current-bearing wire is proportional to the current flowing in the wire.

Solar Cell Simulation

Purpose

To simulate sunlight striking a solar cell.

Materials

large open area such as a playground or field

chalk or duct tape to outline areas

1-2 bells

30 feet of thick rope knotted on each end

Procedure

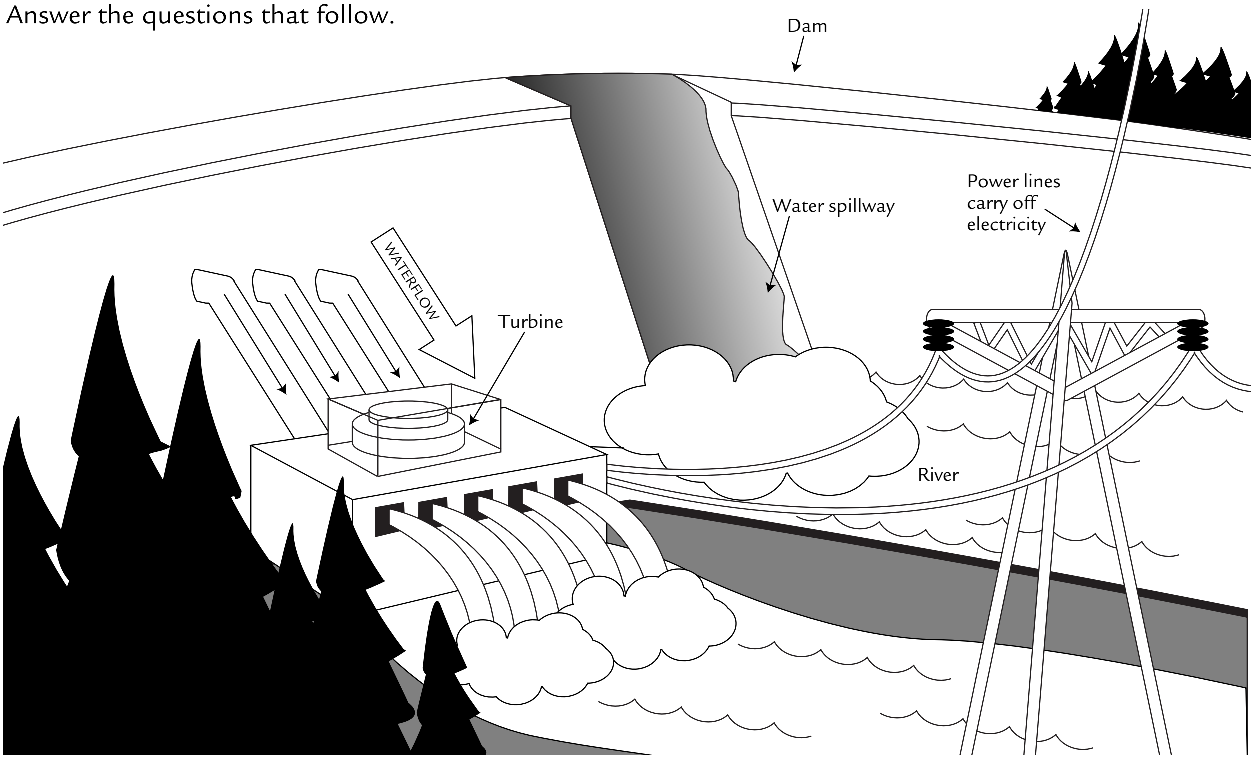
1. Prior to the simulation, the teacher should outline an area on the ground approximately 3 m by 3 m to represent the solar cell.
2. To represent the sun, outline another area as a large circle approximately 5 m in diameter 10-15 m from the solar cell.
3. Discuss with the class the definition of a simulation.
4. Divide the class in half, with one half standing in the solar area (square area) and the other half standing within the Sun (circle area).
5. Have the students in the solar cell grasp onto the rope spacing themselves about 1/2 m apart. Have one end of the rope lie outside the cell and attach the bells to its end to represent the "load" that is being powered by the solar cell. Explain that the students in the solar cell are representing electrons, and the rope represents the wire that electrons travel along.
6. Explain that the students in the Sun are representing photons emerging from the Sun.
7. To begin the simulation, choose one photon to leave the Sun and tag the first electron at the end of the rope opposite the bells.
8. Never letting go of the rope, the "tagged" electron will then move up the rope to tag the next electron. That electron will then tag the next one, and so on until the final electron at the end of the rope has been tagged. Then he/she will ring the bell.
9. Meanwhile, other photons should leave the Sun in an orderly fashion, tagging the last electron and repeating the steps above to create a "chain reaction" that simulates a flow of current created by the photons of the Sun.
10. Continue until all photons have left the Sun.
11. Discuss the simulation with the students.

