



Physical Science

Matter and Energy

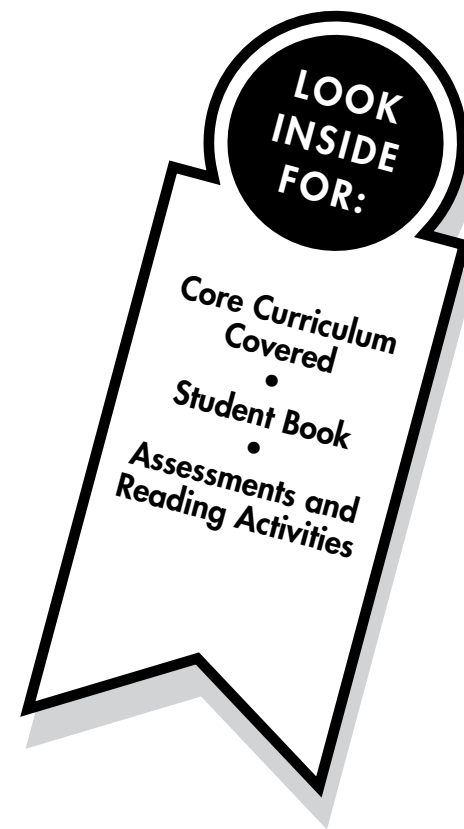
Advanced Level

What Is Energy?

To use FocusCurriculum materials with your students, please purchase a school license.

FOCUScurriculum

866-315-7880 • www.focuscurriculum.com



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)



Physical Science

Matter and Energy

Advanced Level

Student Book

What Is Energy?

To use Focus Curriculum materials
with your students, please purchase
a school license.

To use FocusCurriculum materials
with your students, please purchase
a school license.

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 absorb light, light colors may reflect light.

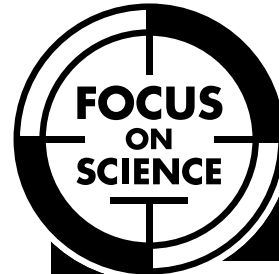
Heat can be released in many ways, for example, by burning, rubbing (friction), or combining one substance with another.

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)

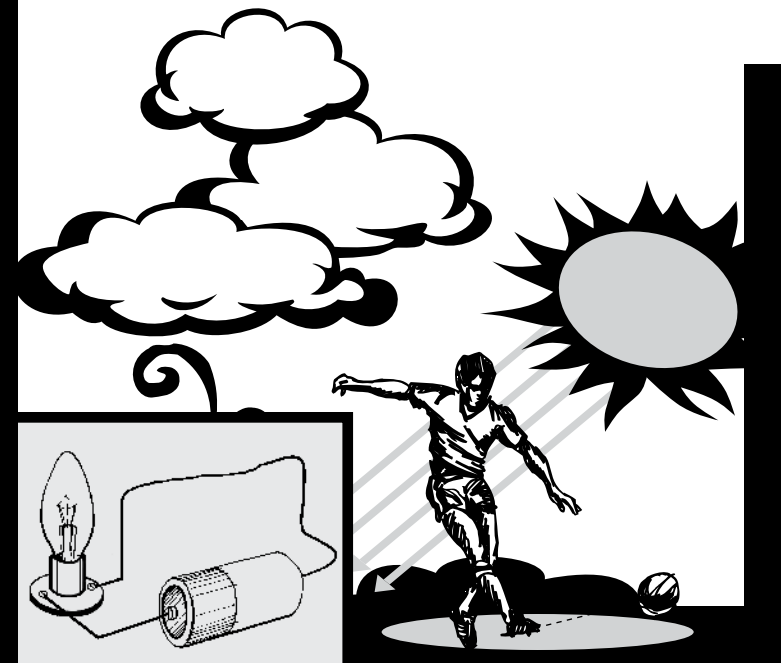


Physical Science

Matter and Energy

What Is Energy?

by Tom Sibila





Physical Science

Matter and Energy

What Is Energy?

