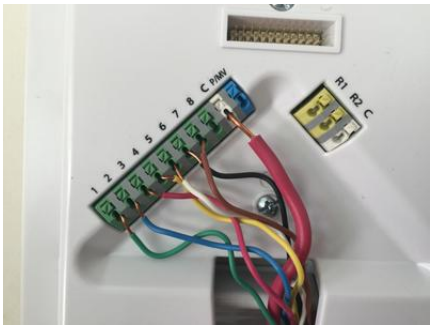
Circuits

Physical Science | Lesson Guide

4th Grade

Photo Description



This image shows a terminal block (a green connector) with eight numbered positions and colored wires attached to it, alongside a blue capacitor and a yellow component labeled with "C" and "F" markings. The wires—red, black, yellow, blue, and green—represent different electrical pathways that can carry electric current through a circuit system, similar to how roads carry traffic.

Scientific Phenomena

Anchoring Phenomenon: How do colored wires help electricity travel through a circuit?

Electricity flows through closed loops called circuits. In this image, the different colored wires are conductors—materials that allow electricity to move easily from one place to another. The terminal block acts as a connection point where multiple wires meet, allowing electricity to flow in different pathways. Each colored wire is insulated (covered in plastic) to keep electricity from escaping and to help us organize which path the electricity takes. Without complete loops and proper connections, electricity cannot flow and power devices like lights or motors.

Core Science Concepts

* Electrical Conductors and Insulators: Metals in wires conduct (allow) electricity to flow, while plastic coating insulates (prevents) electricity from leaking out.

* Complete Circuits: Electricity must travel in a closed loop with a power source, wire, and load (device) to work. If the loop breaks, electricity stops flowing.

* Energy Transfer: Electricity is a form of energy that travels through wires to power devices. The colored wires help direct this energy to different destinations.

* Connection and Organization: Terminal blocks organize multiple wires and create reliable connection points where electricity can safely transfer between different parts of a circuit.

Pedagogical Tip:

When teaching circuits to fourth graders, use the analogy of a racetrack or water pipe: electricity is like a car or water that needs a complete path to travel. If the track has a gap or the pipe is broken, nothing moves. This concrete comparison helps students understand why circuits must be closed loops before electricity can flow.

UDL Suggestions:

Provide multiple means of representation by combining visual (the colored wires in the photo), tactile (students building circuits with wire), and kinesthetic (students acting as "electricity" moving around a human circuit loop) learning experiences. Also, allow students to choose how they show understanding: drawing a circuit diagram, building a real circuit, or explaining circuits to a partner.

Discussion Questions

1. Why do you think the wires in this circuit are different colors? (Bloom's: Understand | DOK: 1)

2. What would happen if one of these wires was cut or unplugged from the terminal block? (Bloom's: Analyze | DOK: 2)

3. How is this circuit similar to a path you walk to get from your classroom to the playground? (Bloom's: Analyze | DOK: 2)

4. If we wanted to add a light bulb to this circuit, where would we connect it, and why does it need to be part of a complete loop? (Bloom's: Evaluate | DOK: 3)

Extension Activities

1. Build Your Own Circuit: Provide students with AA batteries, wire, light bulbs, and switches. Challenge them to build a working circuit and draw a diagram of their circuit. Have them predict what happens when they open and close the switch, then test their prediction.

2. Circuit Scavenger Hunt: Take students on a classroom walk to identify circuits in the school (light switches, interactive whiteboards, computers, charging stations). Have students sketch or photograph each circuit and discuss what it powers.

3. Series vs. Parallel Circuits: Using the terminal block as a model, help students compare circuits where components are connected in a line (series) versus branching off (parallel). Test which setup keeps lights brighter when multiple bulbs are added. Have students record observations and hypothesize why.

NGSS Connections

Performance Expectation:
4-PS3-2: Make observations to provide evidence that energy is transferred by sound, light, heat, and electric currents.

Disciplinary Core Idea:
4-PS3.B Energy can be transferred in various ways.

Crosscutting Concepts:
Energy and Matter — Electricity is a form of energy that flows through pathways.
Systems and System Models — A circuit is a system with interconnected parts that must work together.

Science Vocabulary

* Circuit: A complete loop that electricity travels through from a power source and back again.

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

* Insulator: A material (like plastic or rubber) that stops electricity from flowing through it.

* Terminal Block: A connector that safely joins multiple wires together so electricity can transfer between them.

* Electrical Path: The route that electricity takes as it moves through a circuit from the power source to a device and back.

* Energy Transfer: When electricity moves from one place to another to power something, like a light or motor.

External Resources

Children's Books:

Electricity* by Rebecca Stefoff (DK Findout series)

The Electricity Book* by Lisa Trumbauer (a colorful introduction to circuits)

Spark the Electric Jigsaw Girl* by Betsy Cornwell (narrative-based introduction to circuits and energy)

YouTube Videos:

* "How Do Electric Circuits Work?" by TED-Ed — A clear, animated explanation of circuits using everyday examples. https://www.youtube.com/watch?v=ZDqdC1xfzMo
* "Building a Simple Circuit" by National Geographic Kids — Demonstrates how to build a basic circuit with batteries, wires, and a bulb. https://www.youtube.com/watch?v=S2NR8g-q6QY