Conclusion

1. Are there extra photos in a real solar cell? If so, what happens to them?
2. What would happen if the photons entered the cell and did not connect with the wire?
3. What would happen if the photons stopped coming?
4. Explain what would happen if you put several solar cells together.
5. Explain how to simulate a cloudy day?
6. Draw a diagram that represents the simulation that you did.

Hydroelectric Power

As you read the paragraph, use the diagram below to trace the path of water and how it creates electricity. Answer the questions that follow.



Water can be used to make power or energy. Electric power made by falling water is called hydroelectric power. To make hydroelectric power, companies build dams to control the flow of water. The water stays trapped behind the dam until the gates of the dam are opened. As the gates open, the water rushes down and turns the wheels of a turbine. As the wheels turn, they drive machines that make electric power. This power is then sent through power lines to many places to light buildings, run machines, heat homes, and much more.

1. Must a dam be built to produce hydroelectric power? Why or why not?

2. Why is the power station located below the dam?

3. Explain what you think renewable energy means.

4. In what way would hydroelectric power be a renewable energy source?

Extension

Research hydroelectric power plants and identify the following information:
- location
- benefits of hydroelectric power
- total water used
- potential energy stored by the plant
- present day uses of the energy created by the plant
- any other items of interest

Hydroelectric Power Plants
Niagara
Itaipú
C. H. Corn
Grand Coulee
Chief Joseph
Hoover
Oroville

Check out the NASA "Why?" Files web site, **http://whyfiles.larc.nasa.gov** for helpful internet links to get you started!

Water Turbine

Purpose

To demonstrate the movement of a water turbine as used in a hydroelectric power plant.

Materials (per group)

science journal
2 sewing pins
felt tip pen
utility knife (boxer opener)
ruler
cork
scissors
glue
tape
plastic straw
cardboard 20 cm X 12 cm or larger
stop watch or clock

Procedure

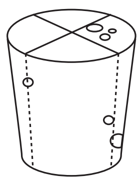


Diagram 1

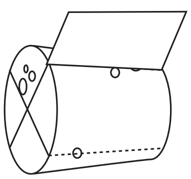


Diagram 2

1. Using a felt tip pen, mark two lines across the center of the top of a cork to create an X.
2. Use a ruler to draw the lines down the sides of the cork from the four points of the X. See diagram 1.
3. With Adult Supervision: Use a utility knife to score along the lines so that the cut is about 1cm deep.
4. From the cardboard, cut out four equal rectangles that measure 5cm x 3cm. Color one rectangle a dark color to contrast with the other rectangles.
5. Insert one rectangular cardboard piece into each cut along the cork. See diagram 2. If the cardboard does not stay firmly in the cut line, carefully place a little glue in the scored line area and then insert the cardboard, holding it firmly for about 30 seconds.
6. Place a pin at either end of the cork. The pins will be the axes for the turning motion of the cork.
7. Cut two 5-cm lengths of plastic straw and place on either end of the cork so that the pin sits inside the straw. This will provide stability and free motion of the cork. See diagram 3.
8. Holding onto the straws at each end, place the turbine you have created under a running stream of water such as a sink faucet. Observe how the cork spins as the water runs over the cardboard water wheel. Record your observations in your science journal and draw a diagram of your design.
9. Place the turbine under a steady stream of water and count the number of rotations in one minute. Record in your science journal.
10. Increase the flow of the water so that it is flowing just a little faster than before. Repeat Step 9 and record.
11. Decrease the flow of water to a trickle. Repeat Step 9 and record.

