ACTIVITY 40

Circuit Experiments

BROWARD COUNTY ELEMENTARY SCIENCE BENCHMARK PLAN

Grade 1—Quarter 4
Activity 40

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. Ask, *Why does a bulb shine brighter with two batteries connected to it instead of one battery?* (Two batteries connected together make the electric current stronger.) *What do you think would happen if you used one battery with two bulbs?* (The bulbs would be dimmer than the bulb in a one-battery/one-bulb circuit.)

2. 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.

ACTIVITY 40

Circuit Experiments

OBJECTIVES

Students build a circuit that includes two batteries and one bulb, then compare the brightness of the bulb with its brightness in a one-battery circuit.

The students

- build a one-battery/one-bulb circuit and observe the brightness of the lighted bulb
- build a two-battery/one-bulb circuit and compare the brightness of the lighted bulb with its brightness in the one-battery circuit
- infer that the additional battery in the circuit increased the strength of the electric current flowing through the circuit

SCHEDULE

About 40 minutes

VOCABULARY

battery terminal

MATERIALS

For each student

1	Activity Sheet 40
1	crayon, yellow
1 pair	safety goggles*

For each team of two

2	batteries, D-cell
2	battery holders
1	bulb, flashlight, #48
1	bulb holder
4	electrical clips
3 pcs	wire, copper, insulated, 15-cm

*provided by the teacher

PREPARATION

1. Make a copy of Activity Sheet 40 for each student.
2. If the wire pieces that students used in Activity 39 are still in good condition, they can be re-used in this activity. If they are not, cut three new pieces for each team.
3. Each team will need two batteries, two battery holders, four electrical clips, three pieces of wire, one bulb, and one bulb holder.

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

Most battery cases, including those of the batteries in the kit, are marked positive (+) on one end and negative (–) on the other end. These markings indicate the positive and negative **battery terminals**. In a battery-operated closed circuit, electric current flows from the negative terminal of the battery to the positive terminal.

When two batteries are connected in series (one after the other) in a circuit, the negative end of one battery is connected to the positive end of the other battery.

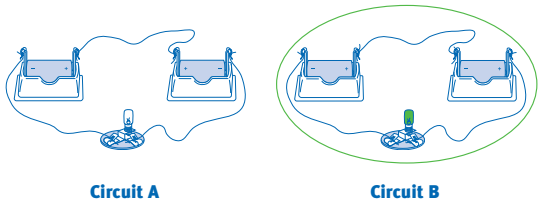
The strength of batteries is measured in volts. The strength of the D-cells in the kit each measure 1.5 volts. When batteries are wired in series, the voltages add together. Thus, the two 1.5-volt batteries connected in series act like a single 3.0-volt battery.

In this activity, students built a circuit with two batteries connected in series and observe that the brightness of the bulb is significantly increased over its brightness in a one-battery circuit.

▼ **Activity Sheet 40**

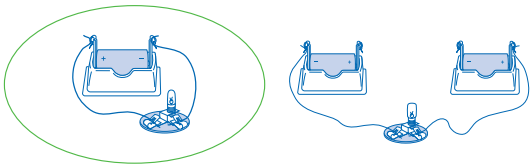
Circuit Experiments

1. Circle the circuit that will light the bulb.



Circuit A Circuit B

2. Circle the circuit that will light the bulb.



Circuit C Circuit D

3. Which of the two bulbs will shine brighter? Color that bulb yellow.

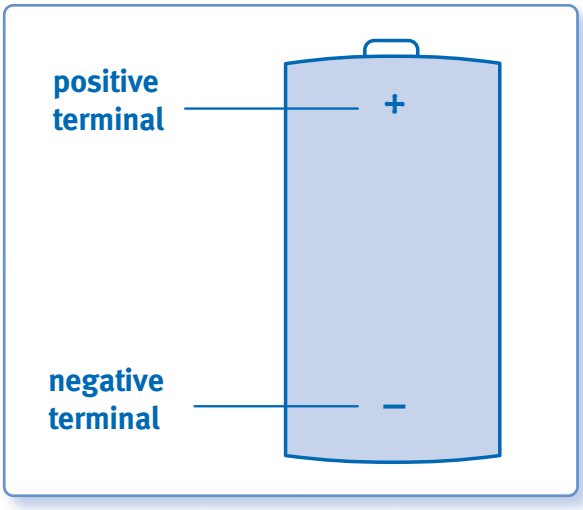
Guiding the Activity

1 Distribute two batteries, two battery holders, four electrical clips, one bulb, one bulb holder, and three pieces of wire to each team. Review the concept of a closed circuit, emphasizing that electric current flows from one end of the battery to the other end.

Draw a simple diagram of a battery on the board, with a small protrusion on one end (see Figure 40-1). Label that end of the battery + and the other end –.

Write *battery terminal* on the board. Explain that in a closed circuit, current flows from the negative (–) end of the battery to the positive (+) end. The positive and negative ends of the battery are called **battery terminals**. Add the labels *positive terminal* and *negative terminal* to your drawing, as shown in Figure 40-1. Have students locate the + and – markings on their own batteries.

Additional Information



▲ *Figure 40-1. The positive and negative terminals of a battery.*

Guiding the Activity

Additional Information

2

Ask students to describe how they made a simple one-battery circuit using a bulb holder and a battery holder and electrical clips in Activity 37. Tell them to make another one-battery circuit now.

