



Physical Science

Matter and Energy

Basic Level

What Is Energy?

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FOR:

Core Curriculum
Covered
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Student Book
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Assessments and
Reading Activities

What Is Energy?

What are some ways that energy can be changed from one form to another?

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.

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

Heat can be released in many ways, for example, by burning, rubbing (friction), or combining one substance with another.

Everyday events involve one form of energy being changed to another.

- animals convert food to heat and motion
- the Sun's energy warms the air and water

Humans utilize interactions between matter and energy.

- chemical to electrical, light, and heat: battery and bulb
- electrical to sound (e.g., doorbell buzzer)
- mechanical to sound (e.g., musical instruments, clapping)
- light to electrical (e.g., solar-powered calculator)



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Student Book

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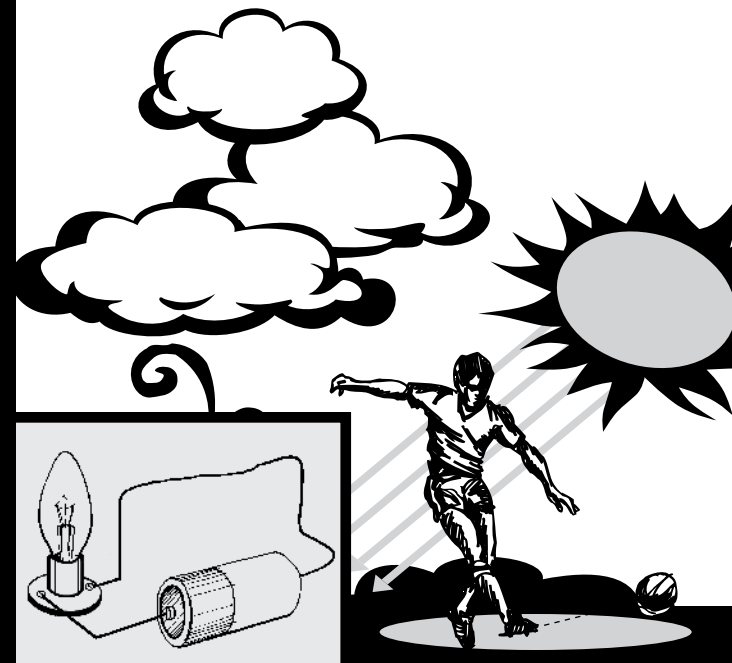


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What Is Energy?

by Tom Sibila





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–Predict–

*What do you think you will
learn from this book?*

INTRODUCTION

Present but Never Seen

What is something that is always here but never seen? How about air? We can't see air. But we can feel air blowing against our skin. We can see a balloon blow up 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 **detect**, or notice, the effects of the energy. So just what is energy?

visible: able to be seen
detect: to notice or discover something

The Ability to Change

Energy is the ability or **capacity** to do work. Heat, light, and electricity are all forms of energy. Energy makes things move or grow. It causes changes in **matter**.

Energy can be found in different forms such as heat, light, sound, and mechanical. Mechanical energy is the energy of motion.

Energy can change forms. For example, when we burn wood, we change the wood's energy into heat and light.

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

Energy Comes from the Sun

Most energy on Earth comes from the sun. We see the sun's energy as light. We feel the sun's energy as heat. Light and heat are both forms of energy.

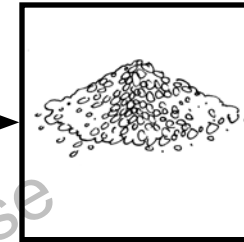
Heat and light energy from the sun are very important to living things. Heat energy from the sun warms Earth so that plants can grow. Light energy allows plants to make their own food.

Plants store energy in their seeds. Some of these seeds grow into new plants. Other seeds are used by people for food. When people eat the seeds, they get the energy stored in the seeds. Then they can live.

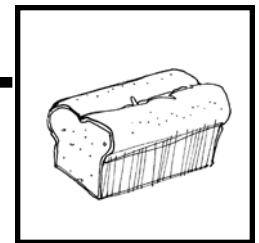
How the Sun's Energy is Used



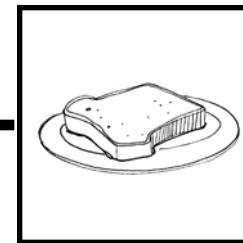
The sun provides heat and light energy for plants to grow.



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 is energy from the sun important to living things on Earth?

