POWER PLAY

The Science of Electricity

When the lights dim and the crowd roars at an OKC Thunder game, something electrifying happens - literally. Before the final quarter of a game, Tesla coils send bright sparks of electricity into the air while playing music. It looks like magic, but it's actually science in action.

Electricity is energy created when tiny particles called electrons move. Even though we can't see electrons, we can see the effects of their movement. In this lesson, students will investigate how electricity works and how scientists observe invisible forces.

HERE'S WHAT YOU'LL NEED:

- **Balloon**
- **Tissue Bits or Paper Scraps**
- **AA Batteries**
- **Copper Wire**
- **Small Bulbs (e.g., from a strand of holiday lights)**
- **Assorted Objects (coin, foil, rubber band, paperclips, fabric, etc.)**
- **Magnets**
- **Iron Filings**
- **Compass**

WARMUPS

Electric Observations

Sparks at the Arena: Show students an image or short video clip of the Tesla coil display used during an OKC Thunder game. In these displays, bright electrical sparks jump through the air while music plays, creating a dramatic effect that energizes the crowd before the final quarter.

Ask students to observe carefully and think about what might be happening.

- What do you notice about the sparks?
- Where do you think the energy is coming from?
- Why do you think electricity can create both light and sound?
- What might be moving that we cannot see?

Explain that scientists ask questions about surprising events like this and investigate how they work. In today's lesson, students will explore how electricity moves and how scientists observe invisible forces like electrons and magnetic fields. To better understand large electrical systems like those used in an arena, students first need to explore how electricity behaves in smaller experiments.

Electric and Magnetic Forces: Electricity happens when electrons move. Before investigating, students explore what they already know.

Guide a short discussion:

- Where have you seen electricity?
- What does electricity do?
- Can electricity exist if nothing is plugged in?

Scientists study electricity by observing what it does, even when they can't see it directly. In this warm-up, students will observe demonstrations that reveal invisible forces created by moving electrons.

Concept	What Students Observe	What it Shows
Magnetic Field	Iron filings form curved patterns around a magnet.	Magnets create invisible forces around them.
Magnetic Direction	A compass needle moves toward a wire carrying electricity.	Magnetic fields have direction.
Electricity and Magnetism	A wire carrying electricity can move a compass needle.	When electrons move, they can create magnetic forces.

Explain that electricity and magnetisms are closely connected. When electrons move, they create energy that can produce motion, light, sound, or magnetic forces.

As students explore electric and magnetic forces, it can be helpful to introduce a few key terms scientists use when studying electricity.

Term	What it Means	Where Students Might See It
Electron	A tiny particle that carries electric charge.	Moving through wires in a circuit.
Electricity	Occurs when tiny particles called electrons move from one place to another.	Lighting systems, scoreboards, and electronics.
Circuit	A complete loop that allows electricity to flow.	Battery, wire, and bulb setup.
Conductor	A material that allows electrons to move easily.	Metals like copper, aluminum, or coins.
Insulator	A material that slows or blocks the movement of electrons.	Rubber, plastic, or fabric.
Magnetic Field	An invisible area where magnetic forces act.	Around magnets or wires carrying electricity.

Optional Discussion Prompts

- What evidence did you see that electrons were moving?
- Why do you think the iron fillings formed curved lines instead of spreading evenly?
- What do these observations tell us about forces we can't see?

Fun Fact: Electricity moves incredibly fast. In fact, the electrical signals that power lights in a building can travel close to the speed of light - about 186,000 miles per second. If electricity could travel around a basketball court at the speed of light, it would circle the entire court millions of times in a single second! Ask students, "Why do you think electricity needs to move so quickly in large systems like arenas, buildings, or cities?"

GAMETIME

Electron Exploration

Now that students have observed evidence of invisible forces, they will investigate how electricity behaves through hands-on explorations. Scientists often test ideas by observing how energy moves from one place to another. In these investigations, students will look for evidence that electrons are moving.

As a class or individually, students should record what they observed, what they think happened, and any evidence supporting their ideas. This can include drawings (models).

