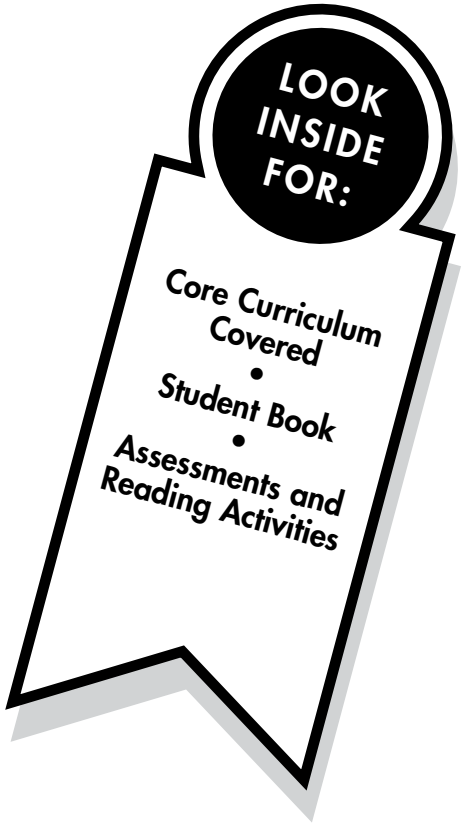
Physical Science

Electricity and Magnetism

Basic Level

Electrical Energy



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Electrical Energy

What are the properties of electricity and magnetism?

CORE CURRICULUM STATEMENTS

Energy exists in many forms, and when these forms change energy is conserved.

Energy exists in various forms: heat, electric, sound, chemical, mechanical, light.

Energy can be transferred from one place to another.

Some materials transfer energy better than others (heat and electricity).

Energy and matter interact: water is evaporated by the Sun's heat; a bulb is lighted by means of electrical current; a musical instrument is played to produce sound; dark colors may absorb light, light colors may reflect light.

Electricity travels in a closed circuit.

Physical Science

Electricity and Magnetism

Basic Level

Student Book

Electrical Energy

Print pages 5–18 of this PDF for the student book.

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Electrical Energy

What are the properties of electricity and magnetism?

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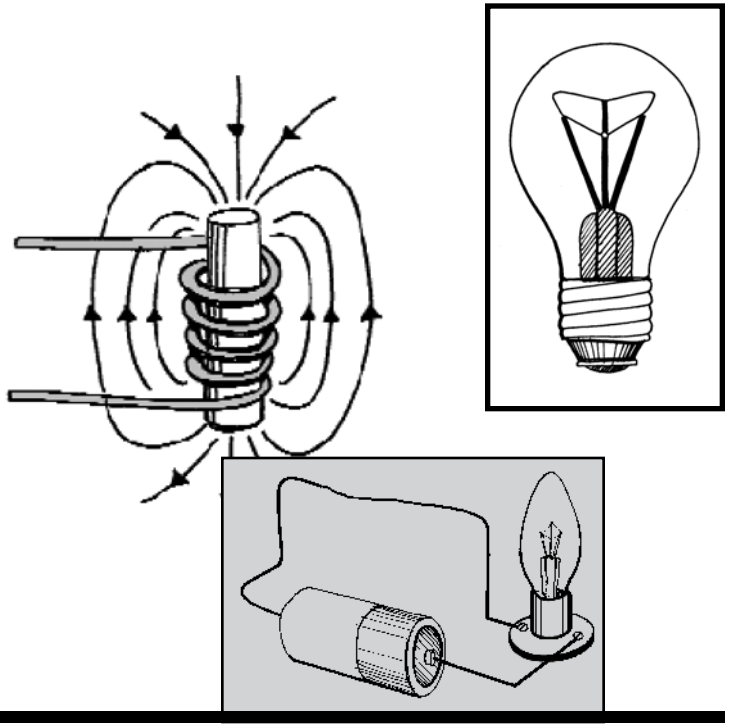
FOCUS ON SCIENCE

Physical Science

Electricity and Magnetism

Electrical Energy

by Ken Sibila



FOCUS ON SCIENCE

Physical Science

Electricity and Magnetism

Electrical Energy

by
Ken Sibila

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Curriculum materials for **your** content standards

Table of Contents

– Predict –
What do you think you will learn from this book?

