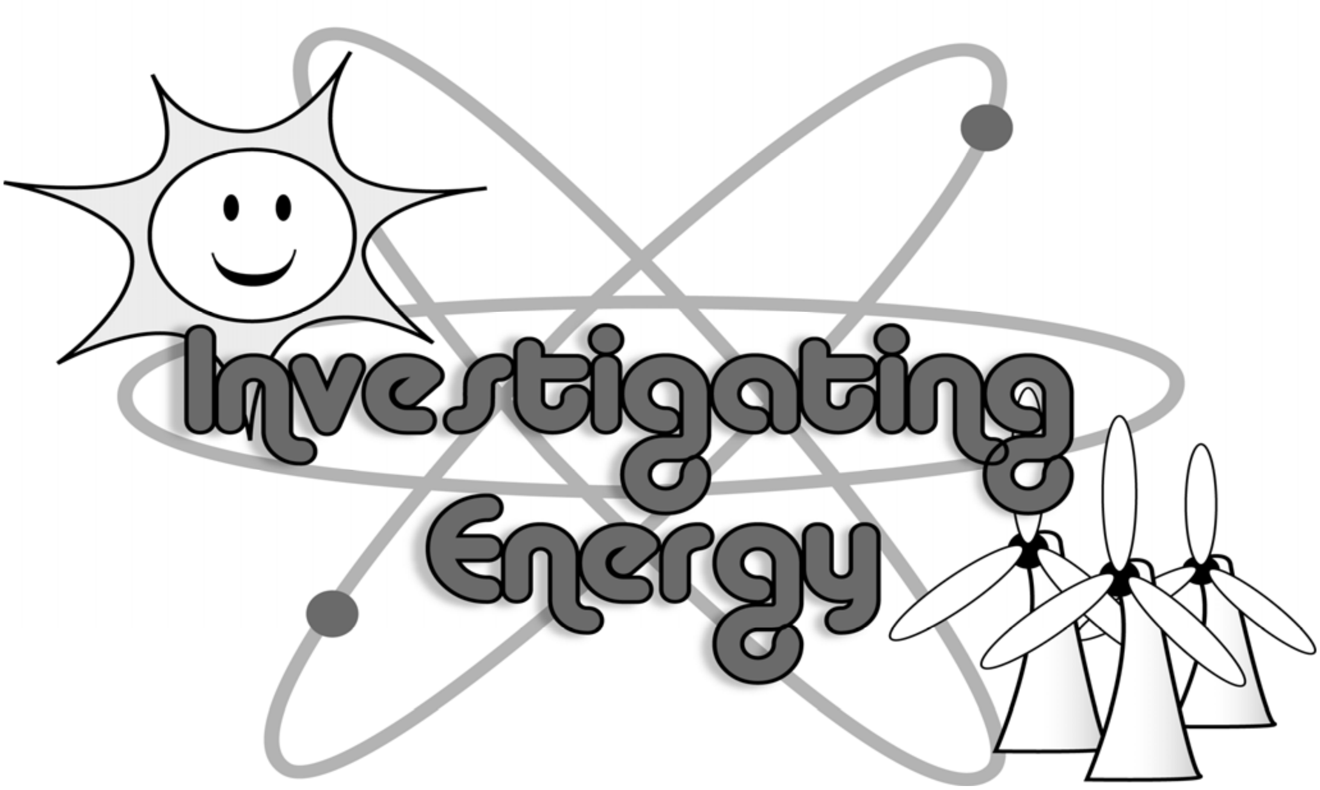


Thank you for inviting COSI on Wheels into your school! To enhance your students' experience, we encourage you to continue to explore the basics of energy in your classroom or home.