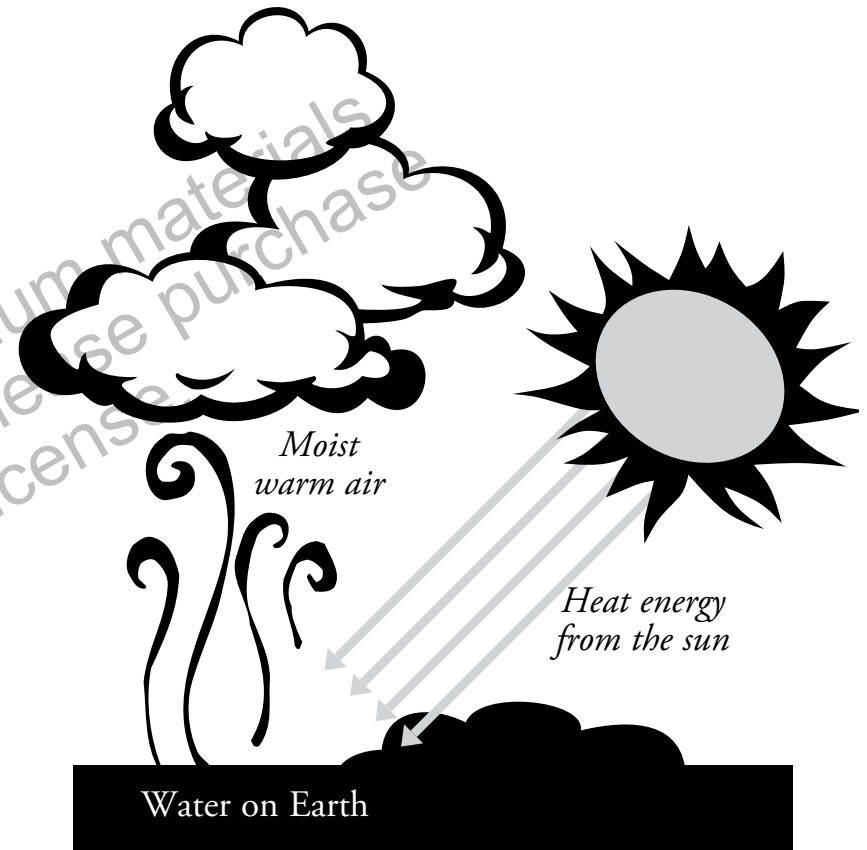
Heat Energy and Freshwater

Heat energy from the sun also gives us fresh water. When water is warmed by the sun, it **evaporates** and rises. As this water **vapor** rises, it cools. Tiny water droplets form. These droplets form clouds. Clouds are moved over land by wind. When too much water collects in a cloud, it falls back to Earth.

This is called the water cycle. It happens because of heat energy from the sun.

