More Power to You!

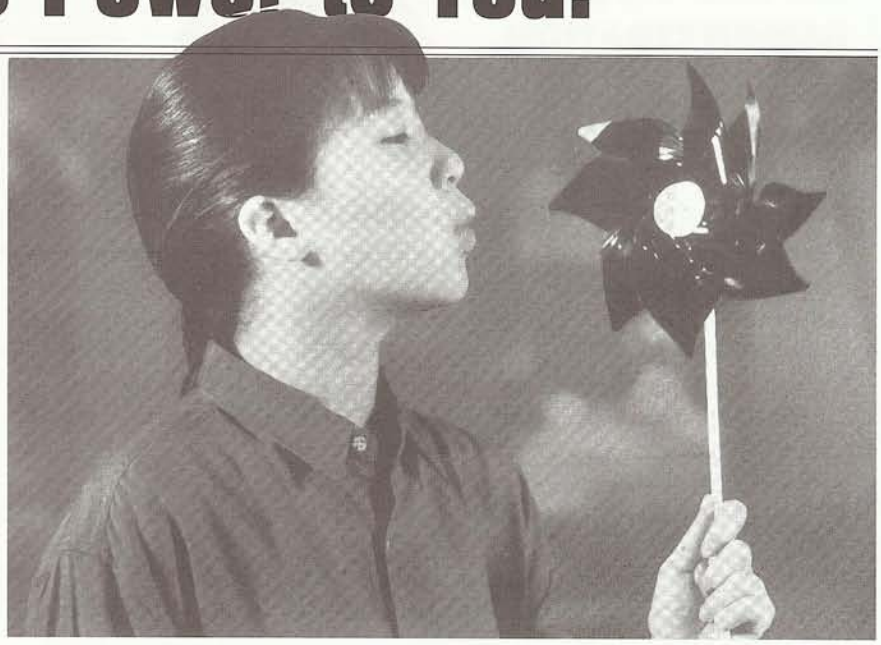
main ideas

- **A magnet moved past a wire–or a wire moved past a magnet–generates an electric current.**
- **A generator is a coil of wire moving inside a magnet.**
- **It takes energy to move a coil of wire in a generator.**
- **A variety of energy sources can be used to operate genera tor–sfalling water, wind, and steam from burning fuel.**

background information

In 1831, English scientist Michael Faraday discovered that a magnet moved through coiled wire generated electricity. Today, most commercial power plants use a similar procedure, only on a larger scale. Steam turns a fanlike device (turbine) connected to a shaft that turns a coiled wire inside large magnets.

Fossil-fuel power plants and nuclear plants use steam to turn the turbine. Hydroelectric plants use the force of falling water. Other power systems use wind or solar energy to create electricity.



PROGRAM SYNOPSIS

SCENE 1 **A Magnetic Personality** *2:50*
Cast member Stephanie generates a little electricity by moving a magnet past a wire. She generates even more by hand-cranking a small generator enough to illuminate a light bulb–but discovers that kid power isn't a very efficient way to provide electricity!

SCENE 2 **Water Works** *1:00*
Outside Las Vegas, cast member Kathy visits Hoover Dam. It notonly provides water for the city but also generates most of the electricity used in the area. A short animation shows kids how this hydroelectric plant works.

SCENE 3 **It's a Breeze!** *1:00*
Miguel investigates a "wind farm"in California where a series of windmills use moving air to generate electricity. As the blades on the windmills move, they turn the shaft that turns the wire inside an electric generator.

SCENE 4 **Getting Steamed Up** *:50*
Stephanie's interested in all the ways you can turn a wire in an electric generator. Flowing water and wind are good sources, but what else will work? Steam? How do power plants get steamed up?

SCENE 5 **Full Steam Ahead** *3:40*
At a fossil-fuel power plant, cast member Robin learns how water, converted to steam in a boiler, turns a turbine. The turbine drives the generator that creates electric current.

