Electrifying The World!

Teach 1	Names of student(s) teaching:
Teach date: Teach time: Teach length: 45-50 minutes	Title of lesson: Electrifying The World! Source (Kit, Lesson, Page #):

Concept statement/Main idea:
Students are introduced to the fundamental concepts of electricity and circuits. They discover the flow of electrons in a circuit by creating their own circuit. The students will learn to use ohm's law to calculate current and voltage.

Standards for the lesson:
Use evidence to create a closed circuit and relate the flow of current to the repelling and attraction of subatomic particles.

Objectives	Evaluation
Write objectives in SWBAT form	Write at least one question to match the objective you listed or describe what you will look at to be sure that students can do this.
SWBAT **explain** which direction current flows through a circuit.	Why does the current of electrons only flow in one direction? Answer: The current of electrons is attracted to the positive side of the battery / source. It does not flow in reverse because the negativity of the electrons cause them to repel.
SWBAT **compare and contrast** an open from a closed circuit.	What occurs to the current in an open circuit? Give an example from real life. Answer: It does not flow. Turning on and off the lights.
SWBAT **utilize** Ohm's law to solve for current.	A battery is connected to a light bulb in a circuit. There is a current (I) of 3 A in the light bulb. The light bulb has a resistance (R) of 0.5

	Ω . What is the voltage (V) of the battery? Use V = I × R to solve this problem.

Engagement

Estimated time: 10 minutes

Description of activity: Students will act out the way in which electricity flows in a circuit.

What the teacher does	What the student does	Possible questions to ask students — think like a student and consider possible student responses
The teacher will find out what students already know about electricity. Ask: What is electricity? What is electrical current? What is an electric circuit? Then the teacher will proceed to ask a group of students to help her/him to act out an electric circuit. (the attachment below will have more details on this short activity)	First the students will participate in a small discussion about electricity. Then the students will play a role in acting out an electrical circuit.	How are the electrons moving in this scenario? Do electrons always move in the same direction? What happens when the circuit opens? Closes?

Resources needed:

- Erasers
- A paperclip
- 10+ small objects (all must be the same)

Teacher's Guide

Safety considerations:

Exploration

Estimated time: 15 minutes

Description of activity: Students will create their own circuit.

What the teacher does	What the student does	Possible questions to ask students — think like a student and consider possible student responses
The teacher will first explain the activity and then pass out the materials to each group.	The student will use the engage activity as a model of a circuit. Using this model they will develop their own circuit.	Why does the bulb not light up when you connect both strips of wire to the negative side? If there is no light in the bulb then what kind of circuit is it?

Resources needed per group:

- 1 D-cell battery
- 5-7 in (13 - 18 cm) insulated wire (gauge AWG 22) (available at most hardware stores)
- 1 small light bulb holder (#40) (optional; available at most hardware stores)
- 1 small light bulb holder (#40) (available at most hardware stores)
- small wire strippers or sandpaper (to remove insulation at wire ends)
- tape (scotch, masking or electrical)

Safety considerations:

Explanation

Estimated time: 10 minutes

Description of activity: The students will explain why current only flows in one direction.

What the teacher does	What the student does	Possible questions to ask students — think like a student and consider possible student responses
The teacher will ask the students to come up with an explanation as to why the	The students will explain why electrons must flow from the negative side of the battery	Try to connect the battery, light bulb, light bulb holder

circuit must be set up a certain way to light up the bulb.	to the positive side of the battery.	and wire so the bulb lights up. Use tape if necessary. How many ways can you connect the light bulb/light bulb holder to the battery so the bulb lights up? Answer: None. You only have one wire! 2.) Now, briefly connect the battery terminals with just a piece of wire. What do you notice about the battery and the wire? Answer: The battery and wire are warm.

Resources needed:

Safety considerations:

Elaboration

Estimated time: 5-7 minutes

Description of activity: The students will discuss the role of circuits in their everyday life.

What the teacher does	What the student does	Possible questions to ask students — think like a student and consider possible student responses
The teacher will ask the students to give real life examples of circuits and the many ways in which they are used.	The students will have a class discussion over the many different applications of circuits there are.	What does a circuit carry? What does the current release? Electricity What around you has electricity?

Resources needed:

Safety considerations:

Evaluation

Estimated time: 5 minutes

Description of activity:

What the teacher does	What the student does	Possible questions to ask students — think like a student and consider possible student responses
The teacher will pass out the worksheet and give the students 5 minutes to complete the worksheet.	The student will complete the worksheet.	