Investigation	Process	Concept(s)
Static Electricity	Rub a balloon on hair or clothing, then bring it near paper scraps. Observe how the paper moves without being touched.	Electrons can transfer between objects and create electric charge.
Simple Circuit	Create a circuit using a battery, wire, and small bulb (like a light bulb from a strand of holiday lights).	Students will see that electricity flows only when a complete loop is formed (i.e., a closed circuit).
Conductors and Insulators	Using the same circuit setup, test objects such as coins, foil, rubber bands, or fabric to identify which materials allow electricity to flow.	Some materials allow electrons to move easily (conductors) while others block movement (insulators).
Electricity and Magnetism	Hold a compass near a wire connected to a battery. Observe how the compass needle moves when electricity flows.	Moving electrons create magnetic fields.

Pro Tip: Encourage students to focus on **evidence** rather than guessing. Scientists rarely see electrons directly. Instead, they observe the effects electrons cause, such as motion, light, sound, or magnetic changes, to understand what is happening.

ANALYZE THE REPLAY

Arena Electricity Systems

Electricity powers nearly everything that happens inside a professional basketball arena. From the bright lights above the court to the giant video scoreboard and sound system, electrical energy keeps the game running smoothly.

Many of these systems rely on circuits and energy transfer, the same ideas students explore in Game Time.

Arena System	How Electricity Is Used
Court Lighting	Electricity flows through circuits to power powerful lights that illuminate the court.
Scoreboard and Video Screens	Electrical signals control thousands of tiny lights to display scores, replays, and graphics.
Sound System	Electrical energy travels through wires to speakers, where it is converted into sound waves.
Tesla Coil Show	High-voltage electricity travels through coils to create sparks of light and bursts of sound.

All of these systems depend on electrons moving through circuits. Engineers design these electrical systems carefully so they work reliably and safely during every game.

Discussion Prompts

- Which arena system do you think uses the most electricity?
- Why do electrical systems need complete circuits to work?
- What might happen if electricity stopped flowing during a game?
- Why do engineers need to think about safety when working with electricity?

Encourage students to connect what they learned during the investigations with the systems they see in real life.

OVERTIME

Engineering Design

As an extension, students can apply what they learned by designing a simple electricity-powered effect for a basketball arena show.

Students sketch a diagram showing:

- Where energy starts
- How electricity moves through circuits
- What effect the energy produces (light, sound, motion, etc.)

Encourage students to explain their design choices using evidence from the investigations.

COACH'S CORNER

Electricity

Electricity is all about motion. When electrons move through a path, energy travels with them. That energy can change form, becoming light, sound, heat, or motion.

The Tesla coils used in arena shows demonstrate how powerful moving electricity can be. They send high-voltage electrical energy through coils that release sparks into the air. Those sparks heat the air so quickly that sound waves form, which is why we sometimes hear a crackling noise along with the light.

Scientists and engineers study electricity so they can design safe technologies, from lighting systems to medical tools to scoreboards. By observing evidence, testing ideas, and revising explanations, they learn how invisible particles can produce visible results.

Skills/Standards Alignment

This activity can be used to support students with developing the following skills and/or content.

Skills/Content	Grade 3	Grade 4	Grade 5
Forces and Motion: • Electric and magnetic forces between a pair of objects do not require that the objects be in contact.	X		
Conservation of Energy and Energy Transfer: • Energy is present whenever there are moving objects, sound, light, or heat. • Energy can be transferred from place to place by electric currents, which can be used locally or to produce motion, sound, heat, or light. • The current may have been produced to begin with by transforming the energy of motion into electrical energy.		X	
Asking Questions • Ask questions that can be investigated based on patterns such as cause and effect relationships.	X	X	
Planning and Carrying Out Investigations • Make observations to produce data to serve as the basis for evidence for an explanation of phenomenon.	X	X	X
Energy and Matter • Energy can be transferred in various ways and between objects.		X	X
Cause and Effect • Cause and effect relationships are routinely identified, tested, and used to explain change.	X	X	X