EXPLORING ELECTRICITY

OVERVIEW: Students will explore the use of electricity by constructing simple circuits using batteries, wires, and lamps

OBJECTIVE: Students will be able to construct and/or explain he following electrical concepts:

*Simple, series, and parallel circuits

*Conductors and insulators

*Chemical, mechanical, and solar electricity generation

GRADE LEVEL: 4

OHIO STANDARDS:

Physical Science Grade 4: Energy can be transformed from one form to another or can be transferred from one location to another

TIME: 45 minutes

MATERIALS:

Battery holder

2 AA batteries

2 lamp holders

2—2.5 volt lamps

2 pieces solid insulated wire

3 jumpers with alligator clips

1 bag of insulators vs. conductors

Student packets

SAFETY TIP

Remind the students that we are using batteries to study electricity because they are safer than using the wall socket. These small batteries will not shock you. Larger batteries, such as lantern and car batteries can also be dangerous. Household electricity, 120 volts, can and does kill many people each year. Use caution around any power source.

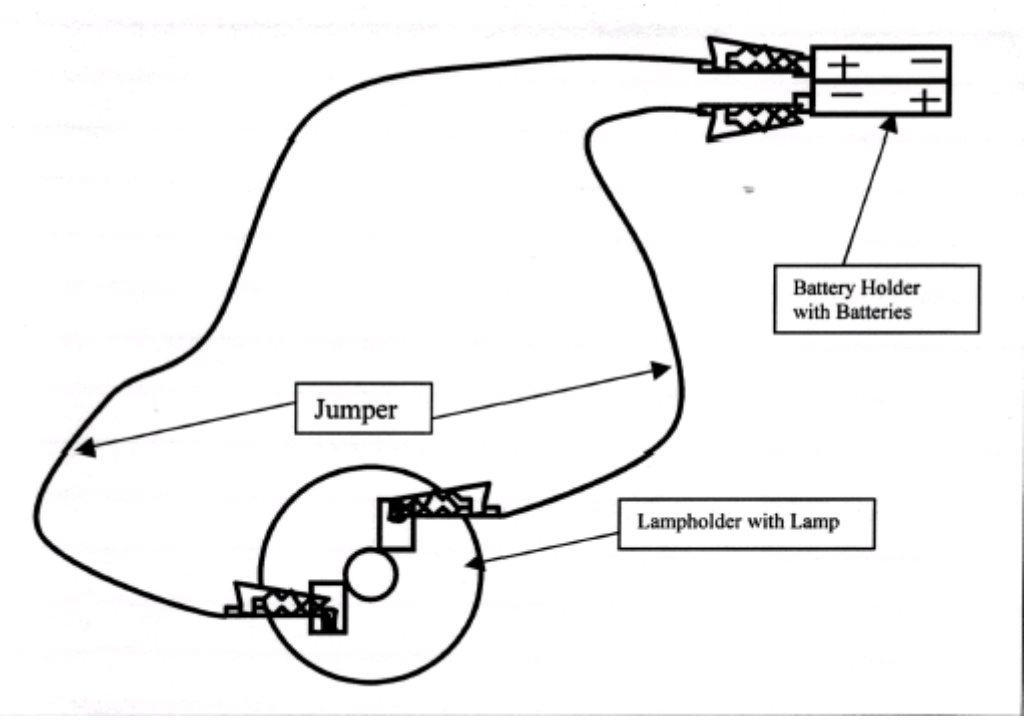
IMPORTANT:

Read all instructions

before proceeding

PROCEDURE
ACTIVITY 1- A SIMPLE CIRCUIT

1. Have the students build the simple circuit shown below:



2. The light should now be on.

The engineer should explain: This is a simple circuit. The electrical power

flows out of the batteries, through the wires of the jumpers to the light. The circuit must be "complete" in order for the light to work because the electrons must be able to flow from one side of the chemical

reaction of the battery to the other side of the chemical reaction. Note that all batteries have a "+" (or positive end) and a "-" (or negative) end. When the circuit is complete, electrons flow out of the negative terminal of the battery, through the wires and lamp (in this case) and back to the positive terminal of the battery. That is called electrical current.

