SCIENCE • GRADE 3

Above Level

California Content Standards
Physical Sciences: 1.A
Physical Sciences: 1.B
Physical Sciences: 1.C
Physical Sciences: 1.D

What Is Energy?

FOCUScurriculum

Curriculum materials for **your** content standards

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What Is Energy?

California's Science Content Standards Met

GRADE 3 SCIENCE

PHYSICAL SCIENCES: 1—Energy and matter have multiple forms and can be changed from one form to another. As a basis for understanding this concept:

a. Students know energy comes from the Sun to Earth in the form of light.

b. Students know sources of stored energy take many forms, such as food, fuel, and batteries.

c. Students know machines and living things convert stored energy to motion and heat.

d. Students know energy can be carried from one place to another by waves, such as water waves and sound waves, by electric current, and by moving objects.

GRADE 3 ENGLISH LANGUAGE ARTS

1.0 WORD ANALYSIS, FLUENCY, AND SYSTEMATIC VOCABULARY DEVELOPMENT

Vocabulary and Concept Development 1.6—Use sentence and word context to find the meaning of unknown words.

2.0 READING COMPREHENSION

Comprehension and Analysis of Grade-Level-Appropriate Text 2.2—Ask questions and support answers by connecting prior knowledge with literal information found in, and inferred from, the text.

Comprehension and Analysis of Grade-Level-Appropriate Text 2.4—Recall major points in the text and make and modify predictions about forthcoming information.

Comprehension and Analysis of Grade-Level-Appropriate Text 2.6—Extract appropriate and significant information from the text, including problems and solutions.

SCIENCE • GRADE 3

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Physical Sciences: 1.A
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Student Book

What Is Energy?

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

How to Make the Student Book

- **The student book is contained on pages 5–18 of this PDF. It begins on the next page.**
- **To make one student book, or a two-sided master copy that can be photocopied, you will print on both sides of seven sheets of 8.5″ x 11″ paper.**
- **Do a test printout of one book first to familiarize yourself with the procedure.**
- **Follow these instructions carefully.**

First–Select the Paper

Since you will be printing on both sides of the sheets of paper, select a good quality white paper. We recommend using at least a 22lb sheet.

Second–Check Printer Settings

Be sure you have the correct page setup settings for your computer and printer. You will print these pages in landscape format.

Third–Print EVEN Pages

Open the PDF of the book you want to print. Select print from your file menu. In your printer's dialogue box enter pages 5–18 to print. Then select EVEN pages only. It is important to print only the EVEN pages first. Click "Print" to print the even pages. (**Important note**: The first page that prints will be blank. DO NOT discard this page. It will be needed to print the cover in the next step.)

Forth–Print ODD Pages

When the even pages have printed, flip the stack of pages over to print the odd pages. Place the stack back in your printer. Select print from the file menu again. In your printer's dialogue box, select ODD pages. Click "Print" to print the odd the pages.

Fifth–Fold the Book

You now have a complete book. Check to be sure the pages are in the correct order with the book's cover as the top page. Then fold the stack of paper in half.

Sixth–Staple the Book

Use an extended-length stapler to staple the pages together. Place three staples in the spine of the book.

Please note that printers vary in how they output pages. Do a test printing with one book and adjust the procedure as necessary.

If you want to make a one-sided master copy, print ALL pages 5–18 at once. Then select "one-sided to two-sided" on the copy machine.

AL

What Is Energy?

California's Science Content Standards Met

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GRADE 3 ENGLISH LANGUAGE ARTS

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FOCUS ON CALIFORNIA STANDARDS