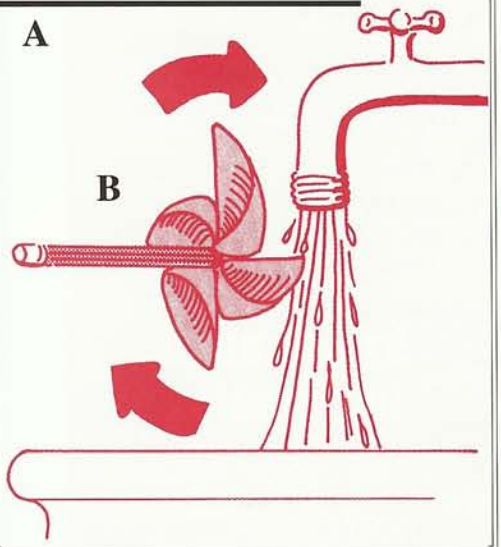
SCENE 6 **Mirror, Mirror** *1:50*
In the California desert, cast member Miguel visits Solar One, a power plant that uses mirrors to reflect sunlight and focus it to heat water in a boiler. Steam made by the heated water turns a turbine connected to a generator.

BEFORE-VIEWING DEMONSTRATION

MATERIALS:

- **plastic-coated paper plate**
- **scissors**
- **tape**
- **pencil**
- **hot plate**
- **teakettle**
- **measuring cup**
- **sink with running water**

A



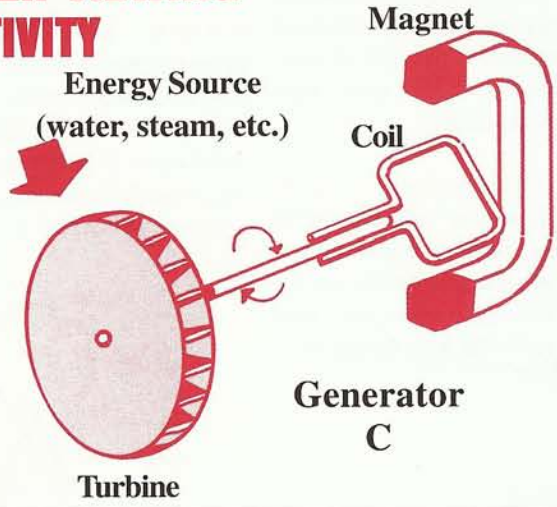
B

1. Cut slits in the plate, fold, and tape to create a pinwheel. (Figure A)
2. Push pencil through the center of the plate and work pencil until wheel turns easily.
3. Pour 2 cups of water into teakettle and heat on the hot plate.
4. Ask kids how they could make the wheel turn. (blow on it; flip it with fingers; etc.)
5. Demonstrate suggestions. Turn, or power, the wheel by moving air, by hand, etc. Then carefully hold the wheel above steam rising from the boil ing water on the hot plate to show that the wheel can be steam–powered too.
6. Ask if the wheel can be powered by water, then go to a sink and prove it can. (Figure B) Ask what really is powered by water. by moving air? by steam?

TUNING IN

Point out to kids that even a small town requires an enormous amount of energy. Let students speculate on what kind of energy source could provide that much electricity. Then have kids watch the video to find out. STOP Pause at the end of Scene 1 and discuss Stephanie's procedure for generating electricity. Ask kids why her way isn't very efficient, then start the tape again.

AFTER-VIEWING ACTIVITY



C

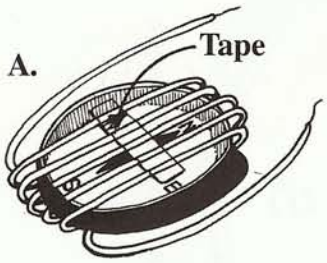
Copy this power-plant drawing (Figure C) on the chalkboard. Discuss how the coil of wire moves within the magnet. Have kids copy the diagram, label each power-plant part, and write a simple explanation of how the device works.