After this circuit is built, have students build one of their own (or borrow one

from a set of students) and substitute the generator in for the battery. Show the students that you can make the lamp light up with the generator.

4. Now discuss that there are several ways to create electricity. Ask the kids if

they can come up with different ways to make electricity. They may say wind, nuclear, solar, etc.

Ways to make electricity:

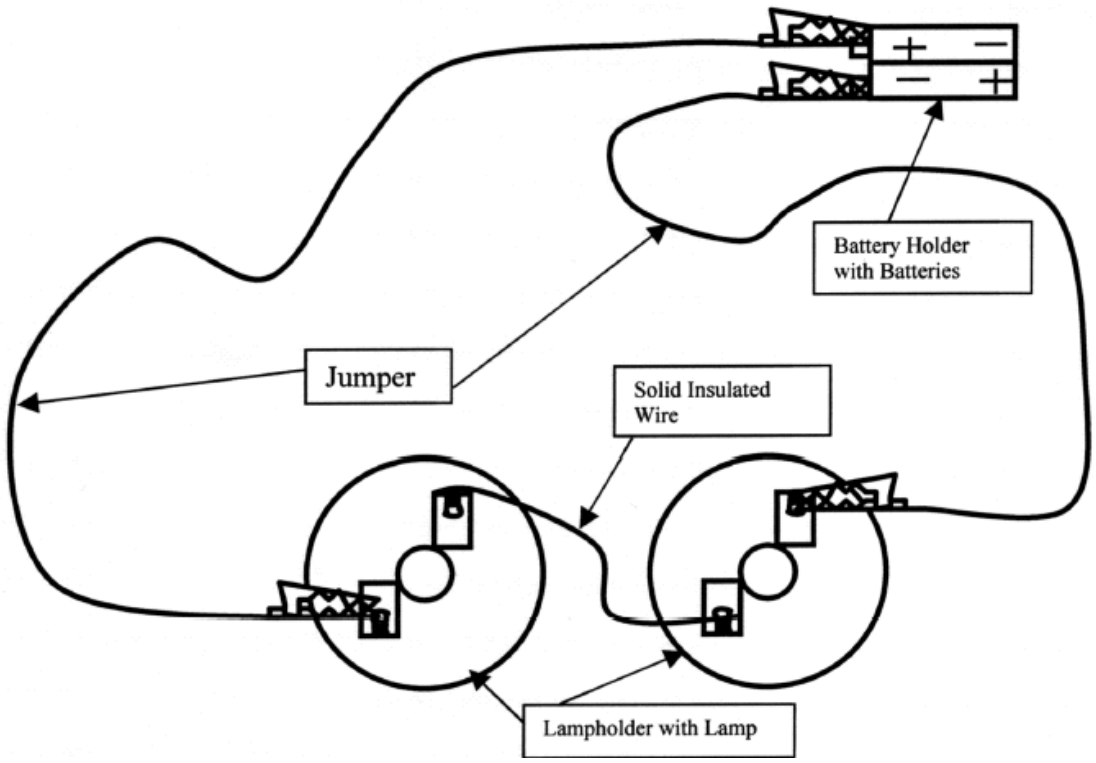
Chemically as in the battery. There are also devices called "fuel cells" which use a chemical reaction to create electricity.

Mechanically as in the hand-held generator. Actually, in the end, wind, nuclear, coal fired, gas-fired, hydro, and many others use the same generation technology as the little hand-held unit. Some form of energy spins a magnet inside a set of wires and electricity is produced

Solar. A special type of electronic device that can convert light into electricity.

ACTIVITY 2 - A SERIES CIRCUIT

Have the student modify the circuit as shown in the drawing below:



Ask the students to observe this circuit relative to the first "simple" circuit.