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

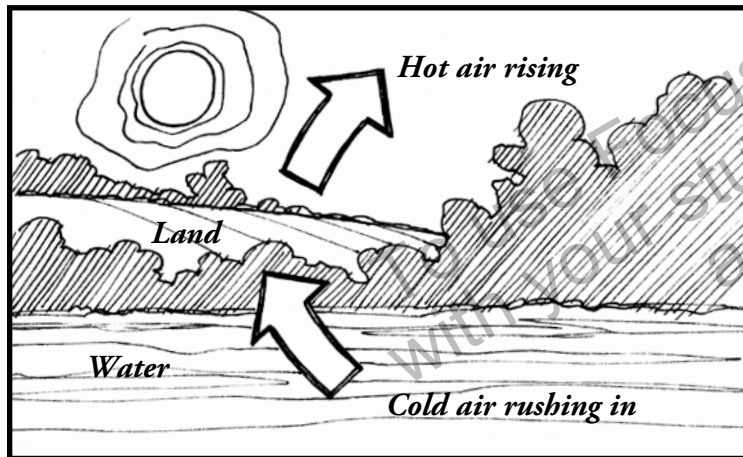
Heat Energy and the Water Cycle



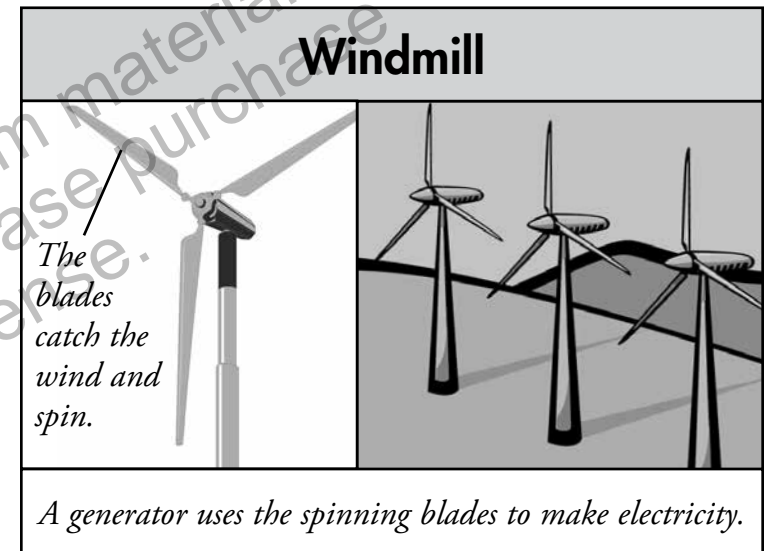
Clouds form when warm, moist air rises off Earth's surface. When clouds build up too much moisture, freshwater falls back to Earth.

Heat Energy and Wind

Wind is created by energy from the sun. First, the sun heats Earth. Next, the air closest to the surface of Earth warms up. This warm air rises. Then cooler air rushes in to fill the space the warm air left behind. This creates wind.



Windmills have large blades. When wind hits the blades, they capture the energy of the wind. The blades spin. The spinning blades are connected to a **generator** which creates electricity.



This is one that energy can change from one form to another. Energy from the sun creates wind energy. Wind energy can be used to create electrical energy.

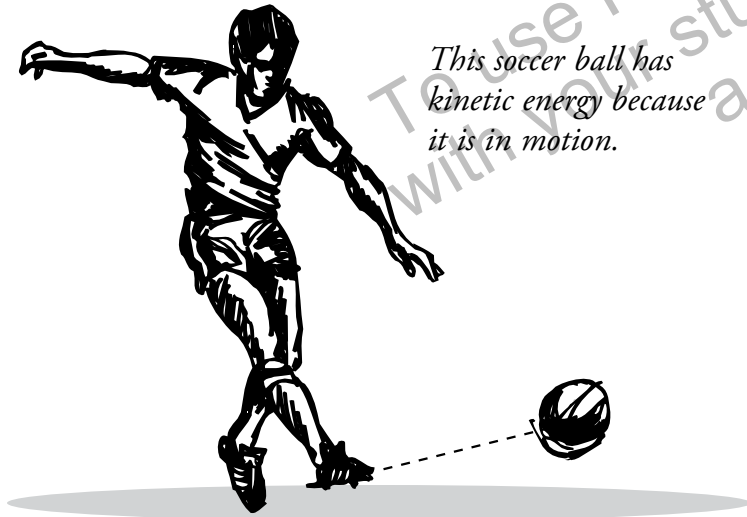
generator: a machine that produces electricity by turning a magnet inside a coil of wire

Categories of Energy

Energy can be classified as either kinetic energy or potential energy.

Kinetic Energy

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



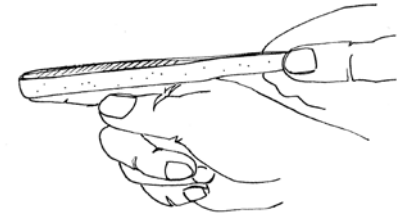
This soccer ball has kinetic energy because it is in motion.

Potential Energy

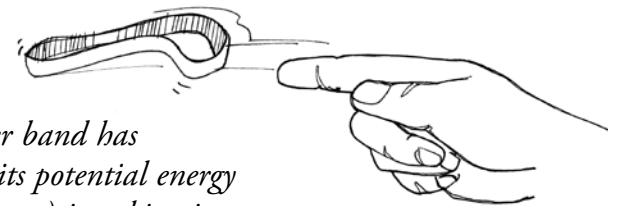
Potential energy is energy at rest. Potential energy is stored energy. It is energy that has the possibility to change into kinetic energy.

Look at the stretched rubber band. It has potential energy. It is not moving. But the rubber band has the potential to move.

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



When you let go of one end of the rubber band, it springs forward. The potential energy of the rubber band is changed into kinetic energy.

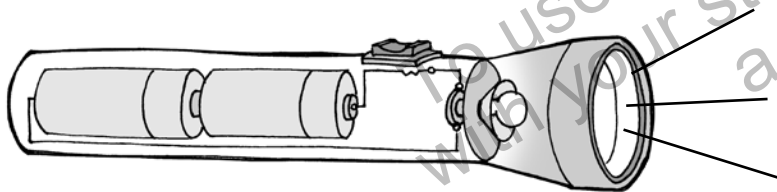


The rubber band has converted its potential energy (energy at rest) into kinetic energy (energy in motion).