Ask kids to name four energy sources in the video–besides Stephanie–that were used to generate electricity. (water, steam, sun, wind) What's a turbine? (a fanlike device that drives a generator) What was used in the hydroelectric plant to turn the turbine? (falling water) in the fossil-fuel and nuclear plants? (steam) How does a wind generator work? (Air powers fan blades that turn the generator.) How does Solar One use mirrors to generate electricity? (Mirrors focus sunlight to heat water and create steam to turn the turbine.)

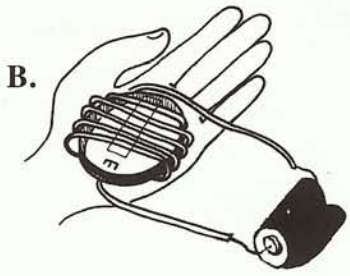
PURPOSE

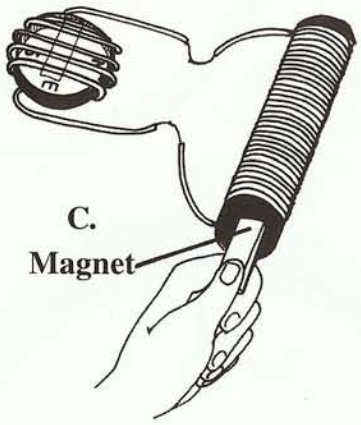
To have kids generate electricity by moving a magnet through a coil of wire.

MATERIALS:
(per 4 students)
- *15 meters of thin copper wire*
- *scissors*
- *compass*
- *tape*
- *sandpaper*
- *D battery*
- *paper tube*
- *strong bar magnet*



Current Tester





WHAT TO DO:

1. Divide kids into groups of 4, and distribute materials and copies of the activity sheet, "Eye on the Needle."
2. Ask each group to cut off 50 cm of wire, sand the ends to remove any insulation, then wrap the wire 5 or 6 times around the compass–leave about 12 cm on each end–and tape it to the compass. (Figure A)
3. Explain that this current tester can check for the presence of electric current. Let one group member hold the compass with the needle pointing parallel to the wire, then connect the 2 wire ends to the battery. (Figure B)
4. Ask all group members to record on their activity sheets what happened to their compass needle.
5. Have groups wrap the rest of their wire around their paper tubes 50 times–leave about meter of wire at each end–cut the wire, then twist the ends together with the current tester's ends. (Figure C)
6. Make sure needles are parallel to coils, then have kids move magnets back and forth inside the 50-turn tubes as shown below and record what happens. (If kids have problems, make sure connections are secure.)
7. Have each group disconnect 1 wire from the current tester, twist together one end of leftover wire and one end of the wire wrapped around the tube, then wrap the leftover wire 50 more times around the tube.
8. Let kids reconnect wires to their current testers, move the magnets back and forth in the 100-turn tubes, then record what happens to their needles.

Kids' results will vary, but should look something like this.

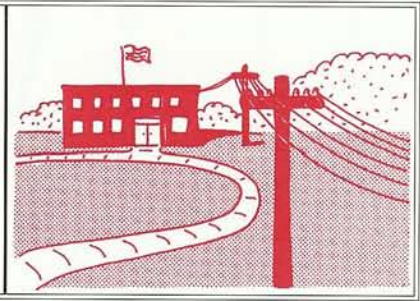
Step 4 **Step 6** **Step 8**

Discuss the experiment. What made the needle move when the battery was attached to the wires? (electricity generated by the battery) when the magnet moved through the tube-coil? (electric current generated by the magnet and wire) Why did the needle move more with the battery than with either the 50-turn or 100-turn coil?
(Batteries produce more electricity.)