by Tom Sibila

FOCUScurriculum

Curriculum materials for **your** content standards

Table of Contents

Introduction:

Present but Never Seen4

Chapter 1:

Energy Comes from the Sun6

Chapter 2:

Categories of Energy12

Kinetic Energy12

Potential Energy13

Converting Stored Energy . .15

Chapter 3:

Transfer of Energy17

Glossary22

To Find Out More23

Index24

–Predict–

*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? How 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 sounds 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 Ability to Change

Energy supplies the power to change things. It is the ability or **capacity** to do work. Energy makes things move or grow. Heat, light, and electricity are all forms of energy. It can run machines. It causes physical and chemical changes in **matter**.

Energy exists in a variety of forms forms such as heat, light, sound, electrical, chemical, and mechanical. Mechanical energy is the energy of motion.

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 their engines which make the cars 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

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 sun's 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.

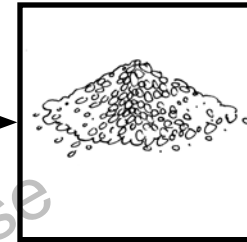
Plants also store the energy from the sun. Most plants make seeds. Some of these seeds grow into new plants. Other seeds are used by humans and animals for food. For example, we use wheat seeds to make bread. When we eat the bread, we get the energy from the seeds to help us survive.

atmosphere: layer of air that surrounds Earth

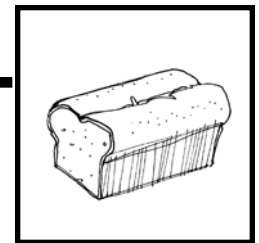
How the Sun's Energy is Used



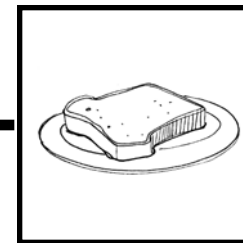
The sun provides heat and light energy for plants to grow.



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

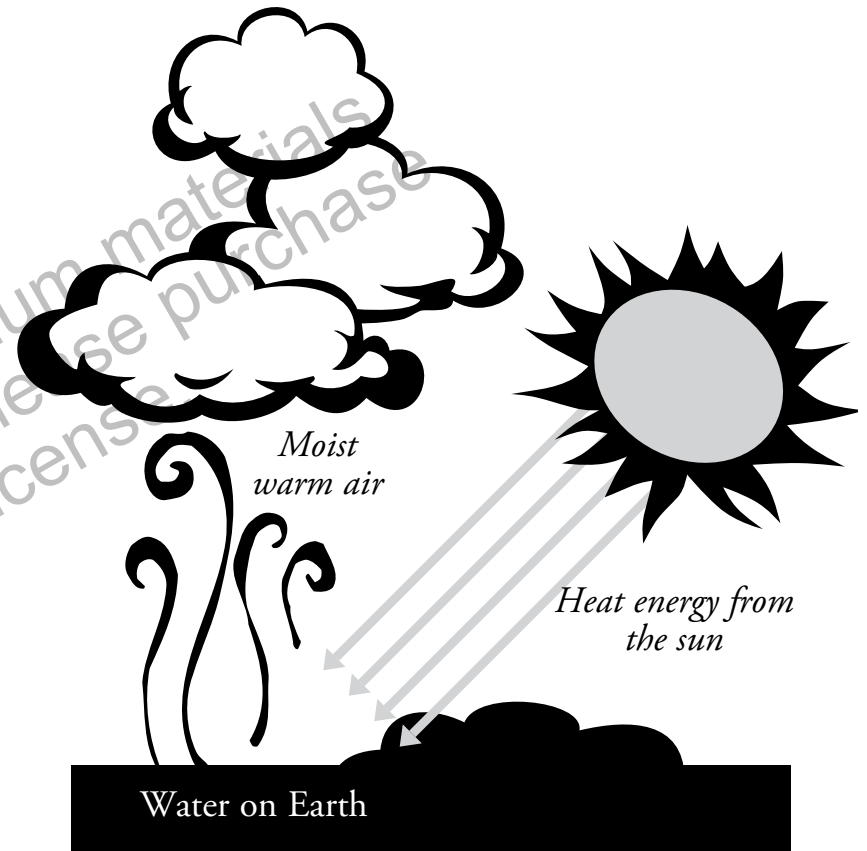
Heat energy from the sun does more than help plants and animals make food. It also provides us with freshwater which is another thing people, plants, and animals need to survive.