Converting Stored Energy

Potential energy can be stored in forms other than mechanical. You know that plants store energy from the sun in their seeds. Batteries store energy, too.

A battery in a flashlight stores electrical energy. When you turn on the flashlight, the electrical energy is converted, or changed, into light energy.

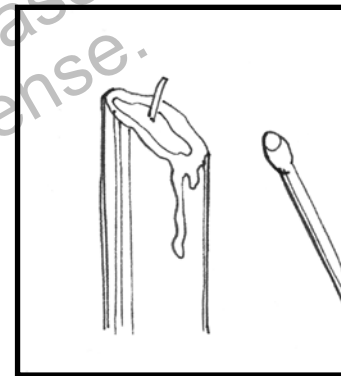


The potential energy in these batteries are released and converted to electrical energy. What other form of energy are converted?

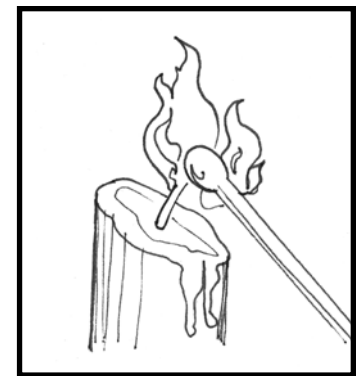
Heat

You can use potential energy to produce heat. Matches are an example.

A match resting in a box is cold, but it has potential energy. When you strike the match, it burns. The potential energy in the match is released and converted into heat and light energy.



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



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

Transfer of Energy

What are some other ways that energy can be transferred, or moved, from one form to another?

Motion is one way. Rub your hands together rapidly. What happens? Your hands make heat. The mechanical energy from your hands rubbing together is transferred into heat energy through **friction**.

Waves are another way that energy can be transferred. Hold a pebble above a tub of water. Now drop the pebble in the water.

What happens? How is energy transferred from one form to another? Write down your findings on a piece of paper. Then continue reading.

Motion

We can also convert potential energy into motion. For example, we can release the potential energy in gasoline and air to make a car move.

Think about a parked car. Gasoline and air are mixed together and are **ignited** in the car's engine. The potential energy stored in the gas and air is converted to kinetic energy. The car can now move.

ignite: to set fire to something

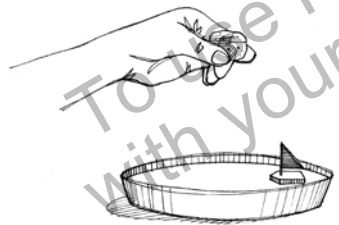
friction: rubbing of one thing against another

Transfers of Energy

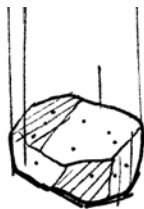
1. When you hold a pebble above a tub of water, you are using the kinetic energy in your muscles—the energy of motion—to move the pebble.



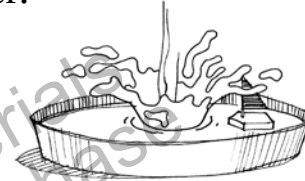
2. When you hold the pebble at rest above the water, you transfer kinetic energy into potential energy. The pebble now has potential energy—the ability to do work.



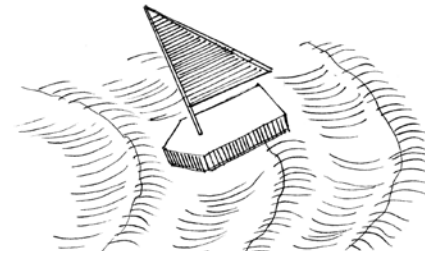
3. When the pebble is released and falls down, the potential energy in the pebble is transferred back to kinetic energy.



4. When the pebble hits the water, it creates waves 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 waves would be transferred to the toy boat. This would cause the boat to bob.