Conclusion

1. How did the number of rotations of the turbine differ with the various streams of water?
2. Explain why they differed.
3. If you were to design a hydroelectric power plant, how would this information help you?
4. Why would an engineer want to increase the number of rotations per minute of the turbine in a hydroelectric power plant?
5. Other than increasing the speed of water, is there any other way that you could increase the number of rotations per minute of the turbine? Explain.

Extensions

1. Create a hydroelectric power plant and use the water turbine you created as part of the design.
2. Change the size or shape of the cardboard pieces to determine what effect, if any, they will have on the number of rotations per minute of the turbine.

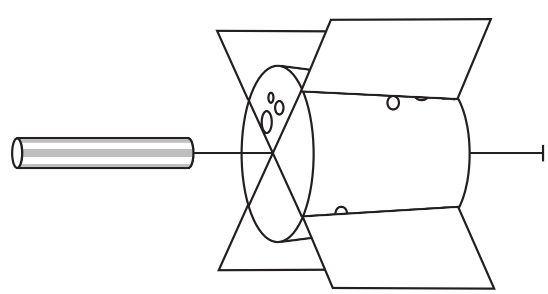


Diagram 3

Fun with Wind

Objective

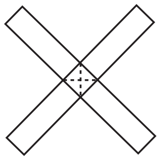
To give students experiences with exploring wind as a renewable energy source.

Materials

- 4 small paper cups (3-oz size)
- scissors
- ruler
- stapler
- push pin
- pencil with sharp point and eraser
- modeling clay
- dark colored marker
- 2 strips of corrugated cardboard each 22 cm X 5 cm
- science journal
- tape (optional)
- pie pan or cookie sheet (optional)

Procedure

Diagram 1.

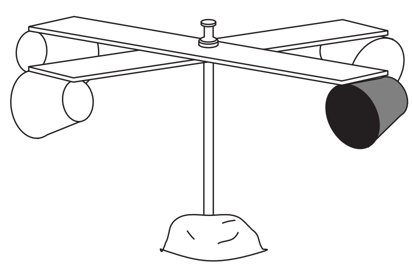


1. To create the cups for the anemometer, you will need to cut the rolled edges off to make the cups lighter.
2. Color the outside of one cup with a marker.
3. Using the ruler, measure 11 cm from one end of each cardboard strip and draw a line to mark the distance.
4. Line the two cardboard strips up on that line so that they make a plus (+) sign. (See diagram 1.)
5. In the middle section where the two strips overlap, use the ruler and pencil to draw lines from the outside corners to the opposite corners. These lines will create an "X." The exact center is where the lines intersect.
6. Push the push pin through the center of the "X" on the cardboard strips to connect them. Staple or tape strips in place.
7. Making sure that all the cups face the same direction, staple one cup to the end of each strip.
8. Place the push pin through the top of the pencil eraser. Check to make sure the cups spin freely by blowing on them. If they do not spin freely, then you may need to adjust the size of the hole in the cardboard. (See diagram 2.)
9. For a stationary model, you may place the modeling clay outside on a smooth surface and then insert the sharpened end of the pencil into the clay. If you would like a more mobile anemometer, you may want to place the clay on a smooth flat surface of an object, such as a pie pan or cookie sheet that can be transported from one place to another.
10. Your anemometer is now ready to use. You will need to go outside to an open area.
11. Your anemometer cannot measure wind speed in miles per hour, but it can give you an approximation of how fast the wind is blowing.
12. To measure the wind speed, place your anemometer in an open area and observe to see if your cups are spinning. If they are, then use your watch and count the number of times the colored cup spins around in one minute. This method measures the wind speed in revolutions (turns) per minute. Record your data in your science journal.
13. Repeat measurement in other areas of the playground/school yard. Record your data, keeping a chart of all the areas where wind was recorded.

