Conductor

Physical Science | Lesson Guide

3rd Grade

Photo Description

A person is using wires to connect a small light bulb to a battery. The light bulb is glowing, which shows that electricity is flowing through the wires from the battery to make the bulb light up.

Scientific Phenomena

This image demonstrates the Anchoring Phenomenon of electrical circuits and conductivity. The light bulb is illuminating because electrical current is flowing from the battery through the conducting wires to complete a circuit. When the circuit is complete (a closed loop), electrons flow from the negative terminal of the battery, through the wires and bulb filament, and back to the positive terminal. The resistance in the bulb's filament causes it to heat up and glow, producing visible light.

Core Science Concepts

1. Electric Circuits: Electricity needs a complete path (circuit) to flow from the power source back to itself
2. Conductors: Materials like metal wires allow electricity to flow through them easily
3. Energy Transfer: Chemical energy stored in the battery is converted to electrical energy, then to light and heat energy in the bulb
4. Closed vs. Open Circuits: When the circuit is complete (closed), electricity flows; when broken (open), it stops

Pedagogical Tip:

Start with hands-on exploration before introducing vocabulary. Let students experiment with connecting batteries and bulbs using different materials to discover which ones work before explaining why some materials conduct electricity.

UDL Suggestions:

Provide multiple ways for students to demonstrate understanding: drawing circuit diagrams, building physical circuits, acting out electron flow with their bodies, or creating digital presentations about conductors and insulators.

Zoom In / Zoom Out

1. Zoom In: Inside the metal wires, tiny particles called electrons are moving from atom to atom, carrying electrical energy through the conductor. The electrons bump into atoms in the bulb's filament, causing them to vibrate and give off light.

2. Zoom Out: This simple circuit is the foundation for all electrical systems in our homes, schools, and communities. From light switches to computers, all electrical devices rely on the same principles of conductors, circuits, and energy transfer.

Discussion Questions

1. What do you think would happen if we removed one of the wires? (Bloom's: Predict | DOK: 2)
2. Why do you think the wire is made of metal instead of plastic? (Bloom's: Analyze | DOK: 3)
3. How is this simple circuit similar to the lights in our classroom? (Bloom's: Compare | DOK: 2)
4. What other materials could we test to see if they conduct electricity? (Bloom's: Create | DOK: 2)

Potential Student Misconceptions

1. Misconception: "Electricity gets used up in the light bulb"
   Clarification: Electricity flows in a complete loop - the same amount that leaves the battery returns to it, but energy is transformed from electrical to light and heat

2. Misconception: "The battery pushes electricity to the bulb"
   Clarification: The battery creates a difference that causes electricity to flow through the complete circuit, including back to the battery

3. Misconception: "Only metal can conduct electricity"
   Clarification: While metals are excellent conductors, other materials like saltwater, graphite, and even the human body can conduct electricity

Cross-Curricular Ideas

1. Math + Science: Have students measure the brightness of the bulb at different distances from a wall, or count how many batteries it takes to light multiple bulbs in a circuit. They can create bar graphs to show their findings.

2. ELA + Science: Students can write "How-To" instructions for building a simple circuit, using sequencing words like "first," "next," and "last." They can also read non-fiction books about electricity and create fact posters with illustrations.

3. Art + Science: Students can create colorful circuit diagrams using string, markers, and construction paper to show the path electricity travels. They can also design and decorate their own "invention" that uses batteries and light bulbs.

4. Social Studies + Science: Explore how electricity powers our communities by investigating different ways people in our town use electricity (traffic lights, streetlights, homes, schools). Students can create a community map showing where electricity is used.

STEM Career Connection

1. Electrician: Electricians install and repair electrical wiring and equipment in homes, schools, and buildings. They use their knowledge of circuits and conductors to keep our lights on and our devices working safely. Average Salary: $56,900 USD per year

2. Electrical Engineer: Electrical engineers design new electrical systems and devices, like smartphones, computers, and power systems for cities. They solve problems about how to make electricity work better and safer. Average Salary: $104,000 USD per year

3. Light Technician: Light technicians set up and operate lighting equipment for concerts, theaters, movie sets, and events. They understand how electricity powers lights and create special lighting effects for performances. Average Salary: $38,500 USD per year

NGSS Connections

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

Disciplinary Core Ideas:
- 4-PS3.A: Energy and Matter
- 4-PS3.B: Conservation of Energy and Energy Transfer

Crosscutting Concepts:
- Energy and Matter
- Cause and Effect

Science Vocabulary

* Circuit: A complete path that electricity can flow through
* Conductor: A material that allows electricity to flow through it easily
* Current: The flow of electricity through a conductor
* Battery: A device that stores chemical energy and converts it to electrical energy
* Insulator: A material that does not allow electricity to flow through it easily
* Energy: The ability to do work or cause change

External Resources

Children's Books:
- Switch On, Switch Off by Melvin Berger
- The Magic School Bus and the Electric Field Trip by Joanna Cole
- Oscar and the Bird: A Book About Electricity by Geoff Waring