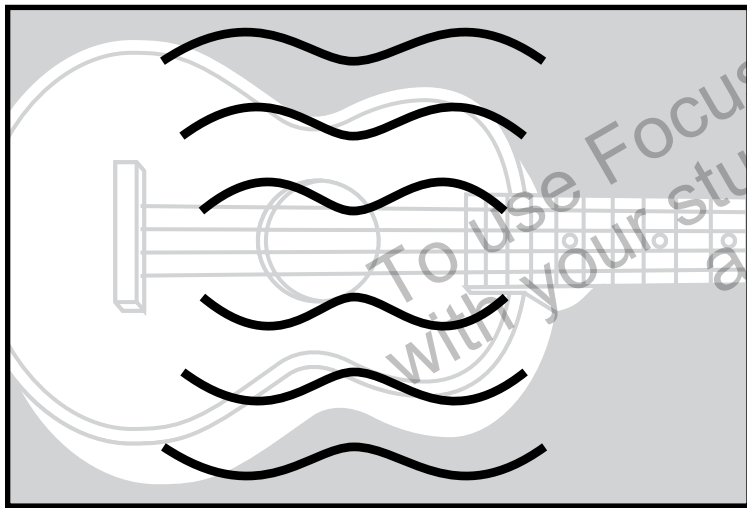
6. The waves would cause the toy boat to bob up and down and back and forth. But the toy boat would stay the same place in the water.

–Explain–

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

Transfer of Sound Energy

Sound energy is also transferred through waves. If you pluck a guitar string, the string **vibrates**. It hits tiny particles in the air, causing them to move back and forth. These moving air particles produce a sound wave—a push, of energy that travels through the air.



A guitar string vibrates back and forth. It hits tiny particles of air. This creates a sound wave.

vibrate: to cause a rapid motion back and forth

Transfer of Electrical Energy

You know that we can use energy from the wind to create electrical energy. There are other sources of energy that we use as well. Coal is burned in power plants to generate electricity. Dams are built to convert the energy of flowing water into electricity.

The electrical energy is then carried through wires to our homes. We convert the electrical energy into heat, light, sound, motion, and other forms of energy.

It All Starts with the Sun

The source of most energy on Earth is the sun. Without energy, there would be no life on Earth.

Glossary

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

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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Assessments

What Is Energy?

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

What Is Energy?

Check Understanding

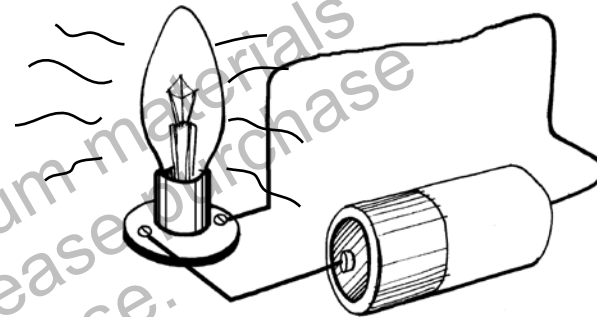
Shade the circle next to the correct answer or write your answer on the lines provided.

1. Most energy travels from the sun to Earth in the form of
 - Ⓐ light
 - Ⓑ heat
 - Ⓒ mechanical
 - Ⓓ sound

2. Wind and the water cycle result from
 - Ⓐ the salty ocean
 - Ⓑ electrical energy
 - Ⓒ the sun's heat energy
 - Ⓓ light, sound, and motion

3. The energy that is stored in food originally comes from
 - Ⓐ electricity
 - Ⓑ sunlight
 - Ⓒ sound
 - Ⓓ water

4. The diagram below shows an electric circuit. Energy is being converted from one form into two others.



Explain the first transfer of energy.

Explain the second transfer of energy.

Check Understanding

5. Most energy on Earth comes from the sun. Explain **one** way your body gets its energy from the sun.

6. Explain how the sun's energy gives us fresh water.

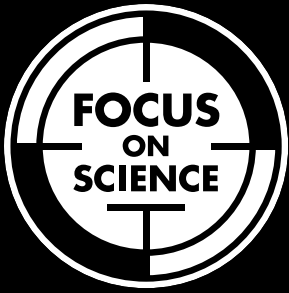
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What Is Energy?

Assessment Scoring Guidelines

1. Answer A is the correct answer.
2. Answer C is the correct answer.
3. Answer B is the correct answer.
4. Electrical energy stored in the battery is converted to light energy in the bulb.
Light energy is then converted to heat energy.
5. The sun's energy is used by plants as food. The resulting stored energy in plants is then used by humans as food.
6. The sun's energy in the form of heat causes the evaporation of ocean salt water and subsequent precipitation of fresh water over the land.

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English Language Arts Activities

What Is Energy?

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

Compound Words

TRY THE SKILL

Compound words are made by joining two short words. The two short words do not always have the same meaning when they are part of a compound word. Still, understanding the two short words will help you figure out the meaning of the longer word.