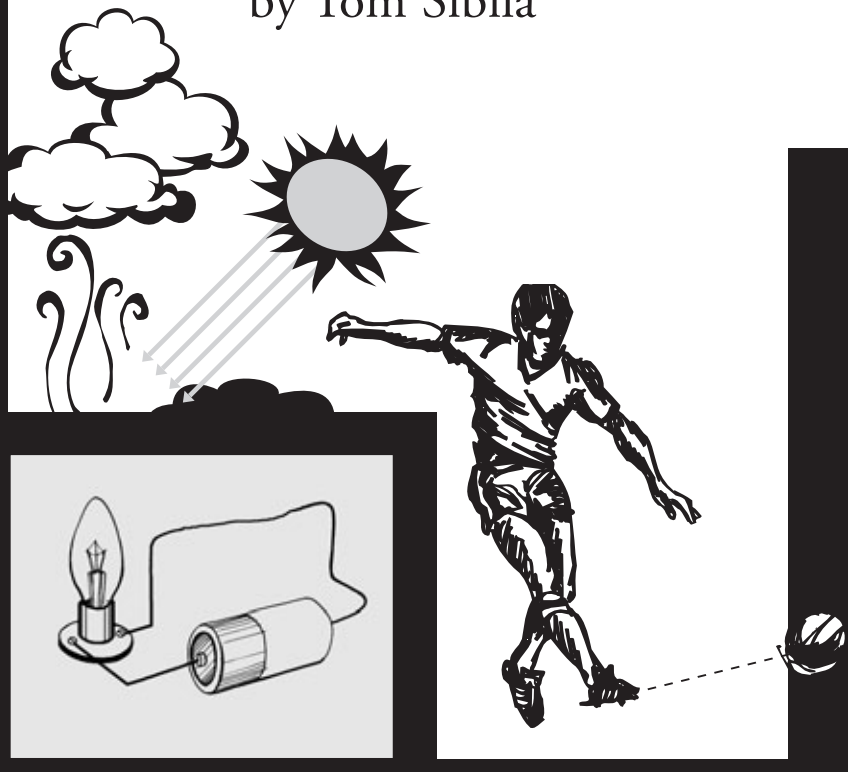
SCIENCE • GRADE 3

California Content Standards

Physical Sciences: 1.A, 1.B, 1.C, 1.D

What Is Energy?

by Tom Sibila



SCIENCE • GRADE 3

California Content Standards

Physical Sciences: 1.A, 1.B, 1.C, 1.D

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Curriculum materials for **your** content standards

Table of Contents

What do you think you will learn from this book?

INTRODUCTION

Present but Never Seen

What is something that is always present but never seen? Think about air. We can't see air, but we know it exists. We can feel air blowing against our skin. We can see a balloon **inflate** because of air.

What else is present but never **visible**? Try energy. We can't see energy, but we know it exists. Like air, we can see or feel the effects of energy.

Kicking a soccer ball requires energy. Eating lunch requires energy. Playing a guitar requires energy. So does hearing the sound made by the guitar strings. You can't see the energy required to do these things, but you can **detect** the effects of the energy.

Energy helps us move things. It warms our bodies. It gives us light. It cooks food as well as keeps food cold. It powers our MP3 players and our cars. Energy helps us do many things. In fact, we could not live without energy. So just what is energy?

inflate: to make something expand by blowing air into it
visible: able to be seen
detect: to notice or discover something

The Power to Change

Energy supplies the power to change things. It is the ability or **capacity** to do work. Energy makes things move, stretch, or grow. It is heat and light and can run machines. It causes physical and chemical changes in **matter**.

Energy does so much, you would think it would run out. However, energy is never used up. There is the same amount of energy today as there was thousands of years ago. That's because when energy is used, it always changes into another form of energy.

Energy changes forms in many ways. For example, when we burn wood, we change the wood's energy into heat and light. Plants use energy from sunlight and change it into energy rich food. Cars use energy stored in gasoline and air to power the engine which makes the car move.

We know energy exists even though we cannot see it. We know energy is not used up, but rather changes into other forms. But where does energy come from? Read on to shed some light on this question.

capacity: the ability to do something
matter: anything that takes up space or has mass

CHAPTER 1

Energy Comes from the Sun

Most energy on Earth comes from the sun. Here on Earth we see the sun's energy as light. We feel the sun's energy as heat. The energy produced by the sun in the form of heat and light is called solar energy. Heat and light are different forms of energy that comes from the sun.

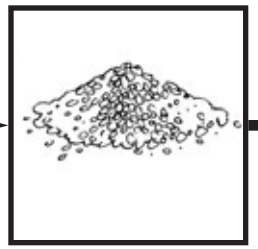
Heat and light energy from the sun are very important to living things on Earth. Some of the light energy from the sun is changed to heat when it enters Earth's **atmosphere**. The heat warms the planet so that plants can grow. Light energy from the sun is used by plants to make food. That is only the beginning.

Plants also store the energy from the sun. Most plants make seeds. Some of these seeds grow into new plants. Other seeds are used by humans and animals for food. For example, we use wheat seeds to make bread. When we eat the bread, we get the energy from the seeds to help us survive.

