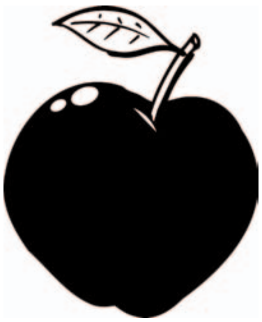


Experiencing Energy

Teacher's Extension Activities

Grade 5 – Conservation of Energy

Energy and Control Strand

Presented by:

ONTARIO POWER GENERATION

ACKNOWLEDGEMENTS

A note of appreciation is extended to all those who helped to create the original Junior Program for Ontario Power Generation. It is from their groundwork that this program has been developed.

Kathleen McGill – author

Each activity has clear, concise directions. Any cautionary information is stated. While every precaution has been taken to ensure fun and safe experiments, nothing substitutes for supervision and common sense. Ontario Power Generation assumes no responsibility for the misuse or mishandling of materials provided in this program.

EXPERIENCING ENERGY
GRADE 5 CURRICULUM CONNECTIONS

This interactive presentation is designed to meet expectations outlined in the new Ontario Curriculum for **Grade 5 Science**. Organized by strand and topic, the following outline lists specific expectations which are met by participating in this interactive demonstration:

Energy and Control – Conservation of Energy:

- ☑ Distinguish between a renewable and a non-renewable source of energy;
- ☑ Investigate ways energy can be stored for later use;
- ☑ Describe how energy is stored and transferred in a given device or system;
- ☑ Recognize that energy cannot be created or destroyed but can only be changed from one form into another;
- ☑ Use appropriate vocabulary, including correct science and technology terminology, in describing their investigations and observations;
- ☑ Compile data gathered through investigation in order to record and present results, using tally charts, tables, and labelled graphs produced by hand or with a computer;
- ☑ Communicate the procedures and results of investigations for specific purposes and to specific audiences, using media works, oral presentations, written notes and descriptions, drawings, and charts.
- ☑ List various sources of energy and identify them as renewable or non-renewable;
- ☑ Describe the advantages and disadvantages of using renewable energy sources as opposed to non-renewable sources;
- ☑ Identify factors that determine how effectively and economically a device can transform one form of energy into another;
- ☑ Explain how humans rely on energy transfers from a variety of products and systems to survive.

Experiencing Energy
Grade 5 Curriculum Connections (continued)

Life Systems – Human Organ Systems:

☑ Describe the relationship between eating habits, weight, height, and metabolism.

Matter and Materials – Properties of and Changes in Matter:

☑ Identify the three different states of matter – solid, liquid, and gas – and give examples of each state;

☑ Recognize, on the basis of their observations, that melting and evaporation require heat;

☑ Identify melting, freezing, condensation, and evaporation as changes of state that can be reversed;

☑ Identify and describe some changes to materials that are reversible and some that are not.

Many expectations are also met in other areas of the new Ontario Curriculum for **Grade 5**. In **Mathematics,** the **Data Management and Probability** strand contains the following specific expectations which are also met by participating in this interactive presentation:

☑ Display data on graphs by hand;

☑ Explain the choice of intervals used to construct a bar graph or the choice of symbols on a pictograph;

☑ Construct labelled graphs by hand;

In **English**, the **Oral and Visual Communication** strand contains the following specific expectations which are also met by participating in this interactive presentation:

☑ Use vocabulary learned in other subject areas in a variety of contexts;

☑ Contribute ideas to help solve problems, and listen and respond constructively to the ideas of others when working in a group.

IDEA PAGE

Have the students write a biography of a significant figure in the history of energy and its related fields. Have them research different events and discoveries associated with the scientist (see list of scientists' names found in this guide). Afterward, have the students design a time line based on the dates of the many discoveries of these figures. Students can then present their research orally in the sequence of the time line. Bind your students' reports into a book and add it to your classroom library.

Further to your students' studies on Greece and Greek myths, have the students write their own myths, incorporating the power of the sun, moon, wind and/or water.

A delicious way to explain the principles of energy to your students is to pop some popcorn with them! Popping corn illustrates that energy cannot be created nor destroyed, but it can change forms. Have the students examine the popcorn kernels. Ask them to observe the size and texture of the corn. Explain the kernels represent "potential" energy. Popcorn kernels have water in them. Ask the students to predict what will happen when it is heated. The energy correlations are endless. Talk about the heat energy of the stove; the light energy of the burners; the mechanical energy of the popping corn; the sound energy of the kernels popping; the chemical energy stored in the body after you eat the popcorn, etc. Enjoy!

In these times of fiscal restraint, have the students create their own galvanometers. Each student will need: a simple compass and 120 cm of insulated copper wire with bared ends (rolls of wire can be found at hardware or electronics stores). You will need: a wire stripper (to cut the lengths of wire and to strip the insulation off the ends), and enough electrical tape for all the students. To make the galvanometer, have the students wrap the wire around the compass at least 8 times leaving about 12 cm of wire left over on each end. If the wire slips off the compass, use the tape to hold it on. Touch each end of the wires to each end of a battery (at the same time). The needle will move if there is still electricity in the battery. This galvanometer can be used to test the simple battery the students can make following the experiment found further on in this guide.