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

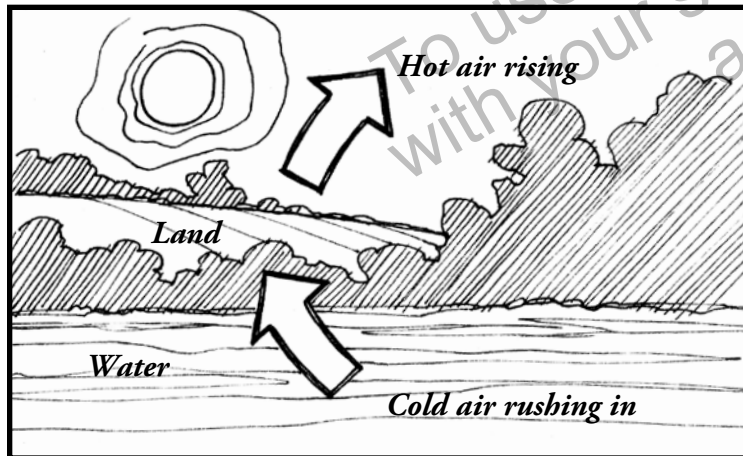


Clouds form when warm, moist air rises off Earth's surface. When clouds build up too much moisture, freshwater falls back to Earth.

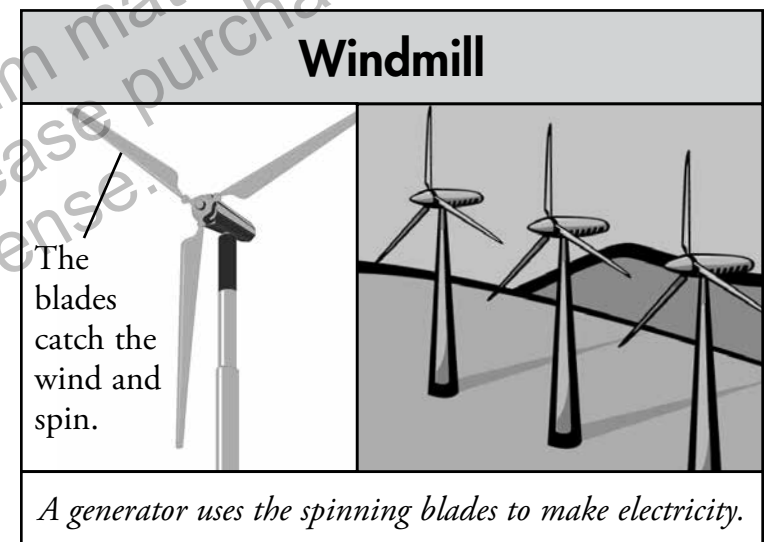
Heat Energy and Wind

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.



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.

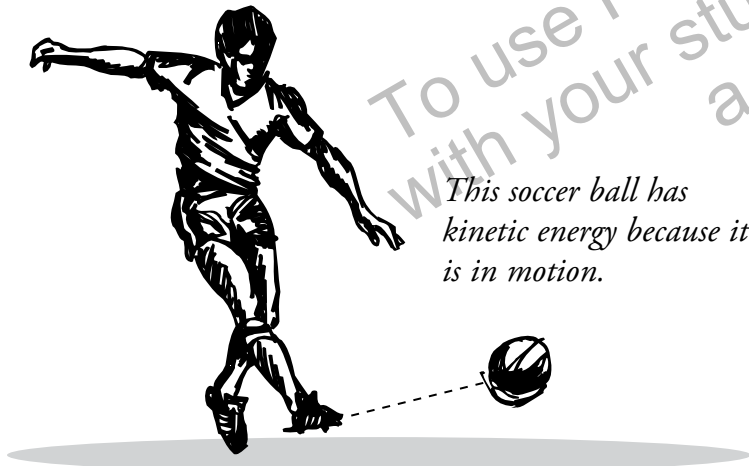
generator: a machine that produces electricity by turning a magnet inside a coil of wire

Categories of Energy

Energy can be classified into two main categories, kinetic energy and potential energy.