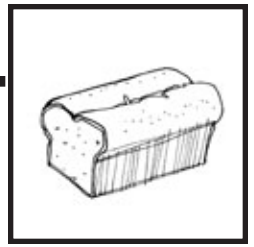
atmosphere: layer of air that surrounds Earth

How Energy from the Sun Is Used

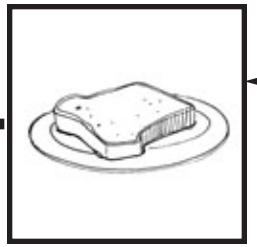
The sun provides heat and light energy for plants to grow.



Plants store energy from the sun when they produce seeds.



Seeds are used to make food such as bread.



Eating bread gives our bodies energy.

We use this energy to work and play.

Explain why energy from the sun is important to living things on Earth.

Heat Energy and Freshwater

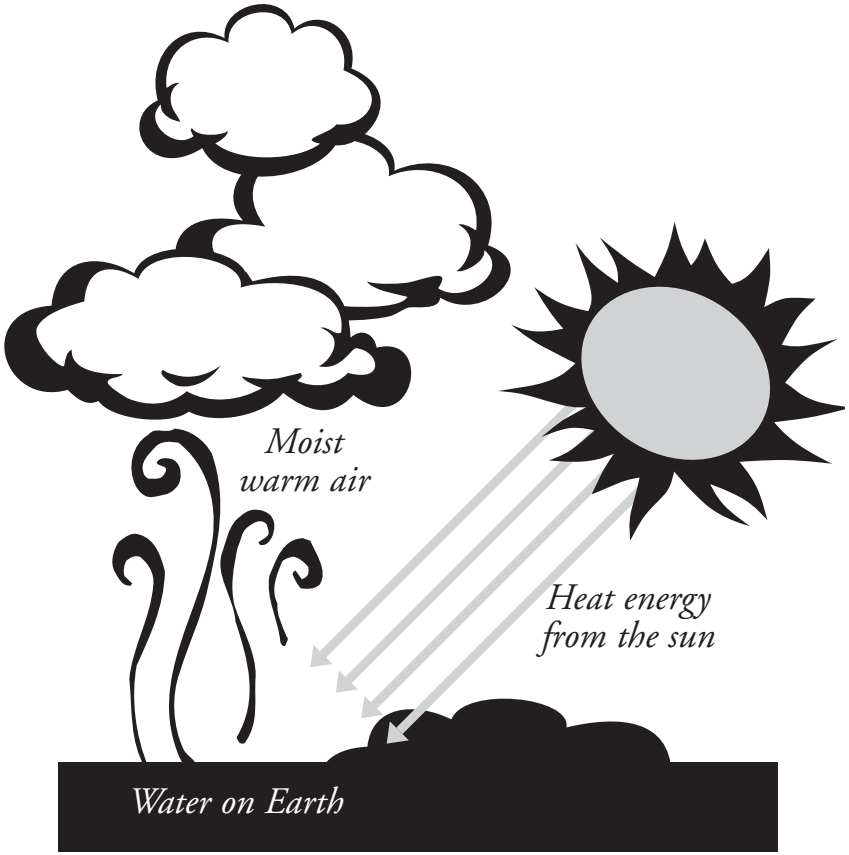
Heat energy from the sun does more than help plants and animals make food. It also provides us with freshwater which is another thing people, plants, and animals need to survive. Freshwater is water with almost no salt.

When water is warmed by the sun, it **evaporates** and rises. As water **vapor** rises it cools, and tiny water droplets form. When these droplets are packed closely together, they become visible and form a cloud. Clouds are moved over land by wind. When too much water collects in a cloud, the cloud can no longer contain all the water, and it falls.

Water goes up into the air and falls back to Earth all the time. This process is called the water cycle and provides freshwater to life on land. The cycle would never occur if not for heat energy from the sun.

evaporates: changes from a liquid to a gas
vapor: the gas formed when a liquid is heated

Heat Energy and the Water Cycle

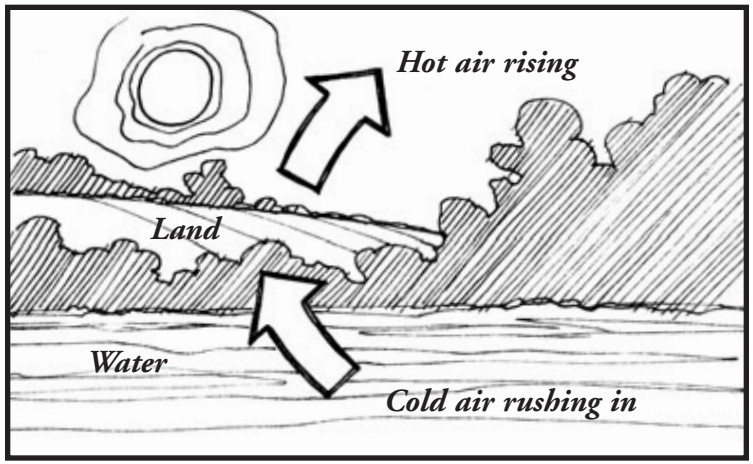


Clouds form when warm, moist air rises off Earth's surface. When clouds build up too much moisture, freshwater falls back to Earth.