Have them record their observations on the worksheet.

4. Have some open discussion:

What is different about this circuit?

What about the lights?

Why might there be a difference?

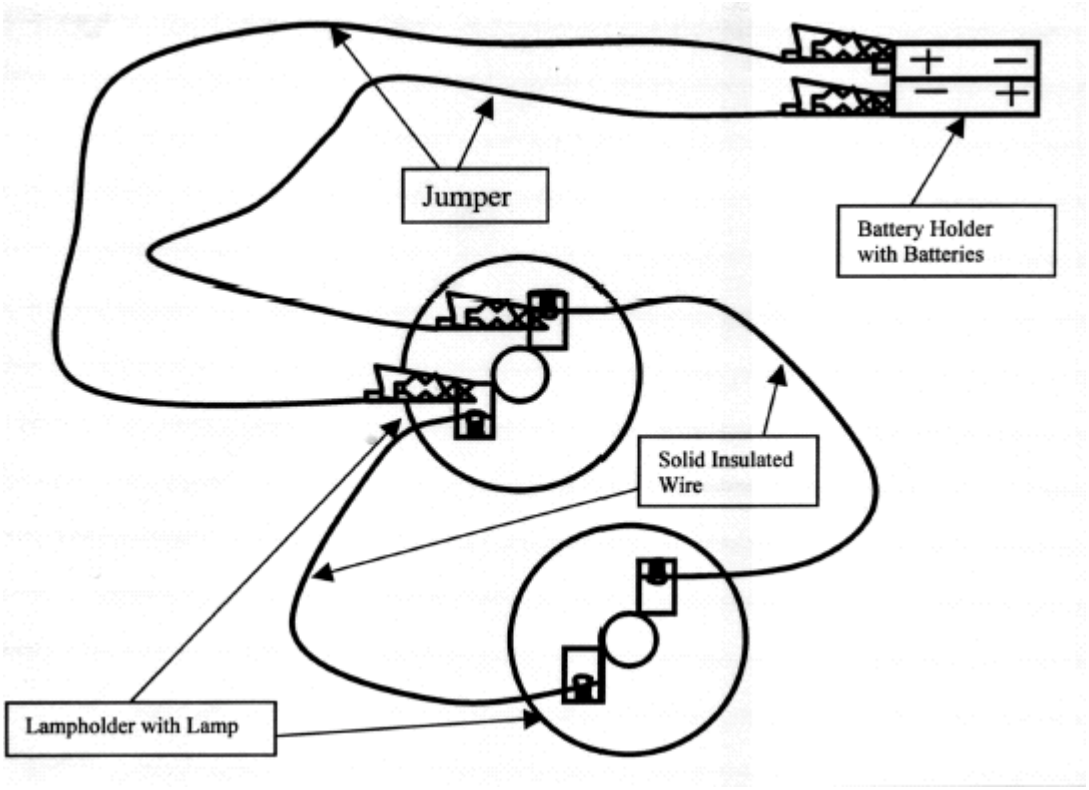
5. Explain: The lamps burn less brightly than in the simple circuit. The reason is that the same voltage is available but now it has to drive two lights because of their arrangement in a line. Therefore, only 1/2 of the voltage is available for each of the two lights and they burn less brightly.

Ask the students to remove one of the lamps from its holder. What happens?

Why?

Explain: The other lamp went out because the circuit was interrupted. This is a characteristic of a "series" circuit. Removing one component essentially turns off the whole circuit. This is just like Christmas lights.

ACTIVITY 3 – A PARALLEL CIRCUIT



Ask the students to observe this circuit relative to the first "simple" circuit.

Have them record their observations on the worksheet.