For example, *windmill* is a compound word. *Wind* means “air that is moving.” *Mill* means “a machine for grinding, cutting, or crushing.” However, *windmill* does not mean “a machine that crushes or grinds air.” It means “a machine that gets its power from the wind.”

Read the definition. Then choose the correct compound word for the definition.

1. A place where winged vehicles land

- Ⓐ airline Ⓒ airplane
- Ⓑ airport Ⓓ aircraft

2. A person whose name is not known at this time

- Ⓐ someone Ⓒ something
- Ⓑ someplace Ⓓ sometimes

3. All of the people

- Ⓐ everything
- Ⓑ everywhere
- Ⓒ everyone
- Ⓓ everyday

4. Part of a car

- Ⓐ daylight
- Ⓑ headlight
- Ⓒ sunlight
- Ⓓ flashlight

5. Land at the edge of a lake or river

- Ⓐ watercolor
- Ⓑ watermelon
- Ⓒ waterfall
- Ⓓ waterfront

6. A curved piece of glass on a car or truck

- Ⓐ windmill
- Ⓑ windpipe
- Ⓒ windshield
- Ⓓ windblown

Suffixes

TRY THE SKILL

Suffixes are groups of letters that are added to the ends of words. A suffix can change the word's part of speech. For example, *happy* is an adjective. When you add the suffix *-ness*, you get *happiness*, which is a noun.

Other suffixes can change the meaning of a word. For example, the suffix *-ful* means "full of." The suffix *-less* means "without."

Look at how suffixes change the meanings of these words:

Word	Meaning	Word	Meaning
careful	full of care	joyful	full of joy
careless	without care	joyless	without joy
teacher	one who teaches	actress	one who acts

Read each sentence and each pair of words below it. Study the suffixes. Then write the letter of the correct word on the line.

- _____ light energy from the sun can damage your skin.
A. Harmless B. Harmful
- You must be _____ when you use electricity.
A. careless B. careful
- Please be _____ about your use of energy.
A. thoughtless B. thoughtful
- She wrapped the glass _____ so it would not break.
A. carelessly B. carefully
- Scientists are _____ that we will discover new ways to save energy.
A. hopeless B. hopeful

Explain Main Ideas

TRY THE SKILL

Some questions require more than a one-word answer. You are expected to write several sentences, a short essay. These steps will help you plan your answer:

1. Read the question carefully, and underline any key words.
2. Figure out whether you are expected to provide a fact, an opinion, an explanation, or an example. Are you supposed to compare two things? If you are not sure about the form of your answer, ask your teacher.
3. Write your main idea first and then add details to support that idea.
4. Write in complete sentences. Leave time to check your spelling and grammar when you are finished.

Use these tips to answer the following questions.

1. How does the sun provide us with freshwater? Start with your main idea. Be sure to mention all the steps in the process.

2. Explain what energy is and give examples of what it can do.

Ask and Answer

TRY THE SKILL

As you read, ask yourself who, what, when, why, where, and how questions. Answering these questions will help you understand what you read. Sometimes the answers will be clear. Other times, you will have to figure them out. To practice, read the paragraph below. Then study the questions and answers that follow it.

Windmills, or wind machines, have 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.

What do windmills do? (They generate electricity.)

When do they do this? (When the wind is blowing.)

How do they do it? (Wind turns large blades that are connected to a generator.)

Where did they do it? (You have to figure out this answer. Windmills must be placed in an area open area of land that receives a great deal of wind.)

Sometimes, you can also ask “Who does this?” This paragraph does not answer that question.

Read this paragraph. Then answer the questions.

Sound energy is also transferred through waves. If you pluck a guitar string, the string vibrates. It hits tiny particles in the air causing them to move back and forth. These moving particles produce a sound wave—a push of energy that travels through the air.

1. What is this paragraph about?

- (A) guitars (C) sound energy
 (B) air particles (D) waves

2. When do air particles move?

3. What is sound energy?

Answer Key

Compound Words

1. B
2. A
3. C
4. B
5. D
6. C

Suffixes

1. Harmful
2. careful
3. thoughtful
4. carefully
5. hopeful

Explain Main Ideas

1. When water is warmed by the sun, it evaporates and rises. As water vapor rises it cools. Tiny water droplets form. These droplets form clouds. When too much water collects in a cloud, it falls back to Earth.
2. Energy is the power to change things. It is the ability or capacity to do work. Energy makes things move, stretch, or grow. It creates heat and light. It runs machines.

Ask and Answer

1. C
2. when a guitar string is plucked and vibrates
3. a surge of energy that travels through the air