Extension Activities:

- Kinetic Art
- Snake
- Blowin' in the Wind
- Rollin' Rollin' Rollin'
- Plan It for the Planet
- Booklist

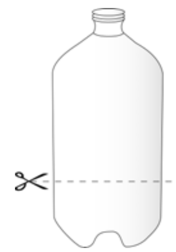
Kinetic Art

ACADEMIC STANDARDS: Science and Technology 1.2, 1.7, 1.8, 3.5; Physical Science 3.4

OBJECTIVE: To design and construct a working water wheel.

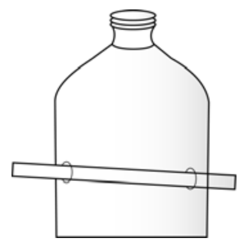
MATERIALS:

- Pop bottle (2 Liter)
- Scissors
- Screwdriver
- Wooden skewers or dowel rods
- Cake pan
- Pitcher
- Large nail
- Margarine tub lids
- Poster board or card stock
- Knife
- Crayons or markers
- Tape or glue
- Funnel
- Cork
- Hammer

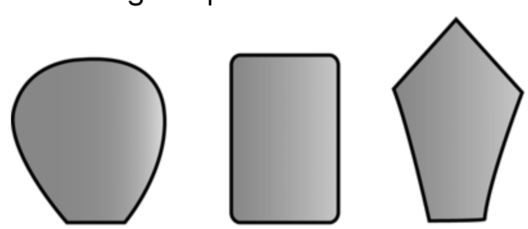


PROCEDURE:

1. Teachers, cut the bottom off the pop bottle so that it sits flat.
2. Punch two holes opposite each other midway up on the bottle with the screwdriver. Make sure the holes are large enough for the skewers to fit.

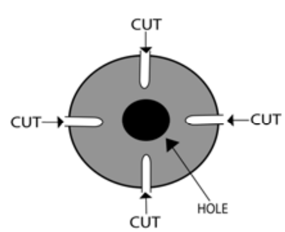


3. The skewer should fit in the holes with little friction and turn easily.
4. Have students draw patterns for the water wheel blades on paper, and decide what pattern they want to use.
5. Make sure that your blades will fit inside of the bottle when attached to the cork.
6. Students, cut the blades from the margarine lids following the pattern chosen.
7. The teacher will want to make a hole through the center of the cork with the large nail and the hammer.



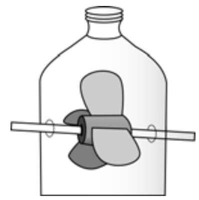
Sample Blade Designs

8. Cut four slits in the cork at even intervals. (The teacher may need to help with this part). Insert the blades into the slits.

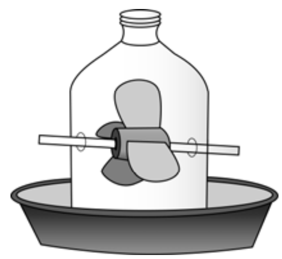


Kinetic Art (continued)

9. Slide the skewer through one side of the bottle, through the center of cork, and then through the other side of the bottle.



10. Set the bottle in the pan and pour water through the funnel into the bottle.



11. Students should design and test different blades for their water wheel to see what blade designs and placements work the best.

What Happened: How many times did your water wheel design change? Did everyone's water wheel work the same? Did they all run at the same speed?

Hydroelectric power uses the gravitational potential energy of water in a reservoir to create electricity. The reservoir is higher than the river flowing away from the dam, which means the reservoir water has more gravitational potential energy. As water is released from the reservoir through the dam, it falls, converting its potential energy into kinetic energy. Some of that kinetic energy is used to spin turbines, which turn generators, which produce electricity.

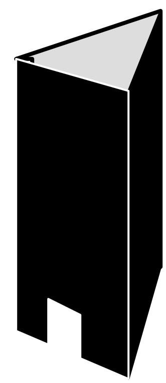
In this experiment the water in the pitcher has *potential energy* when you hold it over the funnel. Pouring the water turns the potential energy into *kinetic energy.* The blades in the bottle use this kinetic energy to spin the cork and skewer.