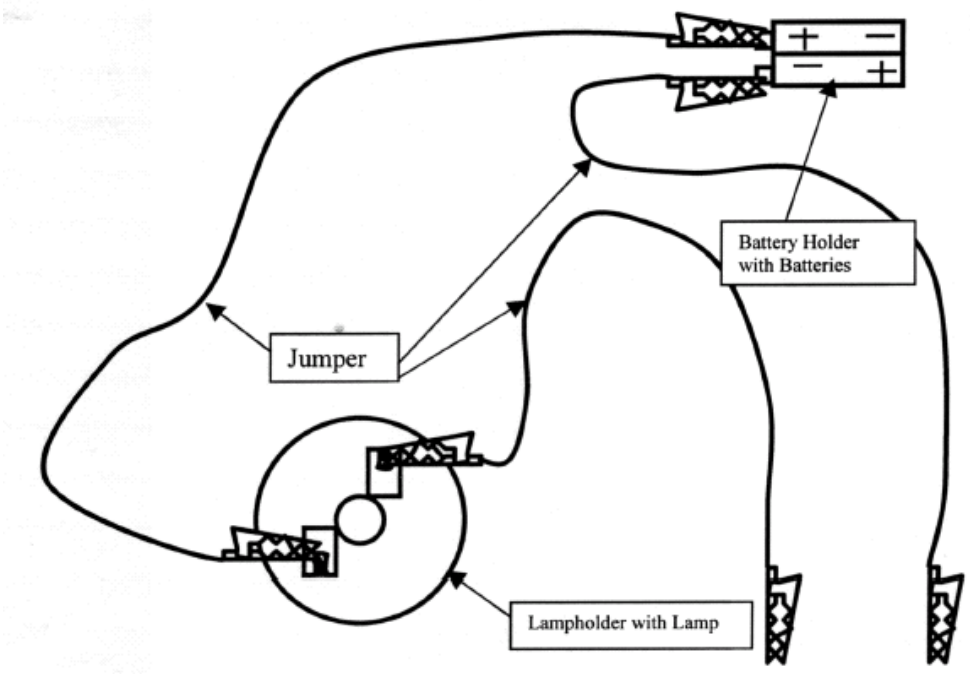
Explain: The lamps burn with the same brightness as in the simple circuit. The reason is that the same voltage is available to both of the lamps so they work the same as if a single lamp were there.

Ask the students to remove one of the lamps from its holder.

What happens? Why? Explain: The other lamp stayed lit because the circuit was not interrupted. This is a characteristic of a "parallel" circuit. Removing one component does not affect the whole circuit.

ACTIVITY 4 – TESTING CONDUCTORS AND INSULATORS

Have the students modify the simple circuit as shown below:



Ask students to observe this circuit relative to the first "simple" circuit. Have them record their observations on their worksheets.

Explain: The lamps burn with the same brightness as in the simple circuit. The reason is that the same voltage is available to both of the lamps so they work the same as if a single lamp were there.

Ask the students to remove one of the lamps from its holder. What happens?

Why? Explain: The other lamp stayed lit because the circuit was not interrupted. This is a characteristic of a "parallel" circuit. Removing one component does not affect the whole circuit.

ACTIVITY 5 – HOW YOU USE ELECTRICITY

Talk about how we use electricity for most everything we do. Ask for ideas on how we use electricity.

After some discussion, discuss a specific example that may not be obvious to them – getting a drink of water. Explain: If your house has a well, no water would be available without electricity to run the pump. If your house has city water, the city uses pumps not only to deliver that water to you (or to the water tower so you can get it), but also to treat the water to remove sediment, and to add chlorine to kill microorganisms.

Now tell the students to start keeping a record of everything they do that requires electricity. Tell them to start right after school today and to do it for 24 hours. Stop at the same time tomorrow. There is a page in the STUDENT PACKET for the record.