Kinetic Energy

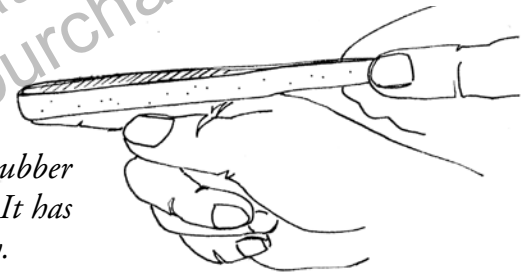
Kinetic energy is the energy of moving objects. A moving car, a runner sprinting, a waterfall, or a kicked soccer ball are all objects that have kinetic energy.



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

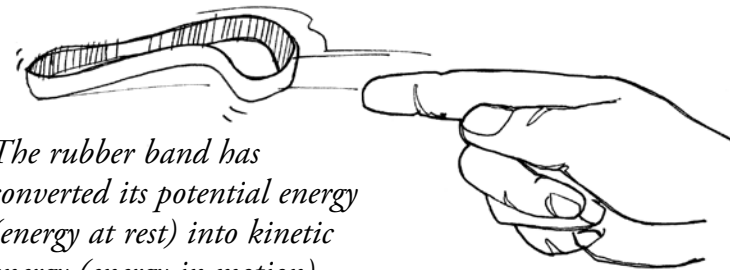
Potential Energy

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.

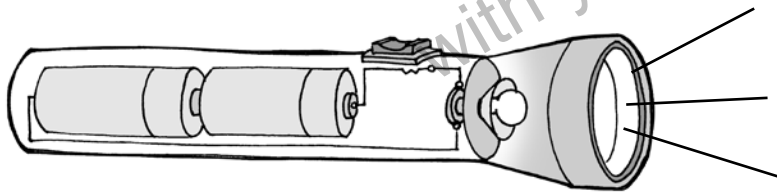


The rubber band has converted its potential energy (energy at rest) into kinetic energy (energy in motion).

Converting Stored Energy

Potential energy can be stored in forms other than mechanical energy such as chemical energy. You have already read how plants use energy from the sun to create food, and how we use the chemical 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.

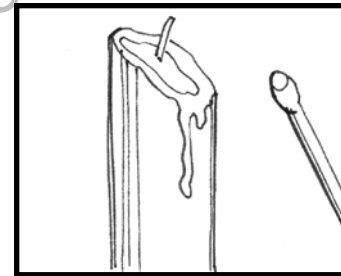


The potential energy in these batteries are released and converted to electrical energy. What other form of energy are converted?

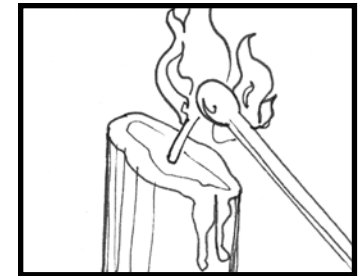
Heat

Over time, people have learned how to convert potential energy to produce heat and motion. Matches and candles are examples of ways we can convert potential energy into heat.

A matchstick resting in a box is cold, but it has potential energy. When you strike the match, the chemicals burn. 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 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

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 mechanical 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.

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.

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

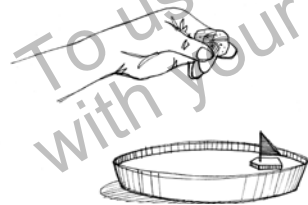
friction: rubbing of one thing against another

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.



