

Simple Circuits: Series and Parallel Circuits

NGSS: MS-PS3 Energy

Overview:

Students will construct and analyze both series circuits and parallel circuits in this lesson's hands-on, group activity. The lesson begins with some direct instruction that is meant to lead the students to an understanding of the similarities and differences between the two types of simple circuits, and challenge them to relate this to their home's circuitry.

NGSS:

MS-PS3: Energy

Note: Many states have nested specific middle school standards related to electricity, circuits, and Ohm's law under this general standard.

This lesson could be paired with other lessons in CURENT's curriculum collection related to this standard like those on Ohm's Law and Conductivity.

Lesson Objectives:

- The students will identify the three essential parts of a circuit.
- The students will construct an understanding of the similarities and differences in series circuits with parallel circuits.
- Students will apply the concept of the simple circuits to their house, determining what type of circuit it has.

Assessment and Evaluation

Student will be given handouts that will lead them through the construction models of both the series and parallel circuits. The handouts will also require the students to draw diagrams of the models they develop. The diagrams should be labeled to identify the essential parts of the circuit.

A ticket-out-the-door will be used to assess the final objective. Students will be asked to identify what type of circuit their house is wired with and what reasoning they used to come to their conclusion.

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Materials

Forces in Nature PowerPoint (see separate file)

battery, 6 V

flashlight bulb with holder (3)

wire leads, copper, insulated with alligator clips attached (5)

Procedures:

1. The class will start with three Bellringer questions:
 - What happens when you turn the lights on?
 - What allows lights to be turned on and off?
 - What happens beyond the confines of the room when you flip the light switch?
2. The class will be given time to formulate their answers and record them in their notebooks. The students will share their answers with their neighbors, then the neighbors will nominate a classmate to share their ideas. Two to three student should be given a chance to share. The teacher will leave the answer open and revisit the question toward the end of class.
3. The teacher will explain the day's objectives after the class has finished its discussion of the bell-ringer. The day's objectives are:
 - Name the three essential parts of a circuit.
 - Compare series circuits with parallel circuits.
 - Determining what type of circuit your house is wired with.
4. Class will continue with a short period of direct instruction. The lecture will introduce the students to the basic parts of a circuit (energy source, wire conductor, and a load). Examples of a load will be provided and the uses of a switch will also be explained (see supplemental pages)

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5. The next two slides will define and illustrate series and parallel circuits. Each of the different parts of the circuit will be pointed out in the diagrams in order to reinforce the names attached to the essential parts.
6. The direct instruction portion of the class will conclude with a brief introduction to the term “short circuit” and a comparison of fuses and circuit breakers.
7. Before transitioning to the lab for the remainder of the class, the teacher will introduce the circuit building activity. The teacher will explain that every student is expected to provide a completed activity sheet showing his or her own work.
8. The teacher will divide the class into groups. It will be beneficial to divide the visual/special learners and the kinesthetic learners evenly through the group to facilitate the process and provide the best opportunities for learning.
9. The teacher will remind the students of the safety precaution they need to take while conducting this simple lab. They need to be aware that even the simple, 6v batteries can cause some wires to get hot, and if they notice this happening, they should disconnect the battery immediately. The need to be aware that the light bulbs will get hot and that they should be handled with care. They should also understand that the bulbs are made of glass and that they could be cut if the glass breaks. In the event there is an accident, they should contact the teacher immediately and allow the teacher to clean up the broken glass.
10. Each group of 3 - 5 students will be given a kit with the materials needed to construct a simple circuit.
11. The groups will be asked to first build a series circuit with two light bulbs. They will sketch their model. They will then add another light bulb to the series and record their observations at to how the brightness of the bulbs changed when the third bulb was added. (The bulb should dim slightly.) They will then be instructed to unscrew one of the lights and record what happens to the circuit (all the lights go out). They will also need to explain why happens (because unscrewing the bulb breaks/opens the circuit).

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12. The second activity sheet requires the students to build a parallel circuit using two light bulbs. They will sketch this model as well. They will then add a third light bulb to the circuit and record their observations with regard to how the brightness of the bulbs is affected (they should stay the same, not dim). Once again, they will be instructed to unscrew one of the bulbs, record what happens, and explain why (only the unscrewed bulb will go out because each bulb has its own complete circuit in a parallel circuit).
13. As the students finish, they will be instructed to clean up their stations, making sure to remove all the leads from the batteries.
14. Students will return to their seats to reflect on the activity and relate it to their lives at home. They will be asked to sketch a room in their home in their notebook. They will need to include the wiring associated with the electrical equipment in the room (lights, TVs, radios, etc.). They will need to label the different parts of the circuit(s) that make up the room, and identify what type of circuit it is. If time does not allow, this activity can be done as homework.
15. Students that do not want to draw can be allowed to give a written description of the circuit. It must identify the type of circuit and the different components that make it complete.

Name: _____

Series Circuit Lab

Procedure

1. Connect a 6V battery and two flashlight bulbs in a series circuit. Draw a picture of what your circuit will look like first. Label the energy source, wire leads, the load(s), and the switch.

Name: _____

Series Circuit Lab

Procedure

2. Add another flashlight bulb in series with the other two bulbs. How does the brightness of the light bulbs change?

3. Carefully unscrew one of the lights from its socket. What happens to the other light in the circuit? Why?

Name: _____

Parallel Circuit Lab

Procedure

1. Connect a 6V battery and two flashlight bulbs in a parallel circuit. Draw a picture of what your circuit will look like first. Label the energy source, wire leads, the load(s), and the switch.

Name: _____

Parallel Circuit Lab

Procedure

2. Add another flashlight bulb in series with the other two bulbs. How does the brightness of the light bulbs change?

3. Carefully unscrew one of the lights from its socket. What happens to the other light in the circuit? Why?