FAMOUS ENERGY SCIENTISTS IN HISTORY

DATE	PERSON	LOCATION	DISCOVERY
100	Hero of Alexandria	Greece	First recorded person to use steam power to power small toys.
1556	Georgius Agricola	Germany	First to write about water-wheel-driven mining pumps.
1764	James Watt	England	Invented the separate condenser steam engine: the “watt”, a unit used to measure the rate at which work is done, is named for him.
1800	Thomas Young	England	First to use the word “energy” in its scientific sense to describe the energy of moving objects.
1829	Gustav-Gaspard de Coriolis	France	Came up with the modern idea of kinetic energy.
1840	James Joule	England	Proved that heat, a form of energy, is created in an electrical circuit; the “joule”, a unit to measure energy, is named for him.
1853	William Rankine	Scotland	Came up with the modern idea of potential energy.

Extension Activities

The students have had a chance to build a telegraph machine and send messages across the table to each other. The real test of a good communication device is to be able to send messages over a long distance. Challenge your students to build a telegraph system that could work between classrooms at a distance of more than 25 feet.

Do advertisers really tell the truth? Have your students challenge the claims of various battery companies by creating a test to find out whose battery lasts the longest. Ensure they identify any variables that need to be held constant to ensure a fair test. Using a flashlight as a tester, buy all types of batteries: different brands, alkaline, carbon, etc. Test how long it takes for each cell to run out and graph the results.

Have the students write a biography of a significant figure in the history of electricity and its related fields. Have them research different events and discoveries associated with the scientist (see list of scientists' names found in this guide). Afterward, have the students design a time line based on the dates of the many discoveries of these figures. Students can then present their research orally in the sequence of the time line. Bind your students' reports into a book and add it to your classroom library.

Have the students write an "atomic diary". Ask them to write about a day in the life of an electron. What's it like to be an electron when it's static electricity or are there differences if it's current electricity?

Using the map entitled Power Generation in Ontario as a guide, have the students identify the different ways electricity is generated in our province (fossil fuel, nuclear, wind, natural gas, hydroelectric). Have the students state whether the sources are renewable or non-renewable and then evaluate the advantages and disadvantages of each.

Extension Activities (continued)

Make an Electrifying Card Game! Have the students research as many circuit symbols as they can find. Using poster board cut out at least 20 cards (10 cm x 15 cm). On these cards, have the students write the NAME of the symbol on one side, ex. Cell, Battery, etc. You may have to repeat the names if your class cannot find 20. These are your "Name" cards. Using another poster board of a different colour, DRAW the symbols, ensuring you draw only the symbols that have a match in the Name cards. These are your "Symbol" cards. One player uses the Name cards and another player uses the Symbol cards. The players each turn over the top card from their piles. If the cards match, the first player to shout "ZAP!" keeps the two cards. If the cards do not match, put them face down to one side in separate Name and Symbol piles. When all the cards have been turned over, the player with the most matches, wins.

Have the students develop an experiment to test the conductivity of various solids and liquids.

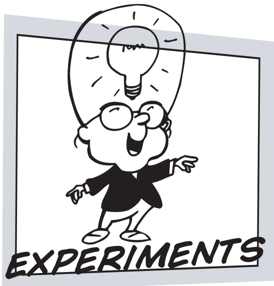
Here's a suggestion: When trying to evaluate whether a student truly understands series and/or parallel circuits, give the student a sheet explaining what results you want and all the equipment needed to put the circuit together, except the battery. Keep the battery in your pocket and test the student's circuit when they call you over. This shows you if the student truly understands because they do not have the battery to use for troubleshooting.

Extension Activities (continued)

- Ask the students to write a story about what it would be like to have no electricity. Have the story begin with this sentence:

  "The strangest thing happened today – when I woke up there was no electricity anywhere…."

- Ask the students to list at least 10 things around their home that use electricity, then challenge their mother or father to add the same number of new items to the list.
- Ask the students to count all the electrical outlets and light switches in their homes. Create a classroom graph to illustrate their findings.
- All electrical plugs have at least two prongs. Have the students research and explain the purpose of the third prong.
- Have students brainstorm lists of home safety problems caused by faulty or improperly used electric circuits. Then have the students research and list the proper safety procedures for solving those problems.



BATTERY POWER

Your Challenge:

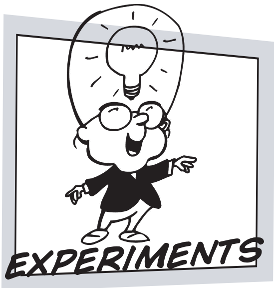
To see that a battery you create contains stored energy.