Circulate around the room to help students with the battery assembly, if needed. Make sure they connect only one wire to each holder clip.

Ask, **How does using the battery and bulb holders make it easier to connect the parts of the circuit?**

You don't have to hold the ends of the wires in place because they are clipped tightly to the holders.

3

Let the teams leave the bulbs lighted in the circuit for a short time, and have students describe the pathway of the electrical current through the circuit.

Current flows from the negative end of the battery to the positive end, through the wire to one clip on the bulb holder, through the bulb to the other clip, through the second wire, and back to the negative end of the battery.

Ask, **What kind of circuit do you have, an open circuit or a closed circuit?**

a closed circuit

What else can you call these connected parts?

a system

What makes the circuit a system?

The connected parts work together to make electric current flow through the circuit and light the bulb.

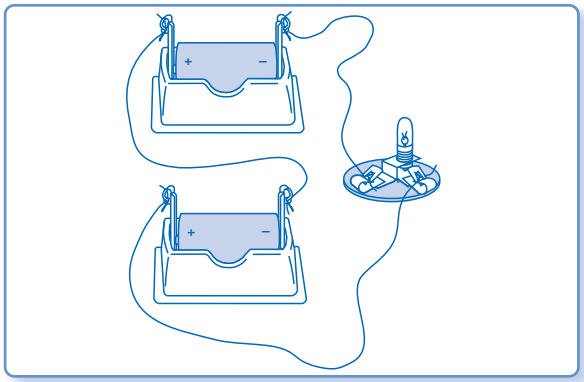
Tell students to remove *one* wire from its clip in the battery holder so the bulb goes out. Ask, **What kind of circuit do you have now?**

an open circuit

4

Next, have students add a second battery to the circuit. Explain that they should use the third wire to connect the negative (–) end of one battery to the positive (+) end of the other battery. The correctly completed circuit should look like Figure 40-2.

If a team's bulb does not light, check to make sure students have connected negative-to-positive terminals and not negative-to-negative or positive-to-positive.



▲ ***Figure 40-2.*** *A one-bulb circuit with two batteries connected in series.*

Guiding the Activity

Additional Information

5 Ask, **How bright is the bulb now? Is it the same as before?**

No. It's much brighter now.

Why do you think the bulb is brighter with two batteries?

Students should infer that the electric current from two batteries hooked together is much stronger than the current from one battery by itself.

Do you think you could keep adding more and more batteries, and the bulb would keep getting brighter and brighter?

Students' answers may vary. If students do not suggest it themselves, explain that at some point, the strength of the current would be too much for the little light bulb, and it would burn out.

Safety Note: *Do not allow students to try adding more batteries to the circuit. Doing so could increase the strength of the electric current beyond the bulb's capacity, and it would blow out and no longer be usable.*

6 Distribute a copy of **Activity Sheet 40** to each student. Tell students to look carefully at each of the two circuits shown in each question, decide which circuit in each pair is correctly wired to light the bulb, and draw a circle around that circuit. When students have made their choices, tell them to use the yellow crayon to color the bulb that will shine the brightest.

Reinforcement

Have students draw the two-battery circuit they built and mark + and – on both batteries to indicate the positive and negative terminals. Then have them add arrows to the diagram to show how electric current flows through the completed circuit.

Science Journals

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

Cleanup

Have student disassemble all the circuit elements. Return the batteries, battery holders, bulbs, bulb holders, and wires to the kit.

Connections

Science Challenge

Let students experiment to observe and compare how brightly the bulbs shine in the following circuits. Ask students to describe the pathway of current and explain their results with each circuit. **Note:** *Do not allow students to go beyond four batteries and two bulbs, as that could overload the bulbs and blow them out.*

- one battery and two bulbs
- two batteries and two bulbs
- three batteries and two bulbs
- four batteries and two bulbs

Science Extension

Have students build a two-battery circuit again, this time with the buzzer they used in Activity 38. First have them rebuild the one-battery circuit to remind them how loud the buzzer is. Then ask them to predict whether the buzzer will be louder with two batteries. Have them build the circuit to test their prediction. (The buzzer will be significantly louder with two batteries.)

Science, Technology, and Society

- Let students work in groups of four to closely examine the flashlights they used to make shadows in Activities 34 and 35. Give each group an empty flashlight with its bulb and two C-cell batteries, and tell students to put the parts together so the flashlight turns on when the switch is pushed forward. Let students try different arrangements until all groups' flashlights light. Then ask students to describe the arrangement of the two batteries inside the flashlight. (To make the bulb light when the switch is turned on, students must arrange the batteries with a negative-to-positive connection, with *either* the two positive ends *or* the two negative ends toward the bulb end of the flashlight.) Ask students to explain how this arrangement is like the arrangement of the batteries in the two-battery circuits they built in this activity.

- Students may wonder how a flashlight can work without any wires connecting the batteries and the bulb. Let students take the C-cells out of the flashlights they used in the above activity and look carefully into the flashlight body as they turn the switch on and off. (They will see a thin metal strip down the inside length of the flashlight. As they turn the switch on and off, a metal part on the strip moves forward and back.) Ask them to explain what the purpose of the metal strip is. (It carries electric current from the batteries to the bulb. When the switch is turned on, the small metal part moves forward and closes the circuit, lighting the bulb. When the switch is turned off, the small metal part moves backward and opens the circuit, making the bulb turn off.)