Heat Energy and Wind

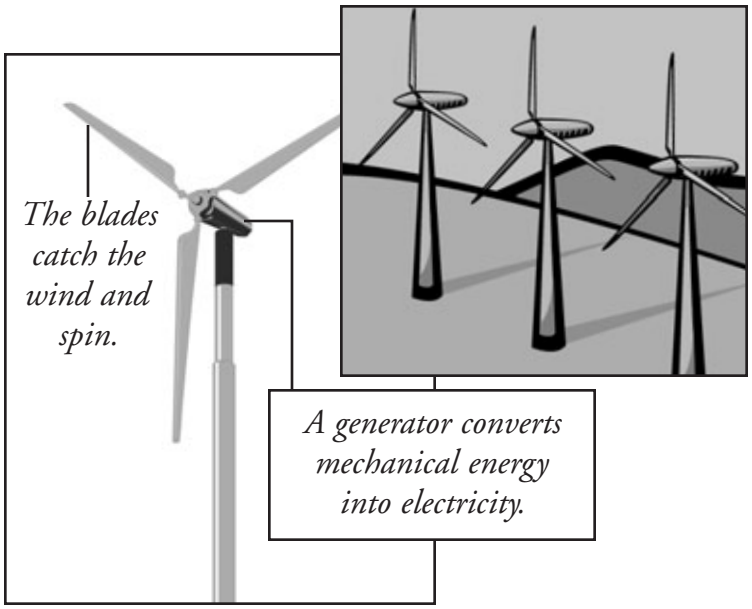
People have learned to use energy from the sun and change it from one form to another. This enables us to do work more easily and live more comfortably. One example is using energy from the wind.

Wind is air in motion. It is created by energy from the sun. When the sun heats Earth, the air closest to the surface of Earth warms up and rises. Then cooler air rushes in to fill the space the hot air left behind. This creates wind. People have learned how to capture energy from the wind and convert it to electrical energy.



Windmills, or wind machines, are designed with large blades. When wind hits the blades, they capture the energy of the wind and the blades spin. The spinning blades are connected to a **generator** which creates electricity. We use this electrical energy to heat and light our buildings and do work for us.

Wind Machine



generator: a machine that produces electricity by turning a magnet inside a coil of wire

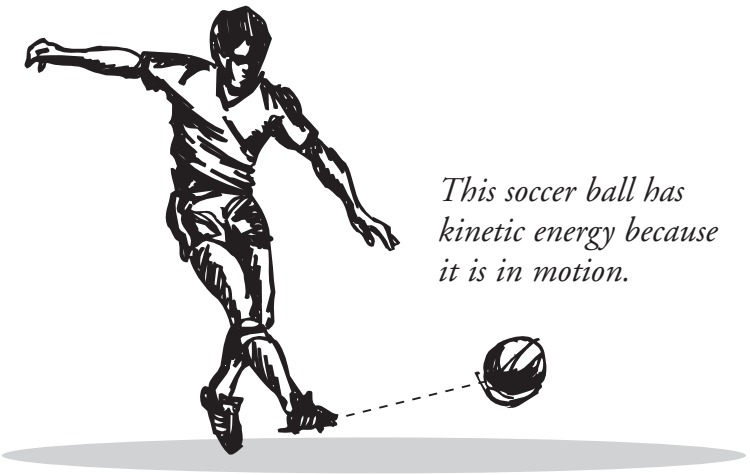
CHAPTER 2

Categories of Energy

Energy can be found in different forms such as heat, light, sound, and motion. These different forms can be classified into two categories.

Kinetic Energy—Motion

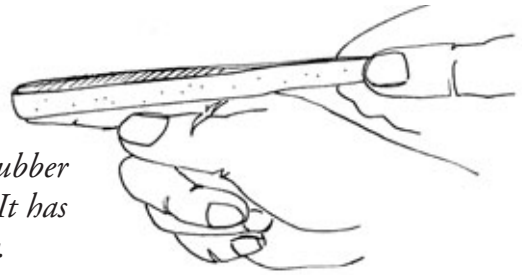
Kinetic energy is the energy of moving objects. A moving car, a runner sprinting, a waterfall, or a kicked soccer ball are all objects that have kinetic energy.



