ACTIVITIES 37&38

Simple Circuits (Sessions I and II)

BROWARD COUNTY ELEMENTARY SCIENCE BENCHMARK PLAN

Grade 1—Quarter 4
Activities 37 & 38

SC.B.2.1.1
The student recognizes systems of matter and energy.

SC.H.1.1.1
The student knows that in order to learn, it is important to observe the same things often and compare them.

SC.H.1.1.2
The student knows that when tests are repeated under the same conditions, similar results are usually obtained.

SC.H.1.1.3
The student knows that in doing science, it is often helpful to work with a team and to share findings with others.

ACTIVITY ASSESSMENT OPPORTUNITIES

The following suggestions are intended to help identify major concepts covered in the activity that may need extra reinforcement. The goal is to provide opportunities to assess student progress without creating the need for a separate, formal assessment session (or activity) for each of the 40 hands-on activities at this grade level.

1. **Session I—Activity 37:** Have each student choose one circuit his or her team found that made the bulb light, draw the circuit, and label the parts. (You may want to write *battery*, *bulb*, and *wire* on the board for students to copy.) Let students show and describe their drawings to the rest of the class.

2. **Session II—Activity 38:** Ask students to name the parts of the electrical system. (the battery, the buzzer, and the wires attached to the buzzer) Ask, *What was the source of energy that made the electrical system work?* (the battery)

3. Use the Activity Sheet(s) to assess student understanding of the major concepts in the activity.

In addition to the above assessment suggestions, the questions in bold and tasks that students perform throughout the activity provide opportunities to identify areas that may require additional review before proceeding further with the activity.

ACTIVITIES 37&38

Simple Circuits

OBJECTIVES

Students are introduced to simple electrical circuits. They construct and test different circuit designs and operationally define each part of a circuit.

The students

- discuss and define the parts of a circuit
- construct simple circuits
- test several arrangements of circuit elements

SCHEDULE

Session I—Activity 37 About 40 minutes
Session II—Activity 38 About 30 minutes

VOCABULARY

battery
circuit
closed circuit
electrical energy
electric current
electricity
open circuit
system

MATERIALS

For each student

1	Activity Sheet 37
1 pair	safety goggles*

For each team of two

1	battery, D-cell
1	bulb, flashlight, #48
2 pcs	wire, copper, insulated, 15-cm

For the class

2	buzzers
1 roll	wire, copper, insulated
1 pair	wire cutters

*provided by the teacher

PREPARATION

Session I—Activity 37

1. Make a copy of Activity Sheet 37 for each student.
2. Use the wire cutters to cut two 15-cm (6-in.) pieces of insulated copper wire for each team of two. Strip the insulation from the ends of the wire pieces as described in Advance Preparation on pages 351–352.
3. Each team of two will need one battery, one bulb, and two pieces of wire (one to test a circuit on the activity sheet).

Session II—Activity 38

1. You will need two buzzers and two batteries for the class to share. Trim some additional insulation from the ends of the wires attached to each buzzer.

Safety Note: *Never try—or allow students to try—any experiments using an electrical outlet. Severe injury can result. Always use the batteries supplied with the kit when carrying out these activities.*

BACKGROUND INFORMATION

A ***battery*** is a device in which chemical energy is stored. Chemicals contained in the battery react with one another and create an imbalance of electrons at the ends of the battery: an excess of electrons is created at one end and a deficit is created at the other end.

If a wire were connected between one end of the battery and the other, electrons would flow from the end containing the excess electrons, through the wire, to the other end of the battery. This flow of electric charge is called ***electric current*** and delivers ***electrical energy.***

Technically, what we refer to as a single battery should be called a ***cell.*** For instance, what we call a D-battery is actually a D-cell. A battery is defined as two or more cells that are connected together electrically. But in most common usage, the terms *cell* and *battery* are used interchangeably. So in these activities and in Activities 39 and 40, the term *battery* will refer to both a single cell and the multi-cell battery.

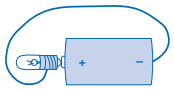
A pathway (such as that provided by wire) is required before the current can flow from one end of the battery to the other. When a pathway is connected so that it allows electric current to flow from one end of a battery back to the other end, we have what is known as a ***circuit.*** If the pathway is disconnected at any place, the current stops flowing and the circuit is said to be an ***open circuit***. If the pathway is reconnected, the open circuit becomes a ***closed circuit*** again, and current resumes.

A completed electrical circuit forms a ***system***, a set of objects that interact with one another. In a closed circuit, matter (the connected battery, bulb, and wires) interact to allow the flow of electric current (energy) through the circuit to light the bulb.

▼ **Activity Sheet 37**

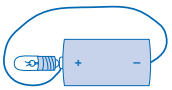
Simple Circuits

1. Will the bulb light? Write *yes* or *no* on the line.



Circuit A

Predict varies



Circuit B

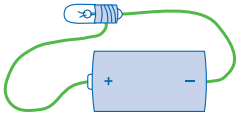
Predict varies

Did the bulb light? Write *yes* or *no* on the line.