INTRODUCTION

Electricity Is Energy

Look around the room you are in right now. Count the number of items that use electricity. Now imagine there is no electricity. What would it be like in that room?

Electricity is an important energy source. It provides us with light, heat, and sound. How can electricity do this? Read on to find out.

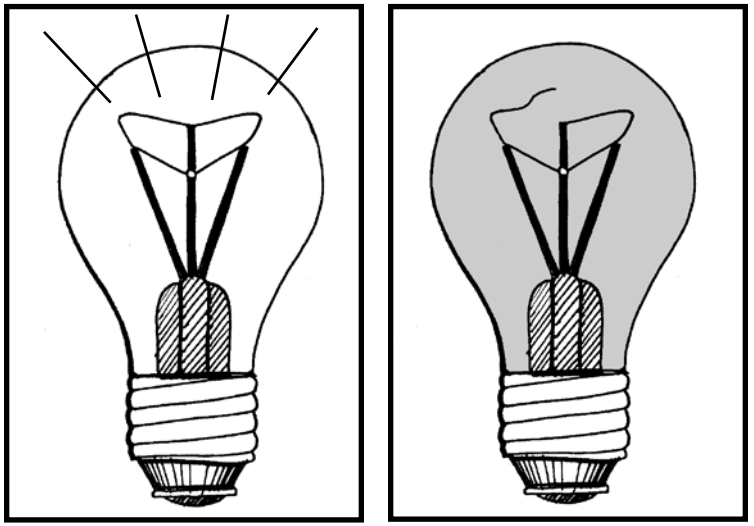
CHAPTER 1

Electrical Circuits

You turn a switch on a lamp. Suddenly, light appears. How does that happen?

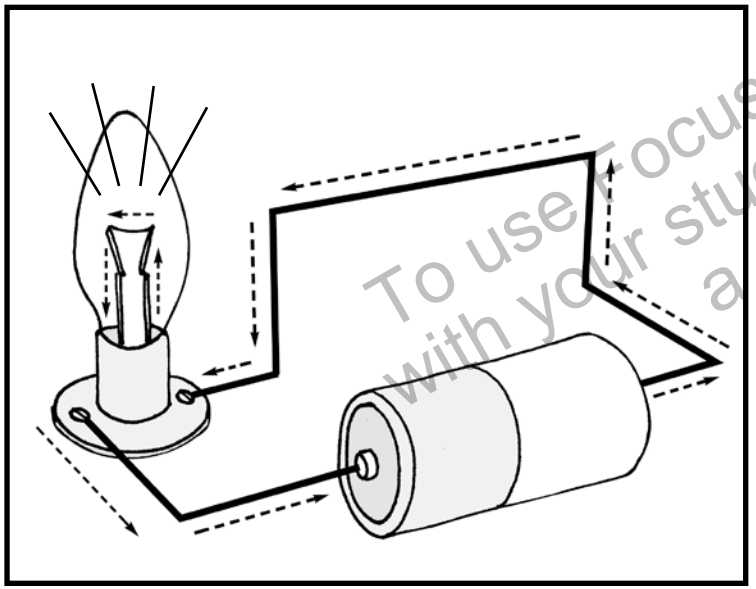
A light bulb has a tiny wire in it. Electricity enters the light bulb and passes through the wire. The wire heats up. This causes the wire to glow, creating light.

If the wire breaks, electricity can no longer flow through the wire. The bulb will not work.



Closed Circuit

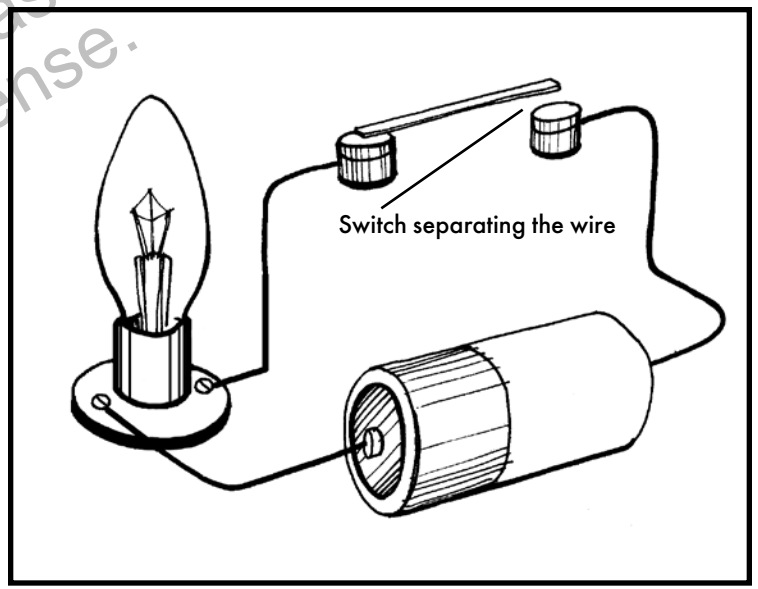
How does electricity get to the light bulb? Electricity flows from a power source through a wire. The wire is connected to the light bulb. Electricity passes through the wire in the light bulb and returns to the power source through another wire. This electrical loop is called a closed circuit.



