

Flowing Electrons

Science Standard IV:

Students will understand features of static and current electricity.

Objective 2:

Analyze the behavior of current electricity.

Intended Learning Outcomes:

1. Use Science Process and Thinking Skills
3. Understand Science Concepts and Principles
4. Communicate Effectively Using Science Language and Reasoning

Content Connections:

Language Arts VII-6

Science
Standard
IV

Objective
2

Connections

Background Information

In order to create a current, electrons jump continuously from one atom to another. Show a model of an atom and locate the position of the electrons.

Invitation to Learn

Hold a D-cell battery up for the students to see. We are going to discover how electricity flows by playing a game called *Flowing Electrons*. Students become an electron moving in a circuit.

Instructional Procedures

1. Students sit in a large circle. Each person is given a Styrofoam ball representing an electron. Their hands are atoms, and the circle represents a pathway, or wire, that the electron must travel on.
2. The teacher positions herself between two students, with the box holding the extra electrons to the teacher's left. On the box (battery) is a + sign at one end and a – sign at the other end, representing the two ends of a real battery.
3. With the command of "pass," students pass the electron to their right with their right hand. At the same time, students receive an electron with their left hand. The teacher takes electrons from the box. The student to the teacher's left passes electrons into the box. Interject the word "and" between the word "pass" as students move the ball from the left hand to the right, thus being ready to hand the ball to the person on the right with the next command of "pass." Don't drop the balls. Students can't pass unless they receive at the same time. A person may never have more than one ball in each hand at a time.

Materials

One per student

- ☐ Two-inch Styrofoam balls
- ☐ *Battery Book Cover* handout
- ☐ Four sheets of bond paper

4. Balls can't be passed unless the receiving student is directly to the right of the passing student.
5. To play, students pass an electron with the command "pass." They are acting out current electricity. The teacher's command turns the flow of electricity on and off.
6. To add a bulb, one person is chosen to represent a light bulb in the line. When he receives an electron, he runs around the desk before passing to the next person in line. The student must then run back around the desk to receive the next electron. After a few times of the student running, ask him how he feels. He should be getting warm. Tell the students that the light bulb offers a resistance to the flow of electrons, and is called a *load*. Anything that uses electricity is a load. It slows the flow down, so the bulb heats up and lights up.
7. Introduce a *switch* by having three students sitting by each other. At the command "off," move forward so they can't receive or pass electrons. This is called an *open switch* because the wire has been interrupted. Switch it on again or close the switch so the electrons can flow in a circuit.
8. Repeat the activity; this time students explain. Students return to their seats.
9. Give each student a wire, bulb, bulb holder, battery and a switch. They are to make:
 - a complete circuit.
 - an incomplete circuit.
 - a closed circuit with a bulb.
 - an open circuit with a bulb.
10. After creating the different types of circuits, students design a *Battery Book Cover* (p. 8-24) and label it *Energy Sources*. Cut it out and trace around it on four sheets of paper so students may have a battery-shaped book. Staple the pages together at the top. On page one, draw a *complete circuit*. Label the parts. Include the vocabulary words *pathway*, *load*, and *power source*. On page two, draw an *incomplete circuit*. Explain why it doesn't work. Label the drawing. Draw a *closed circuit with a bulb* on page three, and an *open circuit with a bulb* on page four. Label the parts on both pages using the vocabulary words. Include the word *switch* on the last two drawings. Explain the difference between an open circuit and an incomplete circuit. Add any reflections on the last page about any new discoveries about circuits.

Possible Extensions/Adaptations/Integration

- Give each student a Kit Kat that has a foil component to the wrapper, a light bulb, and a battery. Have him/her make the bulb light four different ways.
- Students write testable questions about other areas they want to experiment with and present their list to their teacher for approval and a supply of materials. Proceed with further experimentation.