This soccer ball has kinetic energy because it is in motion.

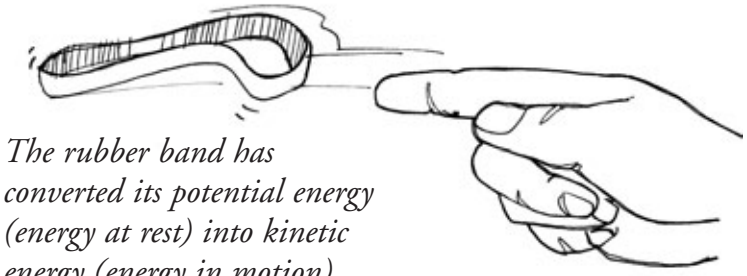
Potential Energy—Stored

Potential energy is the amount of useable energy within something at rest. It is energy that has potential to change into kinetic energy and do work. For example, a stretched rubber band has potential energy. It is not moving, but it has the potential to create motion.



This stretched rubber band is at rest. It has potential energy.

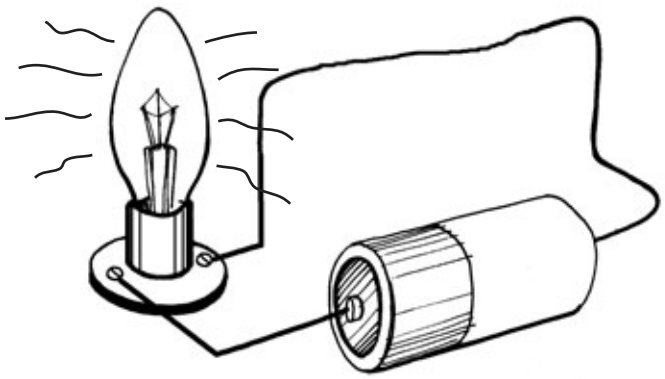
When you release one end of the rubber band, it springs forward. The potential energy of the rubber band is converted into motion or kinetic energy.



The rubber band has converted its potential energy (energy at rest) into kinetic energy (energy in motion).

Potential energy can be stored in different types of matter such as food, fuel, and batteries. You have already read how plants use energy from the sun to create food, and how we use energy from plant seeds to give our bodies energy to grow, stay warm, and do work and play.

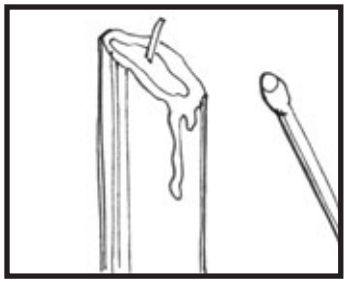
Batteries are another example of something with potential energy. Batteries store energy. We use them to power such things as light bulbs in flashlights. The stored electrical energy in the battery is converted into light energy. However, batteries only store a limited amount of energy. If you leave the flashlight on, the light bulb will eventually go out.



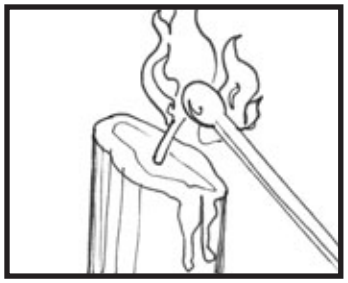
The potential energy in this battery is released and converted to light energy. What other form of energy is converted from the battery?

Converting Stored Energy into Heat

Over time, people have learned how to convert potential energy to produce heat. Matches and candles are an example. A matchstick resting in a box is cold, but it has potential energy. When you strike the match, it burns. You can use the burning matchstick to light a candle. The potential energy in the match and the candle is now released and converted into heat and light energy.



This match and candle is not releasing any energy. However, both have potential energy.



This match and candle is releasing potential energy and converting it into heat and light.

When it is cold, we need more heat than a match or candle can provide to keep our bodies warm. People have learned how to convert the potential energy of natural gas into heat. Natural gas is pumped out of the ground. Then it is used to create heat energy in stoves, ovens, and furnaces.

Converting Stored Energy into Motion

People have also learned how to convert stored energy into motion. For example, we have learned how to release the potential energy in gasoline and air to make a car move. When gasoline and air are mixed together and **ignited** in a car's engine, the potential energy stored in the gas and air is converted into motion or kinetic energy.