A battery is one type of electric power source. Electricity flows from the battery to the light bulb. Electricity then flows back to the battery.

Open Circuit

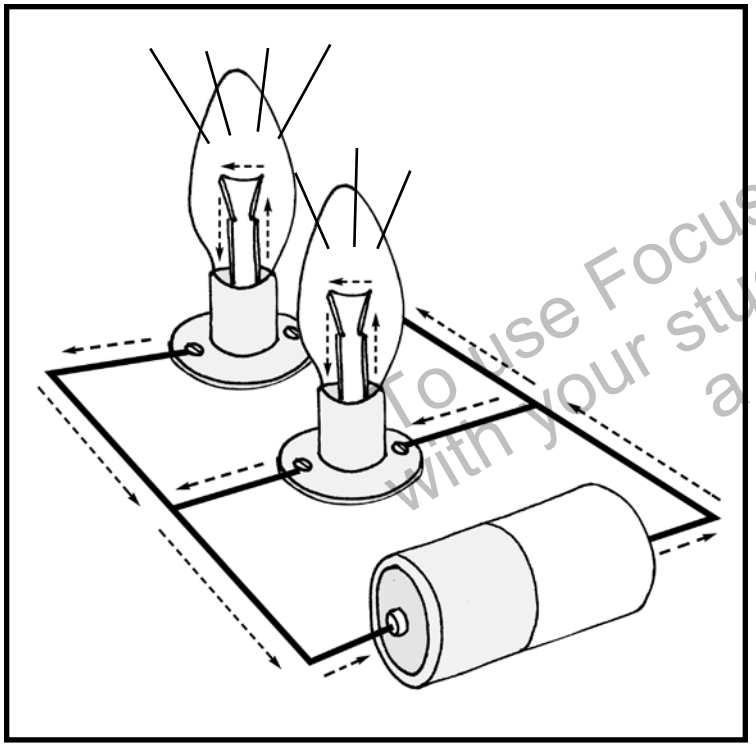
How do you turn a light bulb off? You turn a switch. Look at this diagram. A switch has been placed in the electrical loop. The switch separates the wire. Now, electricty has no place to go. The electricity stops flowing.



This light bulb will not produce light. The flow of electricity has been stopped by a switch.

Parallel Circuit

You can connect more than one light bulb to an electrical circuit. This is called a parallel circuit. The diagram below shows a parallel circuit.



Conductors and Insulators

You have probably plugged an electric cord into an outlet many times. The cord is made of copper wire on the inside and rubber on the outside. Copper is a good **conductor** of electricity. Electricity flows easily through copper.

The rubber on the outside of the cord is an **insulator**. Insulators do not allow electricity to flow. That is why you do not get shocked when you touch a cord that is plugged in.

conductor: a material that carries electricity
insulator: a material that keeps electricity from flowing

CHAPTER 2

Static Electricity

Have you ever reached for a doorknob and been shocked? This happens because electricity from the carpet jumped to your body. This gave your body an electrical charge.

Electricity jumped from your fingers to the doorknob because it had a different electrical charge. That caused a spark. This is static electricity.

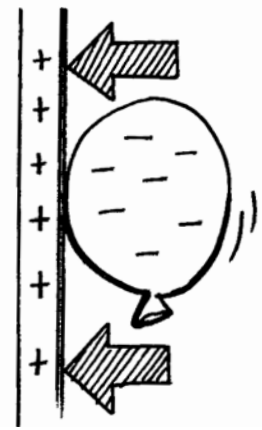
–Explain–
What causes static electricity?