SNAKE[1]

ACADEMIC STANDARDS: Physical Science; K-2 C, 3-5 D & 3-5F

OBJECTIVE: To understand the transfer of heat energy to motion.

MATERIALS: Pencil & crayons or markers
Card stock
Scissors
Black poster board
Tape
Yarn or string
Hole-punch
Mug or pot of hot water



PROCEDURE:
1. Draw a snake on a piece of card stock large enough to fill the entire card stock.
2. Custom design and color your snake.
3. Cut out the snake and punch a hole in the center of its head.
4. Attach yarn or string through the hole and hang the snake in a place where wind won't make it move or spin.
5. Heat up a pot of water (not to boiling point).
6. Hold the hot water under the snake and observe what happens.
7. Make a solar tower with black poster board. Fold the poster board in thirds and tape it into a triangle with the black on the outside.
8. Cut a two-inch door in the bottom of one of the sides.
9. Place the triangle in the sun, hang the snake over it, and observe what happens.

WHAT HAPPENED: What made the snake spin? In what direction did it spin? What could you do to the snake to make it spin the other direction? What would happen if you positioned the snake farther away from the water or solar tower?

Because the gas molecules in hot air are moving more rapidly and are more spread out than the molecules in cold air, the hotter air is less dense and rises above the cooler air. As the hot air rises through the snake it presses on the bottom, causing the snake to turn. If the snake were flipped over it would twist in the other direction. A hole cut in the bottom of the solar tower provides airflow. If there were no hole in the bottom, cool air would be trying to go down into

[1] Sunny Snakes: Experimenting with Energy, Alan Ward

the tower at the same time the hot air was trying to get out. The black color of the tower allows it to absorb more of the heat energy from the sun.

Blowin' In The Wind[2]

Academic Standards: Physical Sciences K.4, K.5, 1.6, 1.9
Scientific Inquiry K.10, 3.5, 5.3

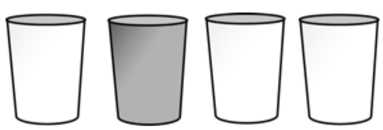
Objective: To create an anemometer to indicate the speed of the wind.

Materials:

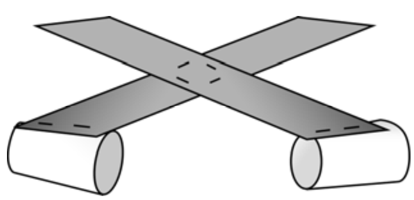
Scissors	4 small paper Dixie cups
Marker	2 strips of stiff corrugated cardboard (1-2" wide)
Ruler	Stapler
Push Pin	Unsharpened Pencil with eraser on end
Modeling Clay	

Procedure:

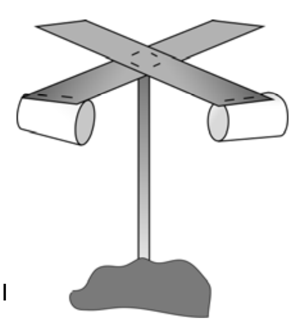
1. Cut the rolled edges off the paper cups to make them lighter.
2. Color the outside of one paper cup with the marker.



3. Cross the cardboard strips so they make a plus (+) sign. Staple them together.
4. Take the ruler and pencil and draw lines from the outside corners of where the cardboard strips come together to the opposite corners. Where the pencil lines cross will be the exact middle of the cross.
5. Staple the cups to the ends of the cardboard strips. MAKE SURE they all point the same direction.



6. Push the pin through the center of the cardboard (where the pencil lines cross) and attach the cross with the cups on it to the eraser point of the pencil. Blow on the device to make sure it spins.



[2] http://www.energyquest.ca.gov/projects/anemometer.html

7. Place the modeling clay on the base of the pencil so it stands straight.
8. Place the Anemometer outside on a base to watch changes!