You Need:

- Five dimes
- Five pennies
- Thick paper towel (blue shop towel works best)
- Two insulated copper wires with ends bared (15 cm)
- Electrical Tape
- Lemon juice concentrate
- Galvanometer
- White vinegar in a bowl

Do This:

1. Clean the five pennies and the five dimes in concentrated lemon juice.
2. Cut the paper towel into nine one-inch squares.
3. Soak the paper towel squares in the bowl of vinegar.
4. Stack the coins and paper towel squares using the following pattern: dime, paper towel, penny, paper towel, dime, paper towel, penny, paper towel, and so on until you have stacked the 10 coins. When you are finished you should have a dime on the top and a penny on the bottom of your stack.
5. Make terminals for your battery by holding the bared end of one copper wire against the dime and the bared end of the other wire against the penny. Using the electrical tape, tape the wires and the entire battery together lengthwise.
6. Test the battery for potential electrical energy by touching the terminal wires of the battery to the wires on your galvanometer. The needle will move if electricity is present.
7. How many pennies and dimes do you need stacked together to get a small 2.5V light bulb to light?



KEEP OUT!

Your Challenge

To create a burglar alarm to keep people out of your bedroom.

You Need

- Aluminum foil
- Two paper fasteners
- Two sheets of stiff cardboard (25 cm x 35 cm)
- Sponge foam
- Two long pieces insulated wire with the ends bared (40 cm)
- One short piece insulated wire with the ends bared (15 cm)
- Two 1.5V batteries and holder
- Electrical tape
- 2.5V light bulb and light socket or buzzer
- Scissors
- Glue

Do This

1. At the corners of both sheets of cardboard, glue a piece of sponge foam. In the middle of both sheets, glue a piece of aluminum foil about 8 cm x 10 cm.
2. Force a paper fastener through each piece of foil and open up the arms on the other side of each sheet of cardboard.
3. Wind the bared ends of the two long pieces insulated wire around the open arms of both paper fasteners. Attach the other ends of the wires to the batteries and the buzzer or bulb in its holder. Then connect the batteries to the bulb or buzzer with the short wire to make a circuit.
4. Lay one sheet of cardboard on top of the other and place both sheets under a mat or carpet outside your bedroom door. Check that the alarm works by stepping onto the carpet above the cardboard “switch”. Also check that the alarm stops when you step off the carpet.
5. Your alarm is now set to go off whenever someone comes into your room.

FUN WITH ENERGY WORDSEARCH

I	A	C	F	X	J	L	N	R	V	E	F	L	U	O	R	E	S	C	E	N	T	B	D	S
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S	P	P	C	X	Y	A	U	I	M	J	V	E	Y	O	I	L	Z	C	O	A	L	L	F	A
U	T	H	D	L	E	C	I	T	R	S	M	L	I	G	H	T	B	A	L	B	A	S	Q	T
L	C	E	Y	U	R	R	N	D	Z	C	T	U	R	B	I	N	E	Z	N	C	A	L	N	I
Z	P	A	S	D	L	A	A	C	E	D	C	O	E	E	P	K	R	B	I	G	R	E	O	N
T	I	V	O	N	R	S	R	I	M	N	G	Q	U	I	I	C	K	R	L	I	C	Q	R	O
N	U	Y	U	N	D	O	U	F	R	W	O	O	D	N	Q	M	T	A	E	S	N	M	T	R
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S	X	J	Z	Q	E	N	E	R	G	Y	R	Y	A	W	U	V	Y	J	F	O	O	R	M	L
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Q	Z	G	E	N	E	R	A	T	O	R	E	E	A	D	L	T	R	H	J	D	G	I	F	X

Search For The Following Words:

chemical
coal
electrical
energy
fluorescent
generator
heat

heavy water
hydroelectricity
incandescent
kinetic
light
liquid
magnet

mechanical
natural gas
nuclear
oil
potential
solar
solid

sound
steam
turbine
uranium
water
wind
wood

FUN WITH ENERGY WORDSEARCH

(Answers Key)

I	A	C	F	X	J	L	N	R	V	E	F	L	U	O	R	E	S	C	E	N	T	B	D	S
R	Z	Y	M	Q	Z	P	M	A	G	N	E	T	T	A	H	K	U	A	O	V	B	W	F	R
S	P	P	C	X	Y	A	U	I	M	J	V	E	Y	O	I	L	Z	C	O	A	L	L	F	A
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Q	Z	G	E	N	E	R	A	T	O	R	E	E	A	D	L	T	R	H	J	D	G	I	F	X

Search For The Following Words:

chemical
coal
electrical
energy
fluorescent
generator
heat

heavy water
hydroelectricity
incandescent
kinetic
light
liquid
magnet

mechanical
natural gas
nuclear
oil
potential
solar
solid

sound
steam
turbine
uranium
water
wind
wood