Conclusion

1. Was it windier in some places on the playground than in others? Why or why not?
2. How would trees or buildings affect the speed of wind?
3. How do you think a wind turbine would compare to a water turbine at a hydroelectric power plant?
4. Would wind be a good source of energy? Why or why not?
5. Where would you build a wind turbine in the U.S.? Why?
6. Research renewable energy and discuss whether wind would be considered a source of renewable energy.

Diagram 2.



Teacher Background

Wind turbines are machines that change the movement of wind into electricity. They need a constant, average wind speed of about 14 mph before the wind turbines can generate electricity. In a wind farm there are a lot of turbines grouped together in windy spots of the United States. These wind farms provide an alternative source for energy and have some advantages over other conventional types of energy. Wind farms are located in three places in California: Altamont Pass, Tehachapi, and San Gorgonio. Have your students research wind farms. They might be surprised to find other locations that have wind farms!

Sun Cooking with a Chance of Rain

Purpose

Using solar energy, the students will discover how color affects the absorption of heat.

Procedure

1. Line the inside of the umbrella with Mylar* using tape to hold in place.
2. Place the umbrella outside in a sunny place around 11:00 AM. Make sure no shadows will be over the cooker.
3. Have the students explain how they think the umbrella cooker will get hot.
4. Ask the students if they think any particular spot on the umbrella will be hotter than other spots. Have them explain their reasoning.
5. Explain that the cooker will have a hot spot due to its shape.
6. To locate the hot spot, have the students move their hands around the perimeter and across the inside of the cooker until they find the hottest area. Once the hottest area is found, have the students raise their hands slowly until they reach the hot spot, which is usually really hot! They will roast their marshmallows at this spot.
7. Have the students choose 3 different colored marshmallows and 3 pieces of spaghetti.
8. Use the spaghetti to skewer each marshmallow.
9. Have the students take turns roasting each marshmallow and timing how long it takes. Record roasting times in science journal.
10. Eat marshmallows and discuss results.

Conclusion

1. What color roasted the fastest? Why?
2. If you were to build a solar cooker, what color do you think would be the best color to use to roast or cook food the fastest?
3. Did any color not roast? Why or why not?

Extensions

1. Design other types of solar collectors. Test to see which one will cook the fastest. Create a competition among groups.
2. Design a solar collector to hold water and test to determine how fast it will heat water by measuring water temperature in 15-minute intervals.
3. Solar energy is a renewable energy source that has many benefits for our environment. Have students research and discuss the benefits.

Materials

umbrella

enough silver Mylar* to line the inside of umbrella (collect used Mylar* balloons and cut balloons apart to use the Mylar* for lining)

tape

flavored marshmallows (they must be different colors)

uncooked thick spaghetti noodles

a clear sunny day

watch or stop watch

science journal

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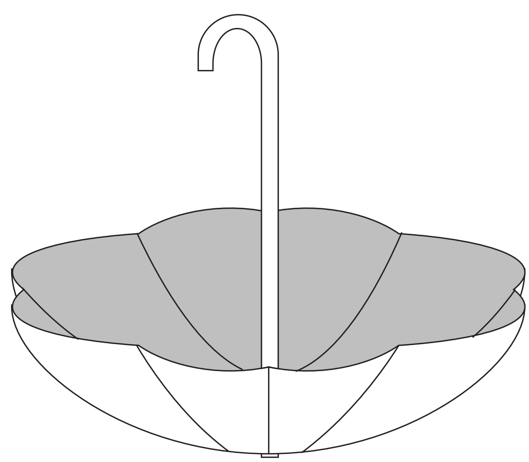

Teacher Background

Parabolic solar collectors collect the light rays of the Sun. Because the shape of the collector is parabolic, the light rays come together at a point above the collector. This point is called the hot spot, and that is why the students had to raise their hands up from the hottest area. The location of the hot spot will vary based on the location of the Sun.