Blowin' In The Wind (continued)

What Happened: Wind is air in motion. The uneven heating of the earth's surface by the sun produces wind. The air over land heats more quickly than the air over water. The hot air rises and cool air moves in to take the place of the hot air – wind in motion. This is how the sun makes the wind blow.

The wind moves the cups around the anemometer which simulates the effects of a wind turbine. The anemometers can give scientists an idea of how fast the wind is blowing. You can test changes in wind patterns by watching at different times of day, or placing it in different areas and elevations outside.

This anemometer cannot tell the wind speed in what we know of as miles per hour, but we can test it by watching the revolutions, or turns, to see how fast the wind blows. Count the number of times the colored cup moves around in an entire circle in one minute, using the watch. This will give you the number of revolutions per minute. A Meteorologist will use this idea to convert wind speed into miles per hour. Wind speed is important for wind turbines. It takes the turbines 14 mph of constant wind to generate any electricity. See if the anemometer changes in a windier spot outside. Do trees or buildings blocking the wind affect the amount of wind speed?

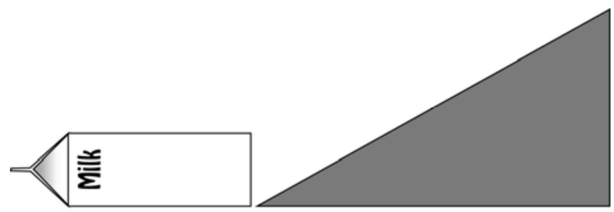
Rollin' Rollin' Rollin'[3]

ACADEMIC STANDARDS: Physical Sciences K.4, K.5, 1.6, 3.3, 3.4

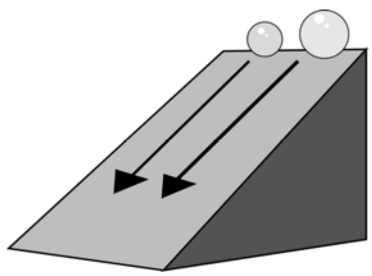
OBJECTIVE: To understand and observe the difference between potential and kinetic energy and the different amount of work done by each

MATERIALS: Three (3) marbles of different sizes
Inclined Plane
Ruler
Milk Carton

PROCEDURE:



1. Set up inclined plane and place the bottom section of a milk carton at the bottom of the ramp. This will be used to measure the distance that the marble moves the carton.
2. Set marbles on top of the ramp. What kind of energy is being used now?
3. Decide which marble has the most potential energy.
4. Hypothesize how many centimeters each marble will move the carton.
5. Roll each marble down the inclined plane and find the distance the marble's energy moved the carton.
6. Try different heights, different drops, and different planes to see other outcomes.



WHAT HAPPENED: The energy in the marble before it is dropped onto the plane is called potential energy, or stored energy. When the marble is dropped, it is called kinetic energy (energy in motion). Potential energy changes to kinetic energy as it rolls down the plane.

Try other sizes of marbles with this activity. Also, try other round objects; such as a high bounce ball, a grape, or a softball. Have students continue to hypothesize which objects will have the most kinetic energy. This is a very open-ended activity. Students and teachers may extend this project to many levels and many test scenarios for energy. Feel free to encourage students to take this a step further.

[3] http://www.ofcn.org/cyber.serv/academy/ace/sci/cecsci/cecsci187.html

Windmills

ACADEMIC STANDARDS: Physical Sciences K.4, K.5, 1.6, 3.3, 3.4

OBJECTIVE: Learners will explore wind energy. They will build their own windmill and see how energy from wind can be converted into a useable form.

MATERIALS:

- Construction Paper
- Shoebox
- 4' String
- Electric Fan
- Tape
- Straw
- Paper Clips

PROCEDURE:
Using the available supplies, students will construct a windmill and test various designs for blades and angles of the blades.

