

Magnetism and Electricity: The Broken Toy Car

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Science Objective

Children will learn that magnets attract and repel each other and some other objects. They will also explore the flow of electricity in a loop through circuits. Electric currents can flow in one direction, or constantly change directions to produce alternating currents. Children will explore how magnetism and electricity are related. Electromagnets are devices that work when electricity and magnetism interact. Their strength can be increased or reduced by changing the amount of wire wrapped around a magnetized iron core.

iScience Puzzle: Fix It

Children are faced with the problem of fixing a toy car to make it run again. Before they can solve this problem, they will need to learn about magnetism, how electricity flows through a closed circuit, and how electricity and magnetism work together.

Objectives ► Children will:

- understand that magnets attract and repel.
- define magnetism and explain how magnetic force pulls things toward each other or pushes things apart.
- understand that electricity is the flow of electrons through a circuit.
- learn how to create an electromagnet and understand its uses.

Materials

- magnets
- iron nails
- brass tacks
- plastic rulers
- paper
- fabric
- wires
- light bulb
- switch
- battery
- compass

Lesson Plan

Before Reading

Investigation

Provide children with magnets and ask them to discover what happens when magnets come in contact with different objects. Give children iron nails, brass tacks, plastic rulers, paper, and fabric. List things that magnets stick to and things that they do not stick to.

Ask: *What happens when two magnets come together? When do they attract, and when do they repel, each other?*

Tell children that they will learn about magnets and magnetic fields as they explore magnetism. They will investigate how electrons move through wires when the wires are connected to a power source and make a complete circuit. Magnetism can be combined with electric current to make electromagnets.

Science Concepts

Magnets stick to iron and repel other materials.

Like poles on a magnet repel; opposite poles attract.

During Reading

Investigation

pp. 7–8: Have children attract objects with magnets, determining what happens as the distance between the object and the magnet increases.

pp. 9–12: Spend some time discussing the illustrations on pages 9 and 11. Be sure children comprehend what the illustrations are showing.

p. 13: Ask: *How long do you think the nail will stay magnetized?*

p. 14: Set up a circuit like the one shown and have children experiment with it. Try using the circuit without the switch. Try it without the light bulb.

p. 16: Ask: *Why do you think wires are made of metal?*

Science Concepts

Magnetic force decreases with distance.

Magnetic force creates a magnetic field. Magnetic force extends in all directions around a magnet, but is strongest at the poles. Like poles on a magnet repel; opposite poles attract.

Iron can be magnetized by magnets.

Electricity flows through closed circuits. Circuits need a power source, wires, and a device that works on electricity. They usually contain a switch as well, to start and stop the flow of electrons.

Conductors are materials that allow electrons to flow through them. Metals are good conductors.

During Reading (continued)

Investigation

pp. 18–19: Compare and contrast series and parallel circuits using a Venn diagram.

pp. 22–23: Set up the circuit shown on page 14, with the switch closed. Then put a compass near a wire and show children what happens.

pp. 24–27: Focus children’s attention on the illustration on page 24. Ask: *What would happen if the wire were wrapped even more times around the core? What would be the effect of a larger core?*

pp. 28–29: Discuss how electromagnets use electricity to create a magnetic force that can be used to perform tasks.

Science Concepts

Current flows through one pathway in a series circuit. A parallel circuit has two or more pathways for current.

Electricity and magnetism affect each other.

An electromagnet has a core with wire wrapped around it through which electrons flow. Adding turns of wire strengthens the magnetic force. Increasing the size of the core increases the force as well.

The combination of electricity and magnetism can be used to power many devices, as well as intricate and strong machines.

After Reading

Restate the key ideas in this book. Magnets are surrounded by a magnetic field, which is stronger near the poles. When magnets move, their magnetic field moves, too. Magnets can stick things together. They can also be used to push or pull things. Electrons flow through wires attached to a power supply. They flow only when the circuit is closed. An electromagnet is made from a coil of wire wrapped around an iron core. When an electric current passes through the wire, a magnetic field is produced around the core. The strength of an electromagnet can be increased by adding coils of wire, increasing the size of the core, and passing more current through the wire.

Investigation

Provide children with wire, a nail, a battery, and paper clips. Have children build their own electromagnet and then use the electromagnet to pick up the paper clips. Experiment with ways to increase the strength of the electromagnet. Have children graph their results.

Understanding Science

The strength of an electromagnet can be increased or decreased. Electromagnets can be used to perform tasks.