Assessment Suggestions

- Students learn *How to Make An Electric Puzzle* (p. 8-25) and are quizzed on what they learned in the electricity unit. Have students write ten questions with answers and cut them into two strips or use the *Electricity Puzzle Pieces* (p. 8-26). Place the questions in one pile and the answers in another. Using a piece of cardstock, center the circuit board worksheet and glue down. Punch ten holes on each side by each question and each answer. Place a paper clip over each hole (to hold their questions and answers) and insert a brad. Flip the cardstock over and attach wires to the brads from the back of the matching questions and answers. Wire ends should be stripped of insulation covering about 1 inch on each end before wire is wrapped around brads.
- To test the puzzle, unbend a paper clip. Secure it to the positive end of the battery using a wide rubber band. Place a wire with the copper ends exposed to the negative end of the battery and tape it down with masking tape. Wrap the other end of the wire around the metal connection on the bulb. Touch the end of the bulb to the question side and the paper clip to the answer side. When the bulb lights, you have a match.

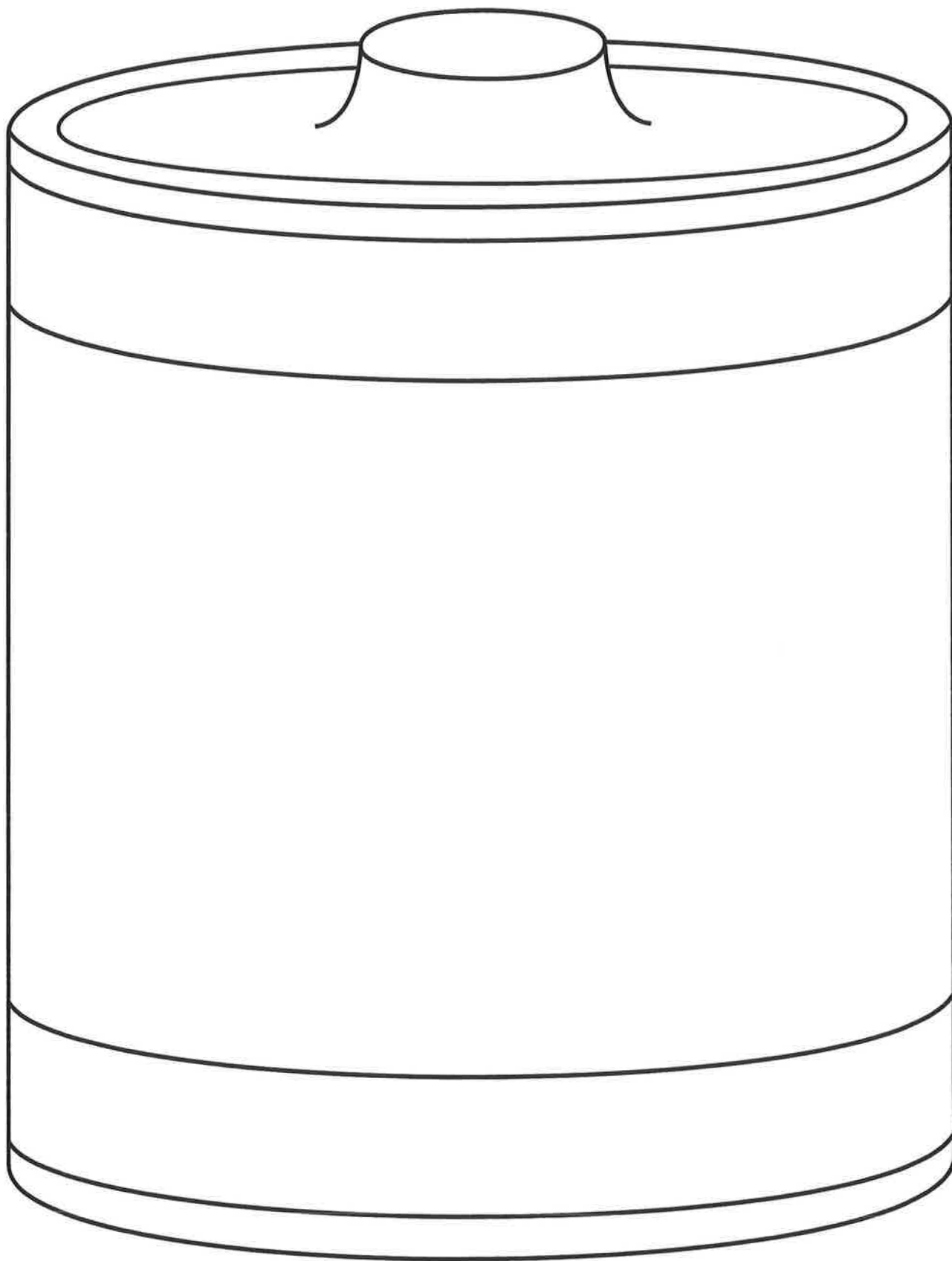
Additional Resources

Electricity, by Ron Marson (Tops Learning Systems,
<http://www.topscience.org/order.html>); ISBN 0-941008-32-0