Constructing the Windmill:
1. Punch a small straw-sized hole through the shoebox.
2. Insert the straw through the hole to create the windmill shaft.
3. Attach the string to one end of the straw.
4. Have students draw 3-4 blades and cut them out using scissors.
5. Attach the blades to the straw.

Testing the Blades:

Place the windmill in front of the electric fan and observe how the blades are pushed by the wind energy. Try attaching a few paper clips to the string to determine how much weight your windmill can lift. How does changing the angle of the blades or a different design impact the results?

WHAT HAPPENED:
Windmill blades are designed to catch the wind and use its energy to do work. Old-fashion windmills often used sails constructed over wooden frames to control how much wind they captured: too little wind would not move the grinding wheels, but too much could destroy the windmill.

From this experience, participants will learn that some materials, shapes, and sizes work better to catch the wind than others, and quality of construction is important as well. They should also learn that it is vital to test and improve a design until it is the best it can be.

While they are thinking about their blade designs, encourage students to remember how their blades caught the wind, as well as the angle between their blades and the fan (wind). There are many different solutions to the angle that the blade faces the wind, and participants will most likely find a successful one if they are permitted to spend some time testing and repositioning the blades.

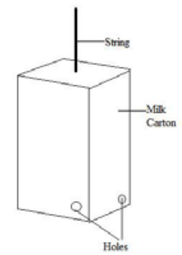
Water Motor

ACADEMIC STANDARDS: Physical Sciences K.4, K.5, 1.6, 3.3, 3.4

OBJECTIVE: Learners will explore how energy from moving water can be used. They will build a water "motor" which will allow them to see Newton's Third Law of Motion at work, as well as seeing the awesome power of water!

MATERIALS:

Paper Milk Carton
Scissors
Yarn/String
Tape



PROCEDURE:

Constructing the Water Motor:

1. Poke a hole through the top flap of the empty milk carton and use a string to suspend it from the ceiling.
2. Poke holes in the lower right corner of all four sides of the empty carton.
3. Keeping the holes plugged, fill the carton with water. Now open the holes and let the water flow out. You will see the carton rotate it in one direction as the water flows out.

WHAT HAPPENED:

According to Newton’s third law of motion, every action has an equal and opposite reaction. Hence when water flows out of a hole in the carton, it pushed the carton in the opposite direction. Since the holes are at the lower right corner of each face, this reaction forces the carton to spin in one direction. This is the basic working of a turbine too. Energy of flowing water is converted into rotational motion.

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PICTURE BOOKS

When Charlie McButton Lost Power by Suzanne Collins, 2004 — Picture Book COLLINS
A boy who likes nothing but playing computer games is in trouble when the power goes out and his little sister has all of the batteries in the house.

Miss Fox's Class Goes Green by Eileen Spinelli, 2009. — Picture Book SPINELLI
The students in Miss Fox's class help keep the planet healthy by turning off lights when leaving a room, taking shorter showers, and using cloth bags instead of plastic ones.

NONFICTION

Energy by Chris Woodford, 2007. — j333.79 W887e
This book covers everything from temperature to food, nuclear and solar power, fossil fuels, propulsion, and other related topics.

Why Should I Save Energy? By Jen Green, 2005. — j333.7916 G796w
A power outage gives Robert the opportunity he needs to teach his friend and her family about the limited sources of energy, what would happen if energy supplies ran out, and some of the ways in which they can all help conserve energy.

Energy Makes Things Happen by Kimberly Bradley, 2003. — j531.6 B811e
Different forms of energy are explained in this simple, fun activity book that encourages budding scientists to conduct their own experiments.

Excited About Energy by Nadia Higgins, 2009. — j531.6 636e
This book explains the different types of energy and explores the sun, fuel, how energy changes, and other related topics.

What is Energy? by Richard Spilsbury, 2008. — j621.042078 S756w
Packed with fun activities, this book explores what energy is, as well as the different types of energy such as heat, electricity, and more.

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