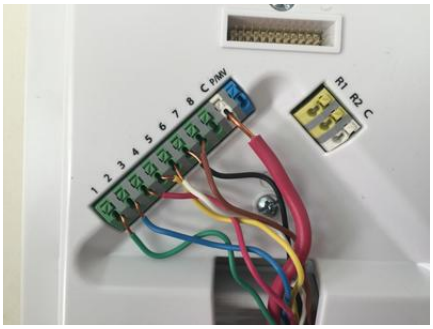
Circuits

Physical Science | Lesson Guide

2nd Grade

Photo Description



This image shows a circuit board with colored wires connected to different numbered terminals and metal contacts. The wires (red, blue, yellow, green, and black) are organized in a way that allows electricity to flow from one place to another. Two yellow boxes on the right side appear to be connection points where power can enter or leave the system.

Scientific Phenomena

Anchoring Phenomenon: Why do lights turn on when we flip a switch?

When wires are connected in the correct order, they create a pathway for electricity to travel through. Electricity needs a complete loop or "circuit" to flow—like a race track where runners go all the way around and come back to where they started. When the circuit is complete (all connections are made), electricity can move through the wires and make things like lights, buzzers, or motors work. If a wire is disconnected or broken, the circuit is "open," and the electricity cannot flow, so the light stops working.

Core Science Concepts

* Electrical Current: Electricity is energy that flows through wires like water flows through pipes. When it flows, it can power devices.

* Circuits: A circuit is a closed loop that electricity travels around. It needs a power source, wires, and something to use the energy (like a light bulb).

* Open vs. Closed Circuits: A closed circuit is complete and allows electricity to flow (the light is ON). An open circuit is broken or disconnected, and electricity cannot flow (the light is OFF).

* Conductors and Insulators: Metal wires (conductors) allow electricity to pass through them easily. The rubber coating around wires (insulators) keeps electricity from escaping where it shouldn't go.

Pedagogical Tip:

For Second Grade, use the "light switch" concrete example repeatedly. Students understand flipping a switch ON and OFF in their homes. Connect this familiar experience to the abstract concept of open and closed circuits. Avoid overly technical terms like "voltage" or "resistance" at this level; focus on simple cause-and-effect: connected wires = light on and broken wire = light off.

UDL Suggestions:

Multiple Means of Engagement: Provide both visual (diagram of circuit) and tactile (hands-on wire-connecting activity) learning experiences. Some students learn best by seeing, others by doing. Multiple Means of Representation: Use color-coded wires (as shown in the photo) and label them clearly so students with color blindness or visual processing differences can still participate meaningfully. Multiple Means of Action & Expression: Allow students to demonstrate understanding through drawing a circuit, building one with manipulatives, or verbally explaining to a partner why a light turned on.

Discussion Questions

1. What do you think would happen if we removed one wire from this circuit? (Bloom's: Predict | DOK: 2)
2. Why do you think the wires are wrapped in colored plastic instead of being bare metal? (Bloom's: Analyze | DOK: 3)
3. Can you think of three things in your house that use circuits to work? (Bloom's: Apply | DOK: 2)
4. How is a circuit like a circle or a loop? (Bloom's: Understand | DOK: 1)

Extension Activities

1. Build a Simple Circuit: Provide students with battery holders, LED lights, and wires. Have pairs work together to connect wires in the correct order to light up an LED. Ask them to predict what happens when they disconnect one wire (open the circuit). Safety note: Use only low-voltage DC circuits with batteries appropriate for children; no wall outlets.

2. Circuit Mapping Game: Draw large circuit diagrams on the floor with tape. Have students physically walk the path of a circuit, starting at the battery, following the wires, passing through a light bulb, and returning to complete the loop. Discuss what happens if someone "breaks" the circuit by stepping out of line.

3. Design a Light Switch: Provide craft materials (paper, brads, foil, batteries, wires, and small LED lights). Challenge students to design their own "switch" using simple materials that can open and close a circuit. Display and test all designs together.

NGSS Connections

Performance Expectation:
2-PS1-1: Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

Disciplinary Core Ideas:
- 2-PS1.A Structure and Properties of Matter — Understanding that objects are made of materials with different properties (e.g., metal conducts electricity; rubber does not).
- 2-ETS1.B Developing Possible Solutions — Designing and building simple circuits to solve a problem (e.g., making a light turn on).

Crosscutting Concepts:
- Cause and Effect — Connecting a switch (cause) to a light turning on or off (effect).
- Systems and System Models — Understanding that a circuit is a system with interconnected parts working together.

Science Vocabulary

* Circuit: A closed path that electricity travels around, like a loop.
* Conductor: A material (like metal) that electricity can flow through easily.
* Insulator: A material (like rubber) that stops electricity from flowing through it.
* Electricity: A form of energy that flows through wires and powers things like lights and toys.
* Switch: A device that opens or closes a circuit to turn something on or off.
* Wire: A thin strand of metal surrounded by plastic that carries electricity from place to place.

External Resources

Children's Books:
- Electricity: A Question and Answer Book by Christopher L. Harbo (straightforward, age-appropriate introduction)
- What Is Electricity? by Robert E. Wells (uses illustrations to explain circuits)
- Circuits and Electricity by Rebecca Olien (part of the "How Do Simple Machines Work?" series)

YouTube Videos:
- "Electric Circuits for Kids" by Crash Course Kids — Simple explanation of how circuits work with clear visuals and age-appropriate language. https://www.youtube.com/watch?v=w6colvoyrd8
- "What is a Circuit?" by ScienceKids.co.nz — Animated introduction showing open and closed circuits using familiar examples (lights, switches, batteries). https://www.youtube.com/watch?v=leKvImE_Zwc

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Teacher's Note: This lesson scaffolds naturally from observing the circuit board to understanding cause-and-effect, and finally to students designing and testing their own circuits. Keep language concrete, use familiar examples, and prioritize hands-on exploration for this age group.