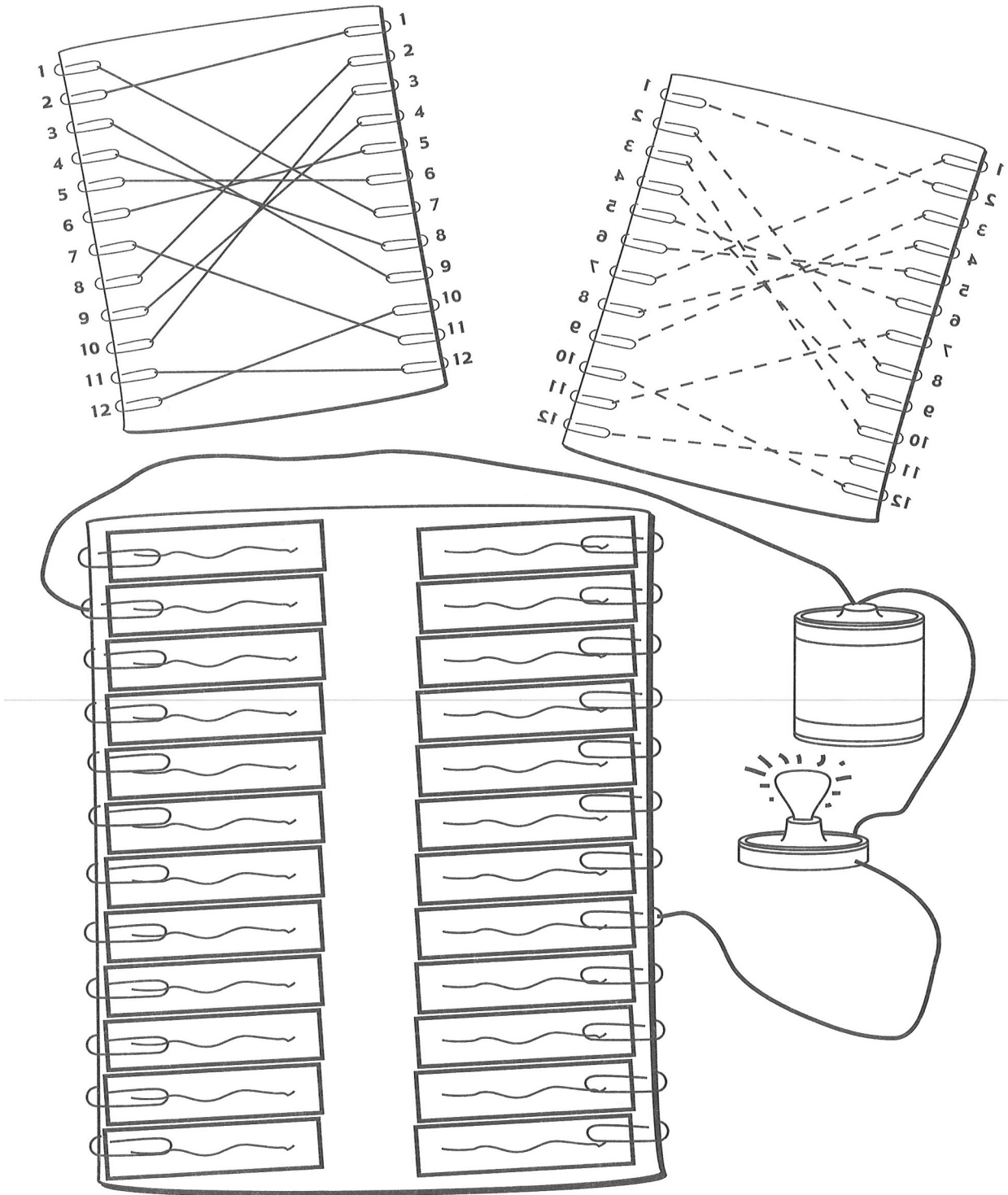
Family Connections

- Students teach their families the *Flowing Electrons* activity.
- Make a list of the items that use electricity in their home during a 24-hour period.