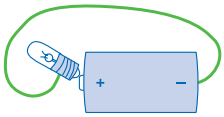
Observe yes

Observe no

2. Draw the missing wires.



Circuit C



Circuit D

Guiding the Activity

Session I—Activity 37

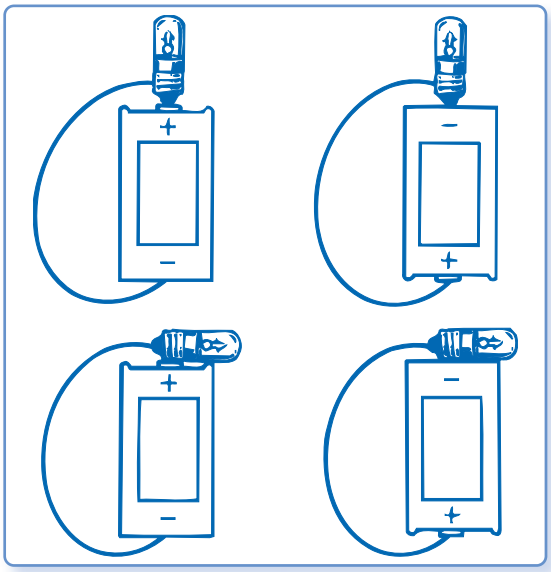
1 Begin a discussion by holding up a battery (D-cell), a length of wire, and a bulb and asking, **How could you put these parts together to make the bulb light up?**

Encourage students to offer ideas about various arrangements of the circuit elements. Draw their suggestions on the board.

Explain that in this activity, they will make and test different ways to make the bulb light up (see Figure 37-1).

Additional Information

Many students may not know how to connect the materials correctly. Accept all suggestions without comment.



▲ ***Figure 37-1.*** *Possible circuit element arrangements to make a bulb light up.*

2 Write *battery, electric current, electricity,* and *electrical energy* on the board. Tell students that a **battery** has chemicals inside it. These chemicals react with each other and cause electrons, or tiny bits of charged matter, to move. **Electricity** is the interaction of electrically charged particles. The electrons collect mostly at one end of the battery, leaving the other end of the battery with far fewer electrons.

Explain that if a pathway connects one end of the battery to the other end, the electrons flow from the end of the battery with more electrons to the end with fewer electrons. This flow of electrons, or electric charge, is called **electric current. Electrical energy** is the energy provided by an electric current. The flow of electrons delivers the energy needed to make a bulb light up. In the home, electrical energy can power radios, flashlights, and toys.

Emphasize to students that batteries only store energy, and a pathway (such as that provided by a wire) is required before the electrons can flow.

Guiding the Activity

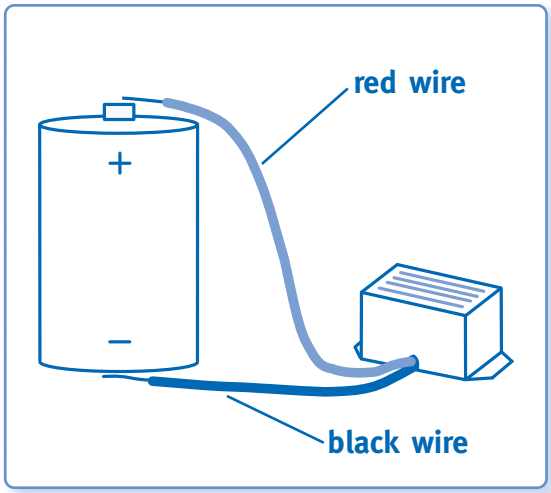
	Additional Information
3 Write the word *circuit* on the board. Explain that a **circuit** is a connected set of electrical parts. Circuits typically contain parts such as a battery, wires, and a light bulb or other part that runs on electricity. Explain that the parts of a circuit form a **system**. They connect to each other to make a bulb light, a bell ring, or some other kind of part work.	
4 Distribute a battery, a piece of wire, and a bulb to each team. Point out that one end of the battery is marked with a plus sign (+), and the other end is marked with a minus sign (–). Have students locate these markings on the battery. Let each team experiment freely with different arrangements of the circuit elements to make the bulb light.	***Safety Note:*** *Tell students to be careful when handling the wire so they do not scratch themselves with the exposed ends.*
5 Distribute a copy of **Activity Sheet 37** to each student. Instruct students to predict whether each circuit shown in question 1 will make the bulb light up. If they think the bulb will light, they should write *yes* on the Predict line. If they think the bulb will not light, they should write *no* on the line. Next, tell students to build and test each circuit in question 1. Have them write *yes* on the Observe line if the bulb lights or *no* if it does not light.	*Students may have difficulty manipulating the battery, bulb, and wire at the same time. Tell them that one student on each team should hold the battery and the bulb as shown on the activity sheet, and the other student should hold the ends of the wire as shown.*
6 Ask, **What parts are in each of these circuits?** Ask, **Does it matter in what order the parts are connected? Why?**	*a battery, a wire, and a bulb* *Yes. To make the bulb light, the current must be able to flow from one end of the battery, through the bulb, and to the other end of the battery.*
7 Draw students' attention to the diagrams in question 2 on the activity sheet, and give each team a second wire. Explain that wires are missing in both diagrams. Tell students to draw the missing wires that would make the bulb light in both diagrams. Have them build each circuit to test and verify their ideas.	