Electrically Charged Objects Can Attract

Electrical charges in objects can attract or repel each other. Here is an activity to prove this.

Rub a balloon full of air against your hair or a piece of wool. Then hold it against a wall. When you let go of the balloon, it sticks to the wall. Why does this happen?

When you rubbed the balloon against your hair or wool, the balloon picked up an electrical charge. The charged balloon becomes attracted to a different electrical charge in the wall. This causes the balloon to stick to the wall.

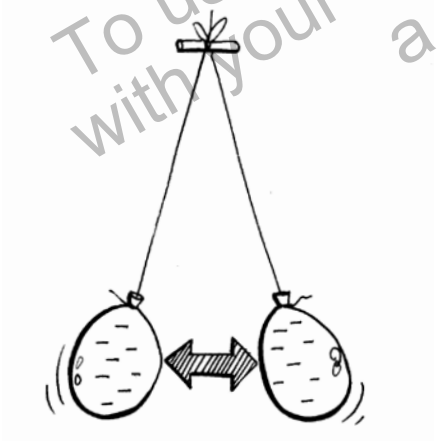


Electrically Charged Objects Can Repel

Objects with similar charges will repel each other. Try this.

Take two balloons and tie a string to each one. Rub the two balloons together. Then hold them by the strings and put them next to each other. The balloons will move apart.

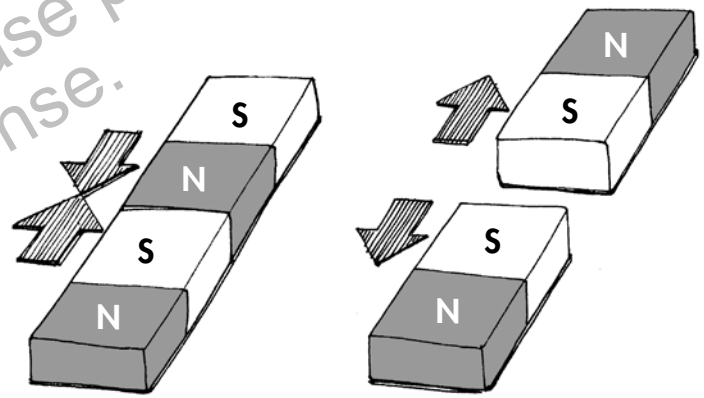
Rubbing the two balloons gave each of them the same electrical charge. Objects with the same electrical charge always **repel** each other, so the balloons pushed each other away.



repel: to drive or force away

Magnets

Magnets attract and repel, too.
Magnets have north and south poles.
A north pole and a south pole attract.
Two north poles repel each other.
Two south poles repel each other, too.



CHAPTER 2

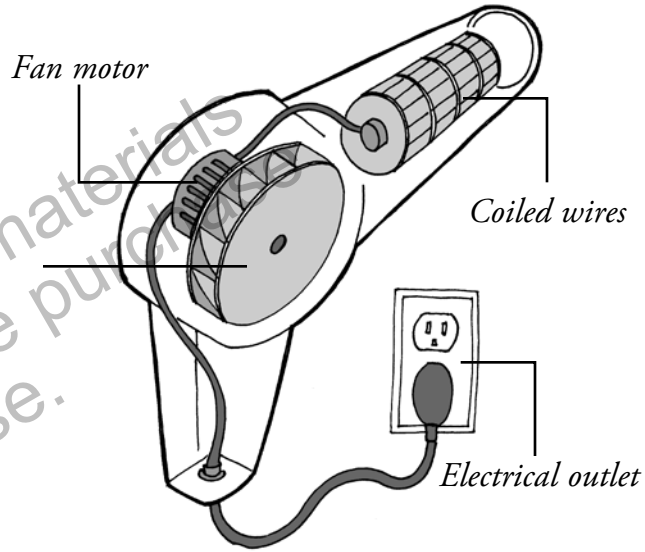
Electricity Creates Heat and Motion

Electricity can also be used to create heat. A hair dryer is an example.

When you want to dry your hair, you plug a hair dryer into an electric outlet. The outlet is the power source. When you turn the switch, electricity flows through the hair dryer.

There are coiled wires in the hair dryer. When electricity travels through the coiled wire, they become hot. A fan forces the hot air out of the hair dryer.

How a Hair Dryer Works



The cord is plugged into an electric outlet.