Battery Book Cover



How to Make An Electric Puzzle



Electric Puzzle Pieces

1. The word “electricity” comes from the Greek Word _____.	A. Like charges repel and unlike charges attract.
2. Static electricity is _____.	B. Amber
3. When the Greeks saw lightning, they thought it was _____.	C. A continuous flow of electrons.
4. Benjamin Franklin was responsible for the first practical use of static electricity by inventing the _____.	D. A yellowish translucent solid made from fossilized tree sap.
5. Law of Electrical Charges.	E. Charged particles that are on the surface and stay in one place.
6. Current electricity is _____.	F. Zeus hurling thunderbolts.
7. Amber is _____.	G. Lightning Rod
8. Conductors are _____.	H. Materials, like rubber or plastics, that do not let charges flow through them. They hold the electric charge on the surface.
9. Insulators are _____.	I. Small parts of the atom that moves around the outside shell. It has a negative charge.
10. A circuit is _____.	J. Object that allows electric charges to move through like many of the metals.
11. An electron _____.	K. A pathway that allows electricity to flow continuously.

Name _____

Conductors

OBJECT	Conductor/Insulator	What did you observe?
1. Penny		
2. Yarn		
3. Aluminum Foil		
4. Paper Clip		
5. Straw		
6. Rubber Band		
7. Popsicle Stick		
8.		
9.		
10.		
11.		

Analyze your data. Draw a conclusion about the type of material that makes a good conductor and the type of material that would make a good insulator.

List Items that are found at home that make good conductors. What are their uses?

Clustering

Science Standard IV

Objective 2

Science Standard IV:

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Objective2:

Analyze the behavior of current electricity.

Intended Learning Outcomes:

3. Understand Science Concepts and Principles
4. Communicate Effectively Using Science Language and Reasoning

Content Connections:

Language Arts VII-1, 2

Background Information

Vocabulary is an essential tool in understanding the concepts of electricity. As students attempt to organize unknown words into related groups, they are faced with a dilemma-they lack the knowledge to complete the task accurately. A purpose for reading non-fiction text is created- specific information is needed.

Invitation to Learn

Each group is given the opportunity to cut apart the vocabulary cards for the electricity unit and arrange them in a web or cluster design. Provide tape and markers to aid groups in developing an organizational pattern of how these words fit together. Each table shares their design when finished.

Instructional Procedures

Materials

For each group

- ☐ Vocabulary Cards
- ☐ Markers
- ☐ Poster
- ☐ Masking tape (about 15 inches)

For each student

- ☐ ABC Electricity handout

1. Arrange students in cooperative groups of no more than five people. Pass out a set of *Vocabulary Cards* (p. 8-30), markers, and a poster to each team. As a group, organize the *Vocabulary Cards* into a web design and create a *Cluster Poster* (allow five to seven minutes for this task). Groups share their *Cluster Posters* and display them on the wall.
2. After sharing, the class is assigned to read in a non-fiction text about electricity. During reading, fill out the *ABC Electricity Words* worksheet (p. 8-31) with vocabulary words embedded in the text. Include in each box a short definition of a word inferred from context clues in the text.
3. With new knowledge gained from the reading selection, groups may revisit their *Cluster Posters* and make adjustments.

Possible Extensions/Adaptations/Integration

- *ABC Words* worksheets work well when taking notes during a video, filmstrip, or discussion.

Assessment Suggestions

- Adjustments made to *Cluster Posters* upon completion of reading are a visual representation of knowledge gained.

Additional Resources

Electricity and Magnetism, by Mary Atwater (MacMillan/McGraw-Hill); ISBN 0-02-276128-4

Family Connections

- The *Cluster Posters* and the *ABC Words* worksheets are two useful tools to organize informational reading at home.

Vocabulary Cards

Electricity	Current Electricity	Load
Pathway	Lightening	Conductor
Insulator	Power Source	Attract
Repel	Incomplete Circuit	Battery
Static Electricity	Complete Circuit	Switch

Name _____

ABC Electricity Words

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