Our bodies do the same thing. The food we eat is broken down into smaller components in our bodies. Some of these food particles is carried to our muscles. The stored energy in the food is then released enabling our muscles to move. The potential energy in the food is converted to kinetic energy.

ignite: to set fire to something

CHAPTER 3

Transfer of Energy

You now know how important energy is to our survival and comfort, and you also know that it changes forms in many ways. What are some other ways that energy can be transferred from one form to another?

Motion is one way energy is transferred. Rub your hands together rapidly. What happens? Your hands generate heat. The energy of motion (your hands rubbing together) is transferred into heat energy through **friction**.

Waves are another way that energy can be transferred from one place to another. Hold a pebble above a tub of water. Now drop the pebble in the water. What happens? Can you describe the transfers of energy? Take a moment and write them down on a piece of paper. Then continue reading.

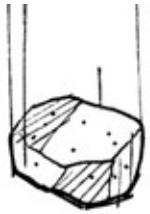
friction: rubbing of one thing against another

Transfers of Energy

1. When you raise a pebble above a tub of water you are using the kinetic energy in your muscles—the energy of motion—to move the pebble.

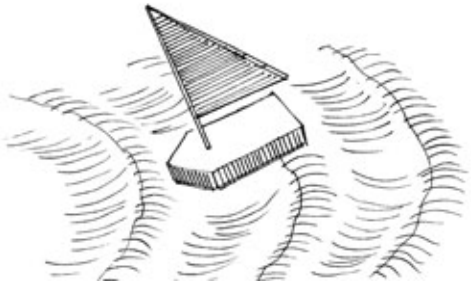
2. When you hold the pebble at rest above the water, you transfer kinetic energy into potential energy. The pebble now has potential energy—the ability to do work.

3. When the pebble is released and falls down, the potential energy in the pebble is transferred back to kinetic energy.



4. When the pebble hits the water, it creates ripples in the water. The energy from the pebble is transferred into wave energy in the water.

5. What if there was a toy boat in the water? What would happen to the boat? Some of the energy from the wave is transferred to the toy boat. This generates a bobbing motion in the boat.

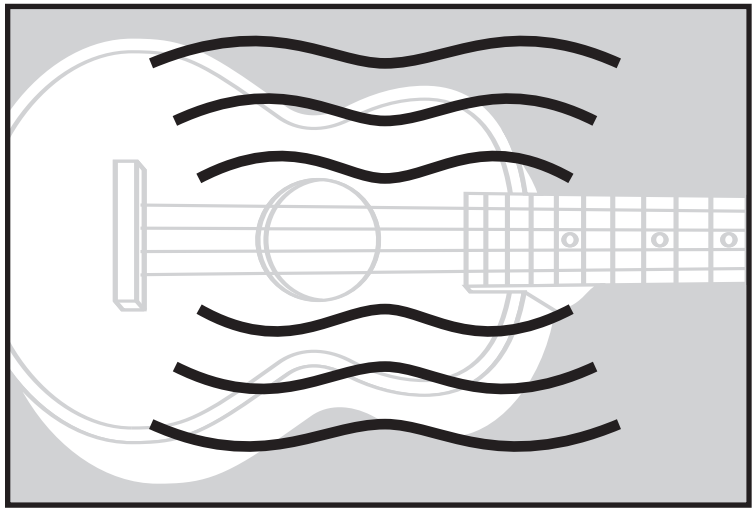


6. The waves would cause the toy boat to bob up and down and back and forth. But the toy boat would stay at the same place in the water.

As the pebble rests at the bottom of the tub, what happens to its energy?

Sound Waves

Another example of energy being transferred through waves is sound energy. If you pluck a guitar string, the string moves back and forth. As the string **vibrates**, it hits tiny particles in the air causing them to move back and forth. The vibrations of these moving air particles produce a sound wave—a surge of energy that travels through the air.



When a guitar string vibrates back and forth, it hits tiny particles of air creating a sound wave.

vibrate: to cause a back and forth motion

Transfer of Electrical Energy

Earlier you read that people have learned to use energy from the wind to create electrical energy. There are other sources of energy that we use to create electricity.

Fossil fuels such as coal are burned in power plants to generate electricity. Dams can be built to convert the energy of flowing water into electricity. The electrical energy is then carried through wires to our communities. At home, we convert the electrical energy into heat, light, sound, motion, and other forms of energy.

It All Starts with the Sun

You've learned a lot about energy and what it can do. You've also learned about converting energy to many different forms. What is amazing is that almost all of this energy came from one place. Do you remember the source?