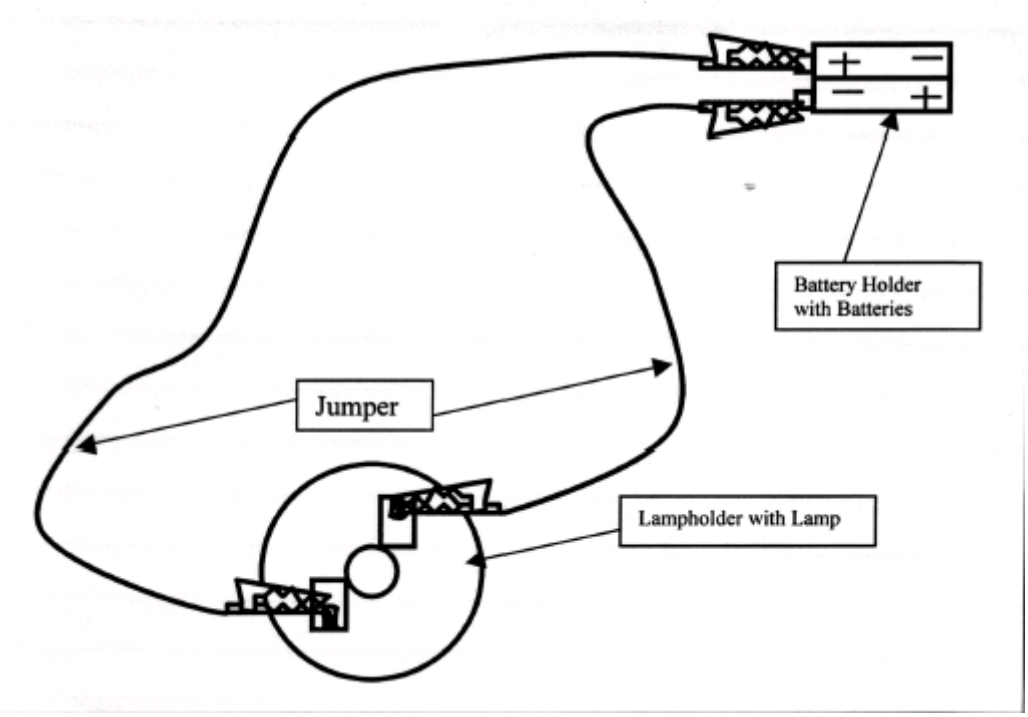
EXPLORING ELECTRICITY STUDENT PACKET

DANGER: DO NOT TRY ANY OF THIS WITH YOUR ELECTRICITY AT HOME!!!!!!!

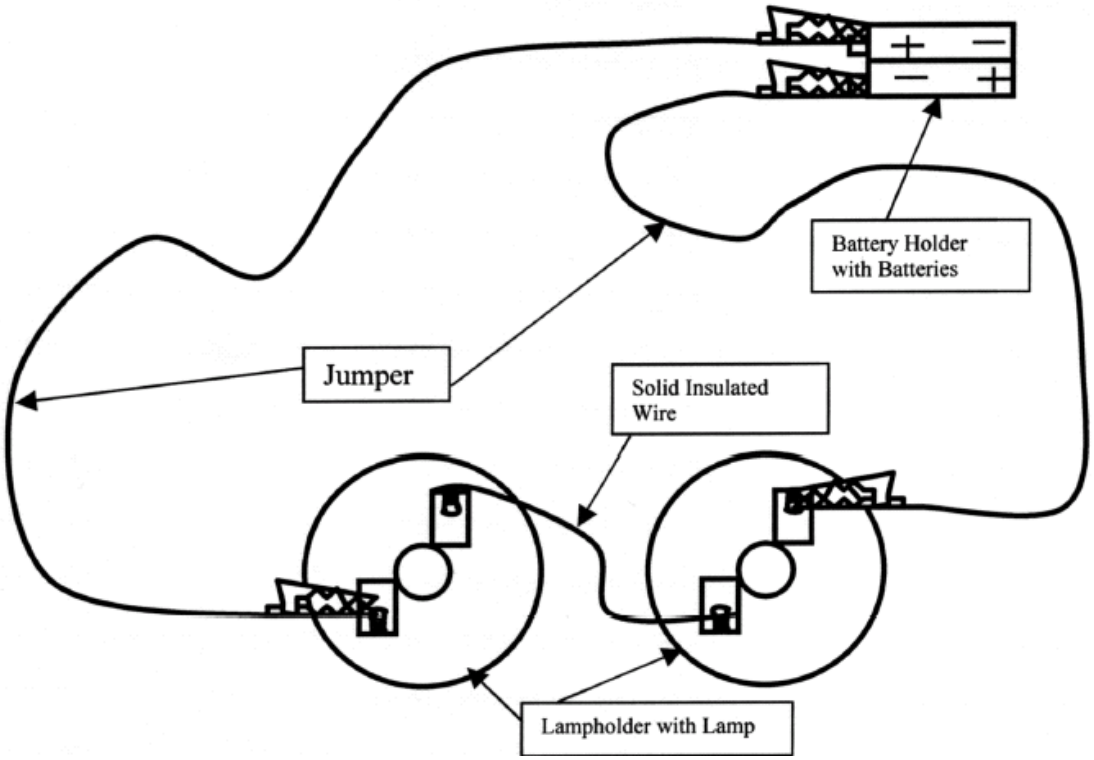
Students: We are using batteries to study electricity because they are safer than using the wall socket. These small batteries will not shock you. Larger batteries, such as lantern and car batteries can be dangerous. Household electricity, 120 volts, can and does kill many people each year Use caution around any power source.

