Wizards of Wright

Lesson: Circuitry

Use WOW! Lesson Intro to begin.

Background Info for Wizards:	When students learn about circuits, they learn about the world around them. Learning about electronics and circuits may lead to a career involving electrical engineering.
Materials:	Vocabulary handouts. Circuitry Maps. Students will need a blue crayon or marker, a red crayon or marker, and a green crayon or marker. 14 student kits: complete with 10 ceramic magnets covered with aluminum foil, Christmas lights (3 single bulb strings, 2 double bulb strings, 1 triple bulb string), 1 DC motor, 1 switch, extension wires, washers, alligator clip extensions, and 3 AA batteries 1 teacher kit with extra parts
Lesson Time: 60-70 minutes	Introduction: 3-5 minutes Guided Lesson #1: 10 minutes Student Activity #1: 5-10 minutes Guided Lesson #2: 3-5 minutes Student Activity #2: 5-7 minutes Guided Lesson #3: 10 minutes Student Activity #3: 15-20 minutes Conclusion: 3-5 minutes
Learning Targets:	Energy can be transferred through different methods. An electrical circuit is a complete path for flowing electricity. Reviewing electricity, the movement of electrons, current, resistors and transfer of energy. Hands on activities with series circuits and parallel circuits.
Introduction for Students: 3-5 minutes	**Ask students to define electricity.** Electricity is a form of energy. When electrons flow, from one atom to another, we have electricity. There is the kind of electricity that we use at home and at school – when we use batteries and outlets. This is called current electricity, because electrons flow in a current.

	There is also something called static electricity. This is when the electrical charge builds up, but doesn't go anywhere, or flow. You've experienced this when you get a tiny zap from rubbing your feet on the carpet, or when your clothes have static cling. Have students list some ways we use electricity every day. (TV, computers, refrigerators, lights, cell phone chargers) All the way back in the 1500's it was discovered that objects charged with electricity either moved towards other objects with a charge, or moved away. This means they were attracted (there was a pull) or they repelled (pushed away) from each other. But how do the electronics around us work? All matter have atoms, and when the electrons move, or flow, through our devices, they produce a sound, or a light, or another effect.
Guided Lesson #1: 10 minutes	**Today we are going to learn more about Circuits.** **Ask the students what they already know about <u>Circuits</u>.** For electricity to flow you have to have a circuit - a complete path, and there needs to be a source of electricity like a battery. Materials that allow electric current to pass through them easily are called conductors. The conductors are used to link the positive and negative ends of a battery, and this creates a circuit. Like we said, conductors allow a current/electric charge to pass through easily. The opposite of that is an insulator – it doesn't let a current/electric charge pass through easily. Plastic is an insulating material therefore it doesn't work as an electrical conductor. It stops electricity from flowing to places where it is not needed. **Ask students to explain the difference between an <u>open and closed circuit</u>.** In an **open circuit** (also called a broken circuit) there is a break somewhere along the line, and the current of electricity cannot flow all the way. The current stops. In a **closed circuit** (also called a complete circuit) the electric current can flow all the way through. When a circuit is closed/complete, electricity can flow. That's how the devices and appliances in our house work. We can turn on a lightbulb, the refrigerator, or our computers.

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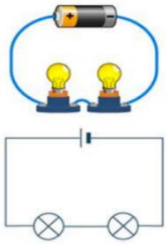
<td>Ask students to explain the difference between <u>a series circuit and a parallel circuit</u>. Let’s use the word <u>resistor</u> in our explanation.

A circuit is the complete/closed path where electricity can flow.

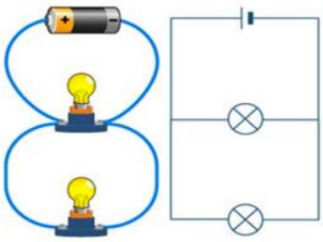
 
A series circuit means there is just one path for the electrical flow. In a series circuit, everything is set up in a line, one after the other.

Series Circuit

A resistor is something in the circuit that limits or lessens the amount of current flowing. In our example, the resistors are the bulbs. If at any time, one of the resistors stops working, the entire circuit will not function. For example, if one of the light bulbs stops working, all of the other light bulbs will also stop working because the path of electricity is broken.

Example: Do you put lights on your Christmas tree? If the lights are in a series circuit, one burned out bulb means none of them will work.
Positive: One advantage though is that you will always know if there is a break in a series circuit.
Negative: If there are many bulbs in a circuit it is very likely that the light will be dimmer because the voltage is split across all of the resistors.

When the resistors are not in a straight path, but on different paths, it is a parallel circuit. There is still more than one resistor, but they are on different paths, or branches, of the electricity flow.

 
Parallel Circuit

Example: Think of all the light bulbs and appliances in in your house. If one light bulb stops working, everything else can stay on. This is because your house is wired with parallel circuits.
Positive: The great thing about parallel circuits is that, even when one resistor (bulb) burns out, the other bulbs will work because the electricity is not flowing through one path.</td>
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<td>Student Activity #1:
5-10 minutes</td>
<td>Review with students important Electricity vocabulary words.
Use Vocabulary Handout.

Students can work on their own, with a partner, in a small group, or you can lead the class and do this all together. Ask the teacher which would be best (quickest).</td>
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Guided Lesson #2: 3-5 minutes	Review with students the idea of a map and key (something they are familiar with). If someone asked you how to get to New York City, how would you find the answer? Yep, you would probably pull up an 'app' on your phone or "Google it". Both of those solutions are using maps which are important in helping us find locations, learn about geography, or learn about the natural features of the Earth's surface. Most maps have something called a map key or a legend. This is almost like a code to understanding what the parts of the map mean. The key uses pictures, different color, or lines to represent important places or landmarks on a map. They are usually located at the bottom left or right of a map.
Student Activity #2: 5-7 minutes	Using their 3 different colored crayons have students complete the Circuitry Map.
Guided Lesson #3: 10 minutes	Connect what we just reviewed about maps and keys to circuits. Just like using a map key and symbols, engineers use symbols with circuitry. Introduce what the symbols mean and how to read and write with circuitry. Use the Symbol Handout. Pass out Circuitry Packets and Kits to the students. Show students how to draw and build the circuits based off of the symbol sheets - do the first couple from the worksheet together. Mention the direction of current and how this differs from the norm.
Student Activity #3: 15-20 minutes	Give students the rest of the time to explore using the kits and to complete the worksheet while you circle the room and assist them with any questions or problems they have.
Conclusion: 3-5 minutes	Discuss results and what was learned. For safety reasons, discuss how the current is what poses danger. "High voltage" signs are warning you that there is a lot of "push", so the electrons are able to "jump" and you should stay away. However, it is the AMOUNT of flow behind that push that can hurt you. High amperage is dangerous! What we did today was safe but you should NOT experiment with your appliances or power outlets at home! This can be very dangerous!

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