Electricity flows through the wire to the fan's motor, causing the fan to move.

Electricity flows to coiled wires, causing the coils to heat up.

Hot air blows out of the hair dryer.

CHAPTER 3

Electricity Creates Sound

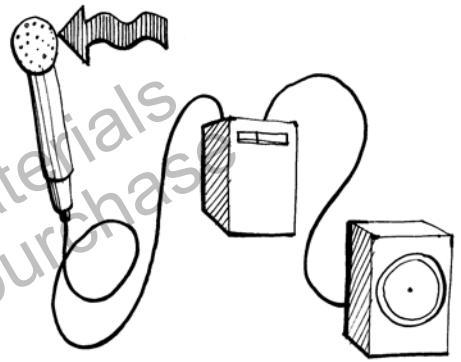
How does a voice travel from your principal's office to your classroom during morning announcements?

When your principal speaks, sound waves from his or her voice cause vibrations in the air. These vibrations are picked up by a microphone and turned into tiny **pulses** of electricity.

These pulses travel through copper wire connected to the speaker. The speaker receives the pulses and begins to vibrate. These vibrations create sound waves.

pulse: a regular beat

How a Microphone and Speaker Work



The principal speaks into a microphone.

Sound vibrations are picked up by the microphone and turned into pulses of electricity.

Pulses of electricity pass through a wire connected to a speaker.

The speaker receives the electric pulses, causing the speaker to vibrate.

The vibrations create sound waves.

CHAPTER 5

Studying Electricity

The word *electricity* came from the ancient Greek word *elektor* which means "beaming sun." The word *elector* was used by the Greeks to describe amber. Amber is tree sap that hardens into stone over millions of years. The Greeks noticed that when they rubbed amber against a piece of fur, the amber attracted dust, feathers, and other objects. They could not explain why this happened.

Dr. William Gilbert

Around 1600, a scientist named Dr. William Gilbert studied this effect. He determined that amber, when rubbed against fur, could be made "electric." He thought that the friction of rubbing the two materials together created the electricity.

Benjamin Franklin

In 1747, Benjamin Franklin thought that all materials contained a single kind of electrical fluid and that rubbing moves this unseen fluid from one material to another. Franklin defined the electrical fluid as positive and the lack of fluid negative.

Hans Christian Oersted

Hans Christian Oersted was a teacher in Denmark. One day in 1820, he set up two **demonstrations**. First, he was going to show how an electric current heats a wire. Then he was going to show magnetism using a compass.

While Oersted was showing how electricity heats a wire, he looked at the compass. He noticed that when the electric current was switched on, the nearby compass needle moved.

He discovered that an electric current flowing through a wire could move the needle of a compass. His discovery showed the connection between electricity and magnetism.

demonstration: showing how something works

Johnstone Stoney

During the 1800s scientists discovered that an electric charge had a natural unit, which could not be divided any further. In 1891, Johnstone Stoney called this unit an *electron*.

Later J.J. Thomson discovered the particle which carried that charge and the name *electron* was applied to it.

These studies were a good example of scientific research. A person thinks about why something occurs, studies it, and suggests an explanation. Each person learns from the next and challenges the explanation with new ideas and investigations. Over time, these scientific theories are proven to be correct or incorrect.

Glossary

conductor—a material that carries electricity

demonstration—showing how something works

insulator—a material that keeps electricity from flowing

pulse—a regular beat

repel—to drive or force away

resistance—a measure of the power of a material to resist the flow of electricity

To Find Out More . . .

Want to learn more about electrical energy?

Try these books

Electricity (DK Eyewitness Books) by Steve Parker and Laura Buller. Dorling Kindersley, 2005.

What Is Electricity? (Rookie Read-About Science) by Lisa Trumbauer. Children's Press, 2004.

The Science of Electricity & Magnetism: Projects and Experiments With Electricity And Magnets (Tabletop Scientist) by Steve Parker. Heinemann, 2005.

Access these Web sites

NASAs Kids Science News Network
http://ksnn.larc.nasa.gov/home.html

The NASA Sci Files
http://scifiles.larc.nasa.gov/text/kids/D_ Lab/acts_ electric.html

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Physical Science

Electricity and Magnetism

Basic Level

Assessments

Electrical Energy

Print pages 20–22 of this PDF for the assessments.