Resources needed:

Completing the Circuit WS

KEY

Safety considerations:

Teacher's Guide: Acting Out An Electric Circuit

Act out an electric circuit, as follows: Ask students to join you in forming a circle. Tell students that you represent a battery and they represent a wire conductor. The circle represents a circuit. Distribute an object -- like a ball, a book, or an eraser -- to each member of the circle, including yourself. Ideally, everyone should have the same object. Tell students that these objects represent electrons inside a wire conductor. Explain that a wire conductor is full of electrons.

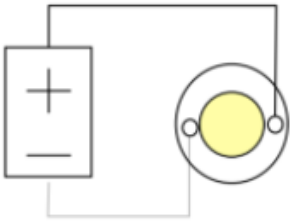
Remind students that you are playing the part of the battery in this circuit, and explain that all batteries have a positive end, represented by your left hand, and a negative end, represented by your right hand. Pass your "electron" to the student on your right. The student receiving your electron should in turn pass the one he or she is holding to the right. Have students continue passing on electrons to the person to their right. Tell students that because electrons share the same negative charge, they repel one another, which keeps them moving along in the same direction. State again that the flow of electrons through a conductor is called electrical current.

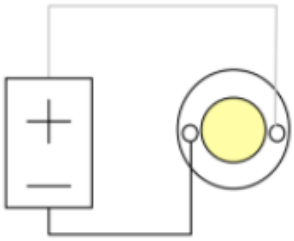
Tell students that as long as the circle remains intact and the electrons continue to flow, their circuit is *closed*. To illustrate what happens when a circuit breaks, or *opens*, create a gap in the circle of students that is too wide across to pass electrons. The current will stop as a result.

Team Name: _____ **Date:** _____

Completing the Circuit Worksheet

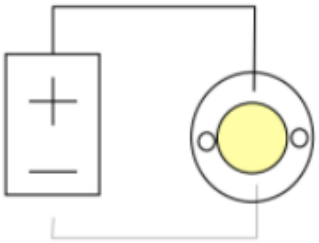
1. In the space below, draw two ways to light the bulb. Use the symbols below.

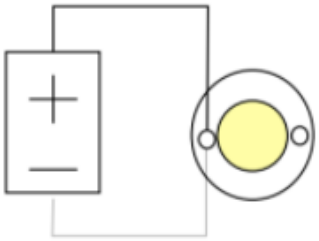




2. What do you have to do to get the bulb to light up?

3. Draw two ways to connect the bulb, battery and wire so the bulb does not light. Use the symbols below.

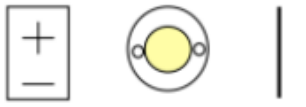




4. Choose the right answer to complete the sentence:

There will be an electric current in _____ circuit.

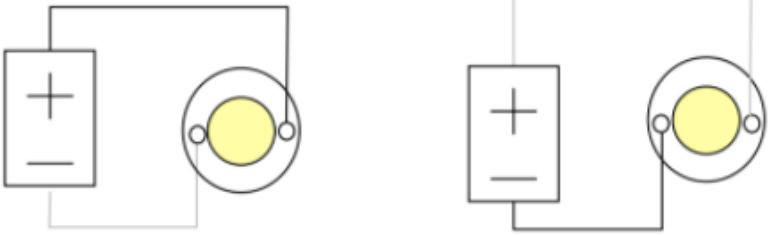
A. an open
B. a closed
C. a big
D. a long



Team Name: _____ **Date:** _____

Completing the Circuit Worksheet ANSWERS

1. In the space below, draw two ways to light the bulb. Use the symbols below.

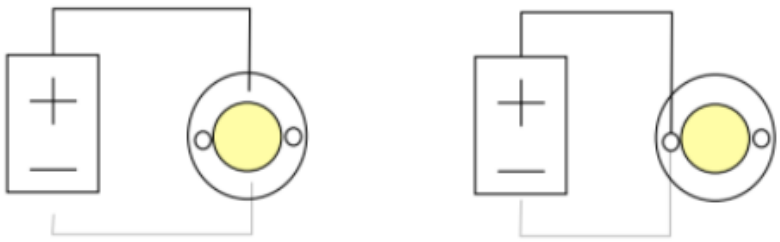


There are four different ways to set it up to light the bulb. Switch the wires for two of the ways to light the bulb, switch the battery around for the other two.

2. What do you have to do to get the bulb to light up?

To get the bulb to light, the circuit must be closed; connect the battery + side to one side of the bulb holder and the battery – side to the other side of the bulb holder.

3. Draw two ways to connect the bulb, battery and wire so the bulb does not light. Use the symbols below.



There are *many* different ways to set it up so the light bulb does not light up. See two examples below.

4. Choose the right answer to complete the sentence:

There will be an electric current in _____ circuit.

A. an open
B. a closed
C. a big
D. a long