CURRICULUM CONNECTIONS

SOCIAL STUDIES

Have kids find out what kind of generator supplies electricity to your school. Invite a local utility company spokesperson to speak to your class, or take kids to visit the company to see how electricity is produced for schools, businesses, homes, and streets in your area.

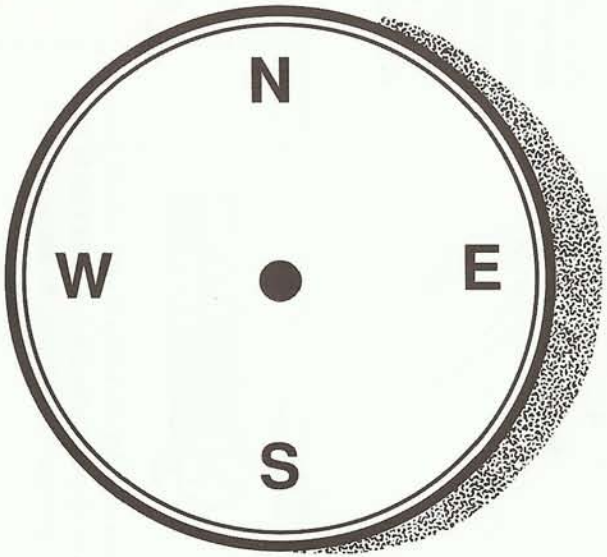


Name:_____

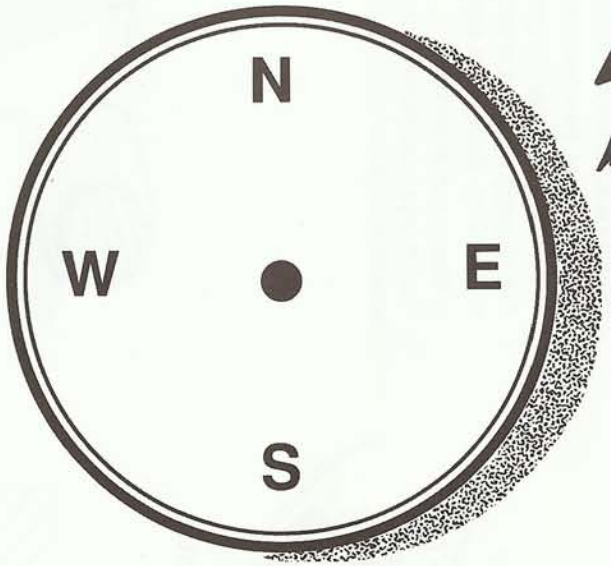
Date: _____

EYE ON THE NEEDLE

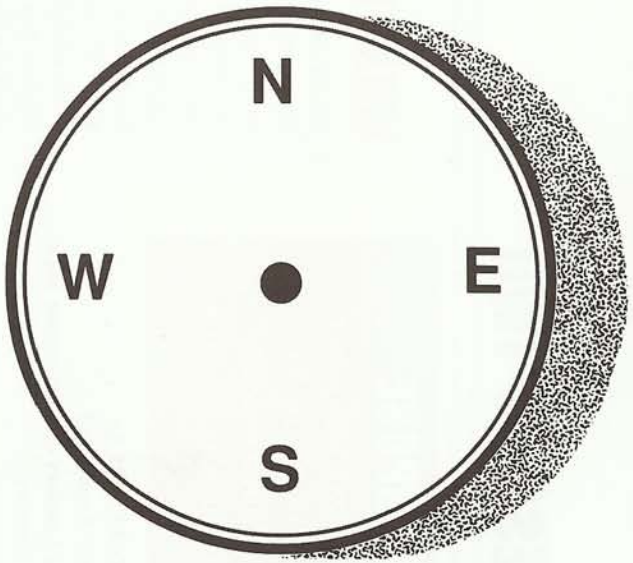
Draw where the needle pointed when....



...wires were connected to the battery.



...the magnet moved through the 50-turn coil.



...the magnet moved through the 100-turn coil