Electrical Energy

Check Understanding

Shade the circle next to the correct answer.

1. A circuit which allows electricity to flow freely is called

Ⓐ a low circuit

Ⓑ a parallel circuit

Ⓒ a closed circuit

Ⓓ an open circuit

Note that question 2 has only three choices.

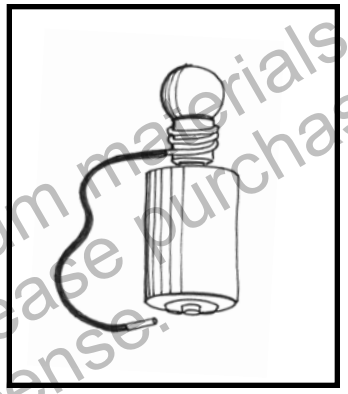
2. A light bulb becomes an open circuit when

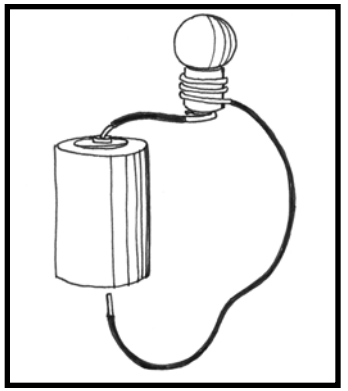
Ⓐ the wire inside it breaks

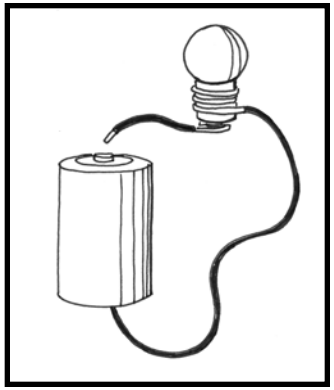
Ⓑ electricity passes through the wire

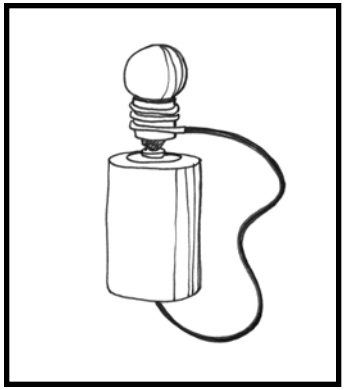
Ⓒ the bulb begins to glow

3. Which electric circuit produces light?

Ⓐ 

Ⓑ 

Ⓒ 

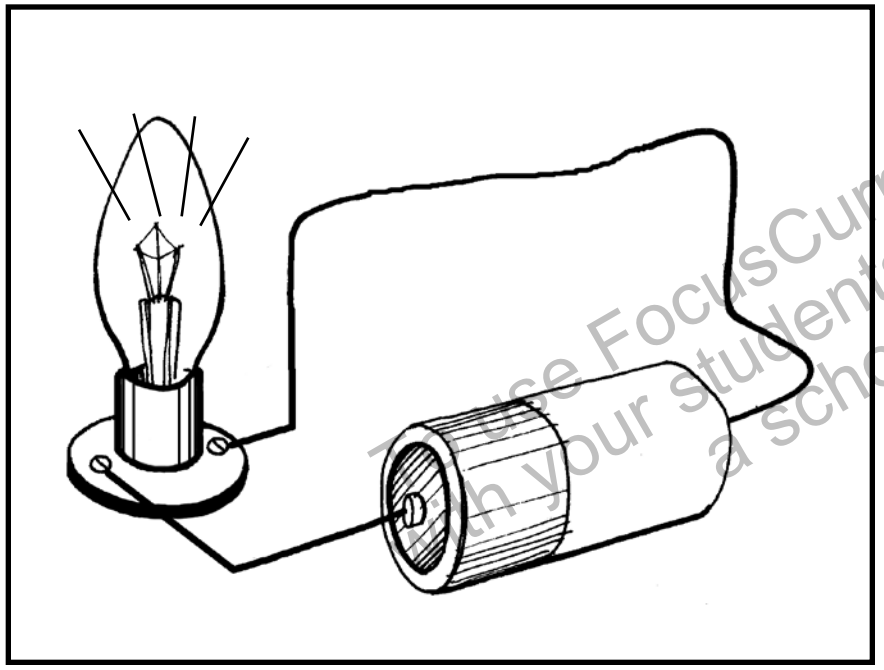
Ⓓ 

Electrical Energy

Check Understanding

Write your answer on the lines provided.

