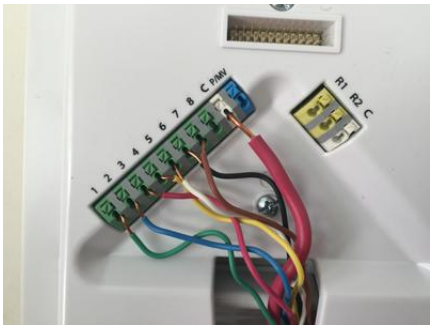
Circuits

Physical Science | Lesson Guide

5th Grade

Photo Description



This image shows a terminal block (a green connector block labeled 1-8) and a relay (a blue component labeled C P/MV) wired together with colored wires in red, blue, yellow, and green. The wires carry electrical current between components, allowing electricity to flow through different pathways. A yellow control box on the right labeled with "C1" and "C2" helps manage the electrical flow in this circuit system.

Scientific Phenomena

Anchoring Phenomenon: Why do electrical devices need wires and special connectors to work?

Electricity needs a complete, closed path (called a circuit) to flow from a power source, through electrical devices, and back to complete the loop. In this image, the colored wires create pathways for electric current to travel between the terminal block, relay, and control box. Without these connections, electricity cannot flow, and the system won't function. The relay acts as a switch—when electricity flows through it, it can automatically turn other electrical circuits "on" or "off," similar to how a light switch works in your home.

Core Science Concepts

* Complete Circuit: Electricity must flow in a continuous loop from the power source through all components and back to the power source. If the path is broken anywhere, electricity stops flowing and devices stop working.

* Conductors and Conductivity: The colored wires are made of copper metal, which is an excellent conductor—a material that allows electricity to flow easily through it. The plastic coating around the wires is an insulator that prevents electricity from leaking out.

* Electrical Components and Their Functions: Different parts of a circuit have different jobs. The terminal block acts as a connection point, the relay is an automatic switch, and the control box manages when electricity flows.

* Series vs. Parallel Connections: Wires can be connected in different ways. Understanding how components connect helps students predict how electricity will flow and whether all parts will receive power.

Pedagogical Tip:

Use the "light bulb moment" strategy: Before discussing circuits formally, have students predict what will happen if you remove one wire from a flashlight circuit. This activates prior knowledge and creates cognitive dissonance that makes the concept of "complete circuits" more memorable. Students learn better when they grapple with the phenomenon first.

UDL Suggestions:

Representation: Provide a color-coded circuit diagram alongside this photo so students can see both the real circuit and its symbolic representation. Some students need multiple modalities to understand abstract concepts like electricity. Consider also offering a tactile version—students can trace their fingers along the wire pathways while you explain current flow.

Engagement: Let students choose which colored wire they'll "follow" as electricity flows through the circuit, creating a physical demonstration where student volunteers hold hands to represent the circuit path.

Discussion Questions

1. What do you think would happen if we removed one of the colored wires from this circuit? Why? (Bloom's: Predict | DOK: 2)

2. How is this electrical circuit similar to a water system with pipes and pumps? What parts are the same? (Bloom's: Analyze | DOK: 3)

3. Why do you think different colored wires are used in this circuit instead of just one color? (Bloom's: Evaluate | DOK: 3)

4. If the relay is like a switch, what do you think it's switching on or off, and how would you test your idea? (Bloom's: Create | DOK: 4)

Extension Activities

Activity 1: Build a Simple Circuit with a Buzzer
Students design and build their own simple circuits using batteries, buzzers, wire, and switches. They test whether adding more batteries in series makes the buzzer louder (voltage increase) and predict what happens if they connect components in different ways. This hands-on experience deepens understanding of complete circuits and how components affect circuit behavior.

Activity 2: Circuit Design Challenge
Provide students with a real-world problem: "Design a circuit that turns on a light when a door opens." Students sketch their circuit design, label the components, and explain the path electricity would take. They can test their designs using circuit simulation software (like TinkerCAD Circuits—free online) before attempting to build them.

Activity 3: "Conductor or Insulator?" Scavenger Hunt
Students explore the classroom and school to find five materials they think are conductors and five they think are insulators. They organize findings in a chart, make predictions about why materials are categorized that way, and test a few with battery and bulb circuits (only with teacher supervision and appropriate safety measures).

NGSS Connections

Performance Expectation: 5-PS2-1: Support an argument that the gravitational force exerted by Earth on objects is directed down.
Note: While this image shows circuits (energy/forces), the primary 5th grade PE for electricity is:

Related PE - Energy Transfer: 4-PS3-4: Apply scientific ideas to design, test, and refine a device that converts energy from one form to another. (This anticipatory standard connects well to understanding how electrical circuits convert and transfer energy.)

Disciplinary Core Ideas:
- 4-PS3.B (Energy Transfer)
- 5-PS2.B (Types of Interactions)

Crosscutting Concepts:
- Systems and System Models (The circuit is a system where parts interact)
- Energy and Matter (Electricity moves through the system via wires)

Science Vocabulary

* Circuit: A complete, closed path that electricity follows as it flows from a power source through devices and back to the power source.

* Conductor: A material (like copper wire) that allows electricity to flow easily through it.

* Insulator: A material (like plastic or rubber) that does not allow electricity to flow through it and is used to protect people from electric shocks.

* Relay: An electronic switch that uses a small amount of electricity to turn a larger electrical circuit on or off automatically.

* Terminal Block: A connector device that securely holds wires in place and allows electricity to flow between them safely.

* Current: The flow of electricity through a circuit, like water flowing through a pipe.

External Resources

Children's Books:
- Electricity All Around by National Geographic Kids (introduces electrical concepts with vivid photos)
- The Magic School Bus and the Electric Field Trip by Joanna Cole (engaging narrative about electricity)
- Who Uses This? Community Workers (shows real-world applications of electrical circuits in jobs)

YouTube Videos:
- "What is Electricity?" - Crash Course Kids, 4:52 min — Engaging, age-appropriate explanation of what electricity is and how it flows. URL: https://www.youtube.com/watch?v=ZwcxKYfwdIw

- "How Do Circuits Work?" - National Geographic Kids, 3:45 min — Clear visual demonstration of complete and broken circuits with real-world examples. URL: https://www.youtube.com/watch?v=drNIAv1XwAc

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Teacher Tip: Start with students' observations of the photo before jumping to explanations. Ask, "What do you notice?" and "What questions do you have?" This positions students as scientific thinkers rather than passive receivers of information and builds stronger conceptual understanding of circuit behavior.