ACTIVITY 1—A SIMPLE CIRCUIT

No need to put any information into the worksheet. Just remember the concept of the simple circuit and the flow of energy from the source, through the load, and back to the source.



ACTIVITY 2—A SERIES CIRCUIT

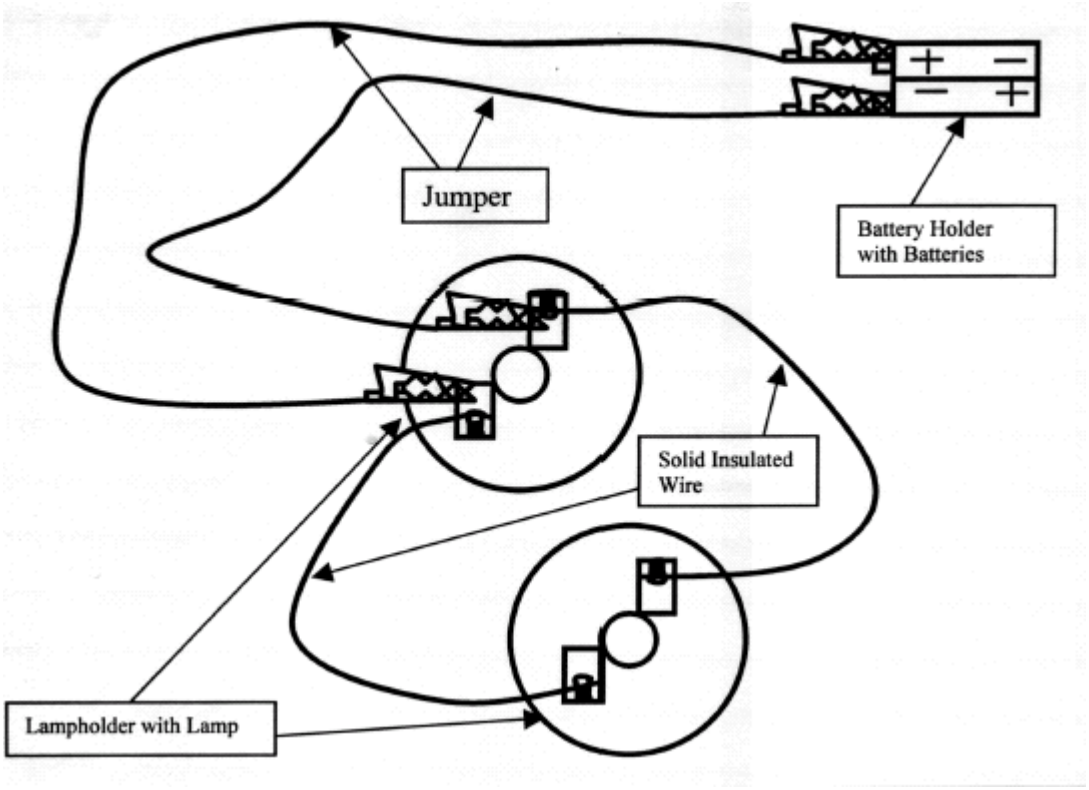


How does this circuit differ from the simple circuit?

Compare the brightness of the lamps in this circuit to the brightness of the lamp in the simple circuit.

What happens when one lamp is removed? Why?

ACTIVITY 3—A PARALLEL CIRCUIT

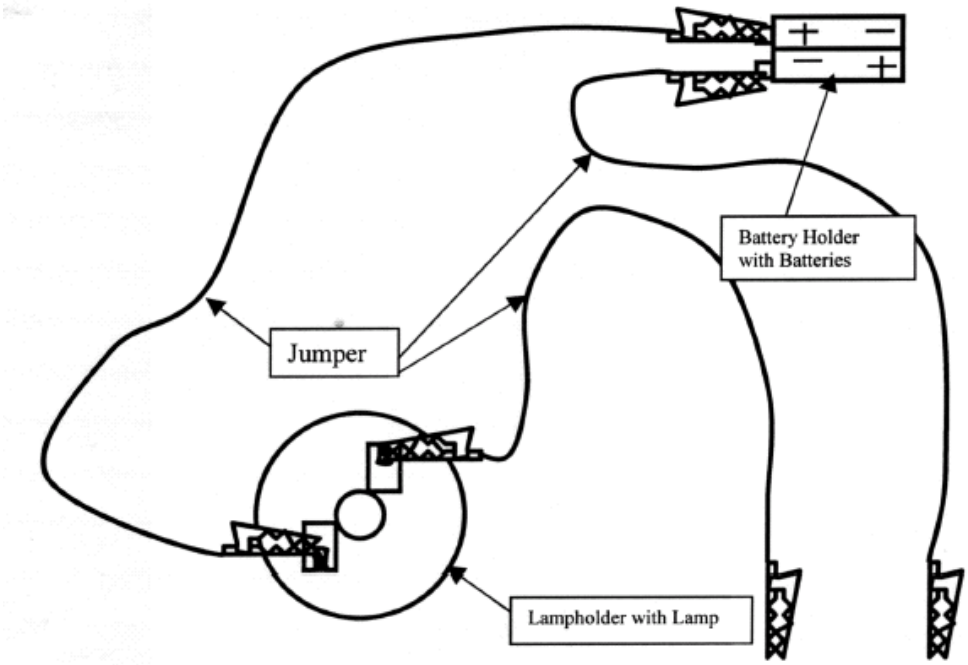


How does this circuit differ from the simple circuit?

Compare the brightness of the lamps in this circuit to the brightness of the lamp in the simple circuit.

What happens one lamp is removed? Why?

ACTIVITY 4—TESTING CONDUCTORS AND INSULATORS



Record the characteristics of the different materials below.

MATERIAL	COMPLETES THE CIRCUIT	DOES NOT COMPLETE THE CIRCUIT
ALUMINUM		
CLOTH		
COPPER		
PAPER		
RUBBER (BLACK STRIP)		
STEEL		
TEFLON (WHITE STRIP)		
WOOD		

Which of the materials are conductors?

Which of the materials are insulators?

Do the conductors have anything in common?

HOW DO YOU USE ELECTRICITY?

Starting right after school today until the same time tomorrow, write down all of your activities that require electricity.

TIME	ACTIVITY	HOW IS ELECTRICITY USED?