4. The diagram below shows a closed electrical circuit.



Describe how electricity flows through a closed circuit and lights the bulb. Begin with the battery as the power source.

First: _____

_____

_____

Next: _____

_____

_____

Then: _____

_____

_____

Finally: _____

_____

_____

Electrical Energy

Assessment Scoring Guidelines

1. Answer C is correct.

2. Answer A is correct.

3. Answer D is correct. All other diagrams show an open circuit.

4. First: A power source provides electricity which flows through a wire connected to the light bulb.

Next: The electricity flows through a wire in the bulb.

Then: The wire in the bulb heats up and begins to glow.

Finally: The electricity then flows from the light bulb through another wire to the battery Completing the loop or circuit.

Physical Science

Electricity and Magnetism

Basic Level

English Language Arts Activities

Electrical Energy

Print pages 24–28 of this PDF for the reading activities.

Make Predictions

TRY THE SKILL

If you understand what you read, you should be able to predict what will happen in a certain situation.

For example, if electricity flows through a wire coiled around an iron bar or nail, a magnetic field will be created.

Read the questions. Then find the answer choice that matches your prediction. Shade in the circle next to your choice.

1. The tiny filament in a light bulb breaks. What will happen next?

Ⓐ The circuit is now open, so the bulb will not light.

Ⓑ The circuit is now closed, so the bulb will not light.

Ⓒ The circuit is now open, so the bulb will light.

Ⓓ The circuit is now closed, so the bulb will light.

2. A microphone picks up the vibrations from a singer's voice. The vibrations are changed into tiny pulses of energy. What will happen next?

Ⓐ The pulses cause heat.

Ⓑ The pulses cause light.

Ⓒ The pulses cause a paper cone to vibrate.

Ⓓ The pulses cause the air to vibrate.

3. Two magnets are placed near each other. Each has two poles—a north pole and a south pole.

Ⓐ The north pole of one will be attracted by the north pole of the other.

Ⓑ The north pole of one will be attracted by the south pole of the other.

Ⓒ The north pole of one will be repelled by the south pole of the other.

Ⓓ The south pole of one will be attracted by the south pole of the other.

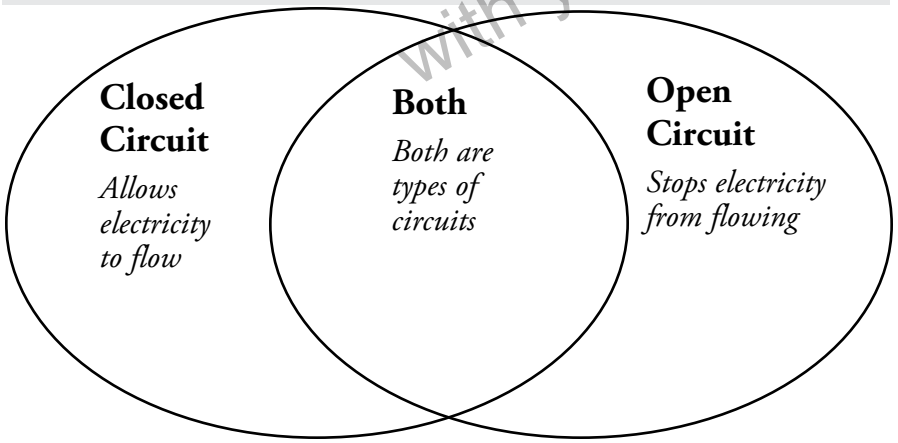
Compare and Contrast

When you compare, you tell how things are alike. When you contrast, you tell how things are different.

Read the passage from *Electrical Energy*. Then, read the Venn diagram that compares and contrasts.

How does electricity get to the light bulb? Electricity flows from a power source through a wire. The wire is connected to the light bulb. Electricity passes through the wire in the light bulb and returns to the power source through another wire. This electrical loop is called a closed circuit.

How do you turn a light bulb off? You turn a switch. The switch separates the wire. Now electricity has no place to go. The electricity stops flowing.