The darker the color of the marshmallow, the faster the cooking time. Based on absorption of heat (darker colors absorb more heat), chocolate marshmallows will cook the fastest, while white marshmallows will never roast. The white color will not absorb enough heat to roast. As students discover darker colors absorb more heat, they should then be able to conclude that a solar cooker would work best if built from dark (black) colored materials.

Answer Key

Fruity Energy
1. Acidic—tends to form an acid, and acidic fruit will have a sour taste. Oranges, lemons, and grapefruits are acidic.
2. Yes
3. Answers will vary depending on fruit used.
4. Only some of the fruits were acidic.
5. Some were brighter than others.
6. Bulbs will glow brighter the more acidic the fruit is
7. Answers will vary.

Battery Tester
1. Answers will vary.
2. Some batteries may have been creating a stronger electrical current. Other factors might include the number of times the wire is wrapped around the compass, the type of battery tested, temperature, or the age of the battery.
3. The compass needle moves because of the magnetic field created by the flowing current through the wire wrapped around the compass.
4. It was necessary to wrap the wire around the compass to create a magnetic field strong enough to move the needle. The more wraps of copper wire around the compass, the more sensitive the battery tester.

Solar Cell Simulation
1. Yes. The materials in the solar cell absorb extra photons.
2. There would not be a flow of electricity created.
3. The solar cell would not create any power.
4. Several solar cells would create a stronger electrical current.
5. For a cloudy day simulation, some of the photons would scatter and not reach the solar cell, thus simulating the Sun's being reflected and absorbed by the clouds.
6. Drawings will vary.

Hydroelectric Power
1. Dams are built to hold large quantities of water that can be released as needed to create electricity. If a dam were not built, the flow of water would be too little to create a large amount of electricity. Dams also help to control the flow of water during seasons that do not have as much rain.
2. The power station is located below the dam so that the falling water will create a greater force, which will turn the turbines faster.
3. Answers will vary.
4. Water is considered a renewable source of energy, and students might explain the water cycle as part of their answer.

Water Turbine
1. With a slower stream of water, the turbine did not have as many spins in a minute as it did with a faster stream of water.
2. The spins differed because the water supplied the force to spin the turbine. If the water flowed faster, it had more force; therefore, the turbine would spin faster.
3. Answers will vary but should include that an engineer would want to design a hydroelectric power plant so that the turbines would spin the fastest. This might be due to the position of the turbines in relationship to the water falling, the amount of water in a river or released from a dam, or even the location of the plant.
4. Engineers would want to increase the number of revolutions in order to create more mechanical energy that could then be converted into electricity.
5. Answers will vary.

Fun with Wind

1-2. Answers will vary. A few reasons for possible windier conditions in some areas of a playground would be the lack of trees or buildings blocking the wind. Another consideration would be if there is an area that creates a "channel" that air flows through (space between two buildings). With a channel, the wind will flow faster as it is forced between the two structures.

3. Both have wheels that turn to create electricity.
4. Answers will vary. Wind is considered a good source of energy if you live in an area that has a sustained wind speed of at least 14 mph. Energy created by wind is clean and good for the environment.
5. Answers will vary.
6. Answers will vary.

Sun Cooking with a Chance of Rain
1. The darkest color should have roasted in the least amount of time because dark colors absorb more heat.
2. A dark colored one such as one made from black materials.
3. White will not roast because it cannot absorb enough heat. White is a reflective color, not an absorptive color such as black, brown, or other dark colors.

To There and Back
1. Answers will vary.
2. Answers will vary.