The major source of energy on Earth is the sun. Without energy, there would be no life on Earth. Next time you are enjoying a nice sunny day, think about all the ways the sun transfers its energy for us to use.

Glossary

atmosphere—layer of air that surrounds Earth

capacity—the ability to do something

detect—to notice or discover something

evaporates—changes from a liquid to a gas

friction—rubbing of one thing against another

generator—a machine that produces electricity by turning a magnet inside a coil of wire

ignite—to set fire to something

inflate—to make something expand by blowing air into it

matter—anything that takes up space or has mass

vapor—the gas formed when a liquid is heated

vibrate—to cause a back and forth motion

visible—able to be seen

To Find Out More . . .

Want to learn more about energy?

Try these books

Eyewitness: Energy by Jack Challoner. Dorling Kindersley, 2000.

What Is Energy?: Exploring Science With Hands-on Activities (In Touch With Basic Science) by Richard Spilsbury and Louise Spilsbury. Enslow Elementary, 2008.

Janice VanCleave's Energy for Every Kid: Easy Activities That Make Learning Science Fun (Science for Every Kid Series) by Janice VanCleave. Jossey-Bass, 2005.

Access these Web sites

Energy Kid's Page
http://www.eia.doe.gov/kids/energyfacts/sources/whatsenergy.html

Energy Story
http://www.energyquest.ca.gov/story/chapter01.html

Just for Kids Energy
http://www.depweb.state.pa.us/justforkids/cwp/view.asp?a=3&q=464796

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ENGLISH-LANGUAGE ARTS • GRADE 3

Above Level

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Comprehension and Analysis of Grade-Level-Appropriate Text: 2.6

English-language Arts Activities

What Is Energy?

Print pages 20–24 of this PDF for the reading activities.

Use Graphic Organizers

TRY THE SKILL

Graphic organizers help you understand information by taking it out of the text and putting it in the form of a picture. Often, when you see a set of facts, the facts make more sense than when you read them in the text.

Use this organizer to define and give examples of the differences between kinetic and potential energy.

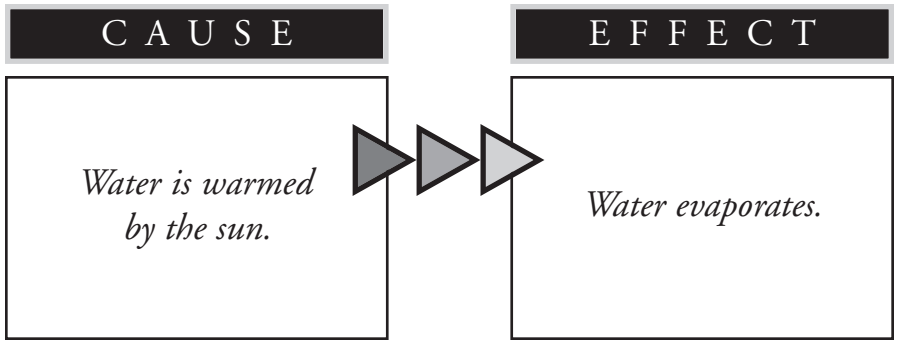
Kinetic Energy	Potential Energy
Definition	**Definition**
Examples	**Examples**

Cause and Effect

To find out an effect, you ask, "What happened?"
To find out a cause, you ask, "Why did that happen?"
Read this passage from *What Is Energy?*

When water is warmed by the sun, it evaporates and rises. As water vapor rises it cools, and tiny water droplets form. When these droplets are packed closely together, they become visible and form a cloud. Clouds are moved over land by wind. When too much water collects in a cloud, the cloud can no longer contain all the water, and it falls.

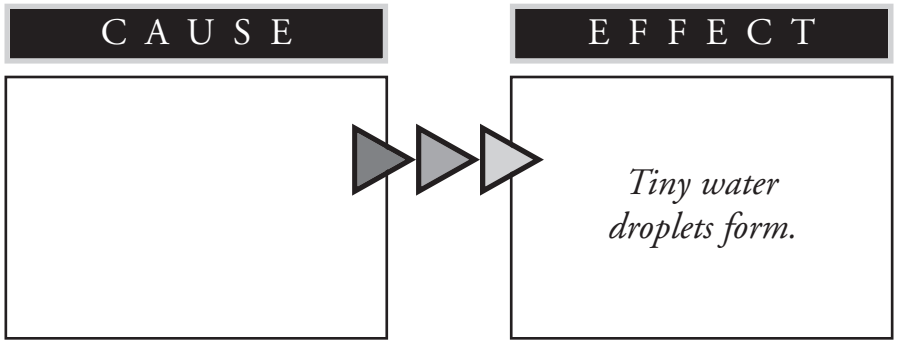
This graphic explains one cause-and-effect relationship in this passage.