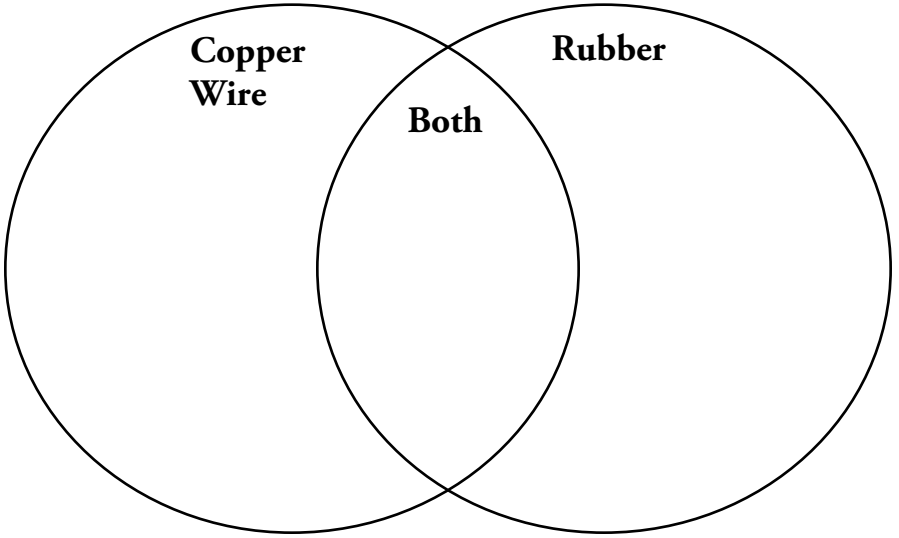


TRY THE SKILL

Read the passage. Think about comparing and contrasting. Then complete the Venn diagram.

You have probably plugged an electric cord into an outlet many times. The cord is made of copper wire on the inside and rubber on the outside. Copper is a good conductor of electricity. Electricity flows easily through copper.

The rubber on the outside of the cord is an insulator. Insulators do not allow electricity to flow. That is why you do not get shocked when you touch a cord that is plugged in.



Context Clues

To figure out the meaning of an unknown word, look for words in the same sentence or nearby sentences that give you clues.

Read this passage from *Electrical Energy*. Try to figure out what *conductor* means.

You have probably plugged an electric cord into an outlet many times. The cord is made of copper wire on the inside and rubber on the outside. Copper is a good conductor of electricity. Electricity flows easily through copper.

What does the word *conductor* mean?

A conductor is a material that carries electricity. The last sentence gives you a clue. It states that electricity flows easily through copper.

TRY THE SKILL

Read this passage from *Electrical Energy*. Answer the questions.

The rubber on the outside of the cord is an insulator. Insulators do not allow electricity to flow. That is why you do not get shocked when you touch a cord that is plugged in.

1. What does the word *insulator* mean in the selection?

Ⓐ material that allows electricity to flow through it

Ⓑ material that prevents electricity from flowing

Ⓒ material that is on the outside of something

Ⓓ material that has little or no resistance

2. Write a sentence of your own that correctly uses the word *insulator.*

_____

_____

_____

Antonyms

Antonyms are words that have opposite meanings. Some examples of antonyms are:

end and *begin*

forward and *backward*

powerful and *weak*

capture and *release*

Read the paragraph. Look for the antonyms.

Positively charged particles are attracted to negatively charged particles. The end of a magnet with a negative charge will repel the end of another magnet if it has a negative charge.

What are the antonyms?

Negatively and *positively* are antonyms. *Attract* and *repel* are antonyms, too.

TRY THE SKILL

Read the paragraph about magnets. Underline the antonyms.

Magnets are objects that attract some metals. Magnets have two poles. One is called the north pole and the other is called the south pole. Each has a charge. One is positive and the other is negative. A negative and positive charge attract each other. Unlike poles attract. Similar magnetic poles repel each other.

Think of other antonyms that have to do with electricity. You'll find more antonyms in this book. Write them in the space below.

_____

_____

_____

_____

_____

Answer Key

Make Predictions

1. A
2. C
3. B

Compare and Contrast

Copper Wire: conductor

Rubber: insulator

Both: used to make electrical cord

Context Clues

1. B

2. Sentences will vary but should indicate that students understand the meaning of the word *insulator*.

Antonyms

Antonyms include:

attract	repel
negative	positive
north	south
similar	unlike

Other antonyms in the book include:

on	off
inside	outside
conductor	insulator
flow	stop
open	close
attach	disconnect
correct	incorrect