Guiding the Activity

		Additional Information
8	Write *closed circuit* and *open circuit* on the board. Explain that a **closed circuit** is one in which all parts of the circuit are connected to let current flow from one end of the battery to the other end. If the current passes through the bulb, it will light up. An **open circuit** is one in which the path is disconnected and the current cannot flow from one end of the battery to the other. In an open circuit, the bulb will not glow.	*Point out to students that they could create a closed circuit in which the bulb did not light if the bulb were not located within the current pathway. (Circuit B on the activity sheet demonstrates such a closed circuit.)*
9	Have students reconstruct Circuit A shown on the activity sheet. Ask, **What happens when you pull the wire away from the light bulb? Is this now an open circuit or a closed circuit?**	*The bulb does not light. This is now an open circuit.*

Session II—Activity 38

10	Hold up a battery and a buzzer with its wires attached. Ask, **Do you think you'd need the wire you used before to connect the buzzer to the battery, like you connected the light bulb? Why, or why not?**	*No. The buzzer already has wires attached to it, so you wouldn't need another wire to connect it to the battery.*
11	Tell students that when the circuit is completed correctly, the buzzer will make noise. Demonstrate this for the class by connecting the wires to the battery as shown in Figure 38-1.	*Do not point out the different colors of the buzzer's wires or explain how to connect the wires correctly.*



▲ ***Figure 38-1.*** *Connect the red wire to the + end of the battery and the black wire to the – end.*

Guiding the Activity

Additional Information

12 Divide the class into two teams, and have each team line up in a row with students' backs facing toward the front of the room (so students will not be able to watch one another connect the buzzer and battery correctly but will have to test the two possibilities themselves).

Give a battery and buzzer to the first student in each row. Explain that each student on the team will have a chance to connect the buzzer and battery to make the buzzer buzz. Tell them they cannot watch the previous student to see which arrangement works. The first team to pass the battery and buzzer to the last student in the row, with each student making the buzzer buzz, wins the race.

13 When the teams have completed the race, ask, **How did you have to connect the wires to make the buzzer buzz?**

The red wire had to be connected to the "plus" end of the battery, and the black wire had to be connected to the "minus" end.

Ask, **Why do you think the buzzer only worked when you connected the wires this way?**

Do not expect sophisticated explanations at this level. It is enough if students simply suggest that the electric current only flows the "right way" to operate the buzzer with the wires connected red to plus and black to minus.

Reinforcement

Arrange a battery, bulb, and wire so that the bulb glows. Have students trace the path of the electric current from one end of the battery, through the wire and bulb, back to the other end of the battery.

Science Journals

Have students place their completed activity sheets in their science journals.

Cleanup

Have students return all batteries, bulbs, wires, and buzzers to the kit.

Science at Home

Have students draw maps of their "closed circuits" from home to school and home again. Their route is not a closed circuit until they complete the loop.

Connections

Science Challenge

Ask students whether they think there would be any difference in the brightness of the bulb if they used a longer wire. Record students' predictions, then provide long lengths of wire so students can test their predictions using the brightness of the bulb as a measure of current strength. (*Note:* Make sure students use well-charged batteries for their tests.) Also let students test a shorter wire. Students will find that the length of the wire—the distance that the current must flow between the battery and the bulb—has no observable effect on the brightness of the bulb.

Science and Language Arts

Ask students to describe experiences they have had with static electricity—for example, getting a tiny shock when they touch a doorknob after walking across a carpet, or hearing faint "crackles" of electricity (and perhaps seeing small sparks, if the room is darkened) when they stroke a cat's or dog's fur in cold, dry weather. Explain that with static electricity, the electric current does not flow smoothly and continuously, as it did in the circuits they built with the light bulb and the buzzer. Instead, the electric charge builds up on one object (for example, your body), then suddenly "jumps" to another object (such as a doorknob) all at once when you touch it.

Science, Technology, and Society

Many flashlights, small power tools, and other devices today contain batteries that can be recharged by plugging the device into a wall receptacle. Separate rechargeable batteries are also available for use in any device that runs on batteries. Bring in a rechargeable flashlight. Show it to the class, turn it on, and let it sit undisturbed until the light beam becomes very weak. Then plug the flashlight into an electrical outlet overnight. The next day, unplug the flashlight, and have a volunteer turn it on. (The light beam should be strong again.) Ask students to explain what happened when the flashlight was plugged into the wall outlet. (Do not expect sophisticated explanations. Students can simply suggest that the flashlight's battery "collected more electricity" from the outlet and was usable again.)