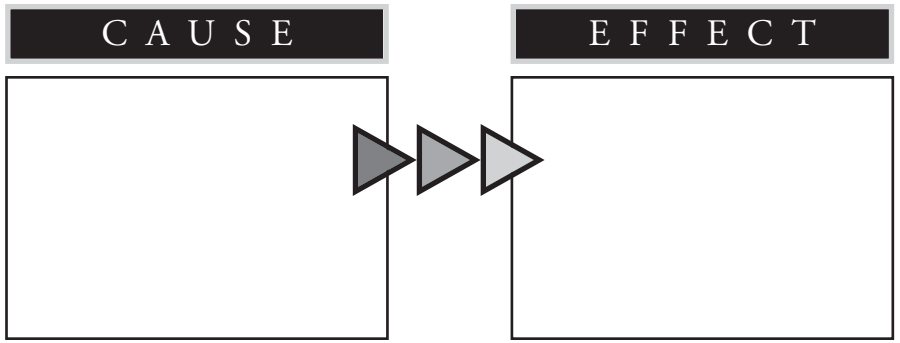
TRY THE SKILL

Read the passage again. Then complete each graphic.

1. What causes tiny water droplets to form?



2. What causes a cloud to form?



Context Clues

TRY THE SKILL

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

Look for word clues in each sentence at the right to figure out which word from the box should complete it. Then write the correct word on the line.

capacity—the ability to do something

evaporate—the process of changing from a liquid to a gas

friction—rubbing of one thing against another

generator—a machine that produces electricity by turning a magnet inside a coil of wire

ignite—to set fire to something

inflate—to make something expand by blowing air into it

vapor—a gas formed from something that was a liquid

vibrate—to cause a rapid motion back and forth

1. The _____ of rubbing two sticks together will cause heat.
2. Victor uses a match to _____ the candle.
3. The water _____ in the air rose and cooled down forming water droplets.
4. Jamal's father's truck is so big it has the _____ to carry very heavy loads.
5. The power went off because of the storm, so we used a _____ to create electricity.
6. When warm water _____, it rises into the air.
7. The sound coming out of the speakers was so loud you could feel the room _____.
8. Terika had a flat tire on her bike so she had to _____ the tire with air.

Question and Answer

You can monitor your understanding of what you read by asking questions and then reading to find the answer. Sometimes authors will even write a question in the text and then answer it.

Read the paragraph from *What Is Energy?*

> Energy supplies the power to change things. It is the ability or capacity to do work. Energy makes things move, stretch, or grow. It is heat and light and can run machines. It causes physical and chemical changes in matter.

What question could you ask?

What is energy?

What is the answer?

Energy is the power to change things. It is the ability or capacity to do work.

TRY THE SKILL

Read the paragraphs from *What Is Energy?*

> Most energy on Earth comes from the sun. Here on Earth we see the sun's energy as light. We feel the sun's energy as heat. The energy produced by the sun in the form of heat and light is called solar energy. Heat and light are different forms of energy that comes from the sun.

1. What question could you ask to help you remember what you read?

_____

2. What is the answer?

_____

_____

3. What is another question could you ask to help you remember what you read?

_____

4. What is the answer?

_____

_____

Answer Key

Use Graphic Organizers

Kinetic Energy

Definition: Kinetic energy is the energy of moving objects.

Examples may include: a moving car, a runner sprinting, a waterfall, a kicked soccer ball, a falling rock

Potential Energy

Definition: Potential energy is the amount of useable energy within something at rest. It is energy that has potential to change into kinetic energy and do work.

Examples may include: a stretched rubber band, a pencil resting on a tabletop, oil deep in the earth, seeds from plants, a battery not in use, a matchstick

Cause and Effect

1. **Cause**: Water vapor rises and cools.
2. **Cause**: Water droplets pack closely together.
   Effect: A cloud forms.

Context Clues

1. friction
2. ignite
3. vapor
4. capacity
5. generator
6. evaporates
7. vibrate
8. inflate

Question and Answer

1. Where does energy come from?
2. Most energy comes from the sun.
3. What is solar energy?
4. The energy produced by the sun in the form of heat and light.