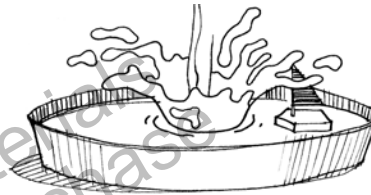
2. When you hold the pebble at rest above the water, you transfer kinetic energy into potential energy. The pebble now has potential energy—the ability to do work.



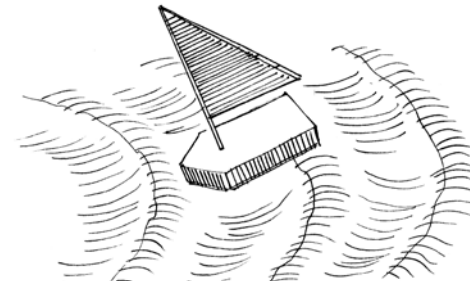
3. When the pebble is released and falls down, the potential energy in the pebble is transferred back to kinetic energy.



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.



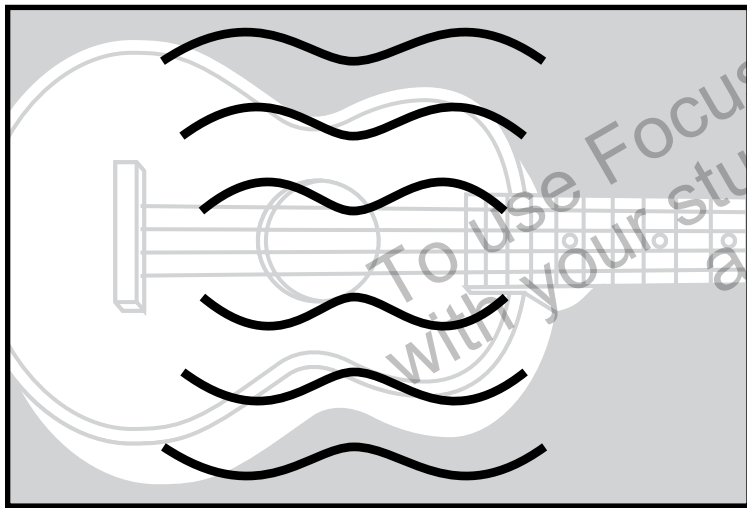
6. The waves would cause the toy boat to bob up and down and back and forth. But the toy boat would stay the same place in the water

–Explain–

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

Transfer of Sound Energy

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>

Index

batteries, 14
electricity, 10–11, 21
gasoline, 16
heat, 6, 15, 17
kinetic energy, 12, 16
light, 6, 14
potential energy, 13–14, 15, 16
sound, 20
sun, 6–10
water cycle, 8
waves, 17–20
wind, 10–11

Published by FOCUScurriculum

866-315-7880

www.focuscurriculum.com

Copyright © 2019 FOCUScurriculum

Order Number: PS-22AL

Created by Kent Publishing Services, Inc.

Designed by Signature Design Group, Inc.

No part of the book may be reproduced without purchasing a license from the publisher. To purchase a license to reproduce this book, contact focuscurriculum.com. The publisher takes no responsibility for the use of any of the materials or methods described in this book, nor for the products thereof.

To use FocusCurriculum materials with your students, please purchase a school license.



Physical Science

Matter and Energy

Advanced Level

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. Which statement best describes the way a plant uses the energy it absorbs from the sun?
 - Ⓐ It uses all of it to fuel its own growth.
 - Ⓑ It stores all of it to pass on when it reproduces.
 - Ⓒ It uses the energy to make food for other plants.
 - Ⓓ It uses some to make food and stores the rest.
2. The most important function of a gasoline engine in a car is to transfer
 - Ⓐ stored energy into heat
 - Ⓑ kinetic energy into motion
 - Ⓒ potential energy into motion
 - Ⓓ kinetic energy into potential energy
3. Which type of energy is needed to hit a baseball with a baseball bat?
 - Ⓐ chemical
 - Ⓑ light
 - Ⓒ mechanical
 - Ⓓ heat

4. Describe the energy transfer that results from plucking a guitar string.

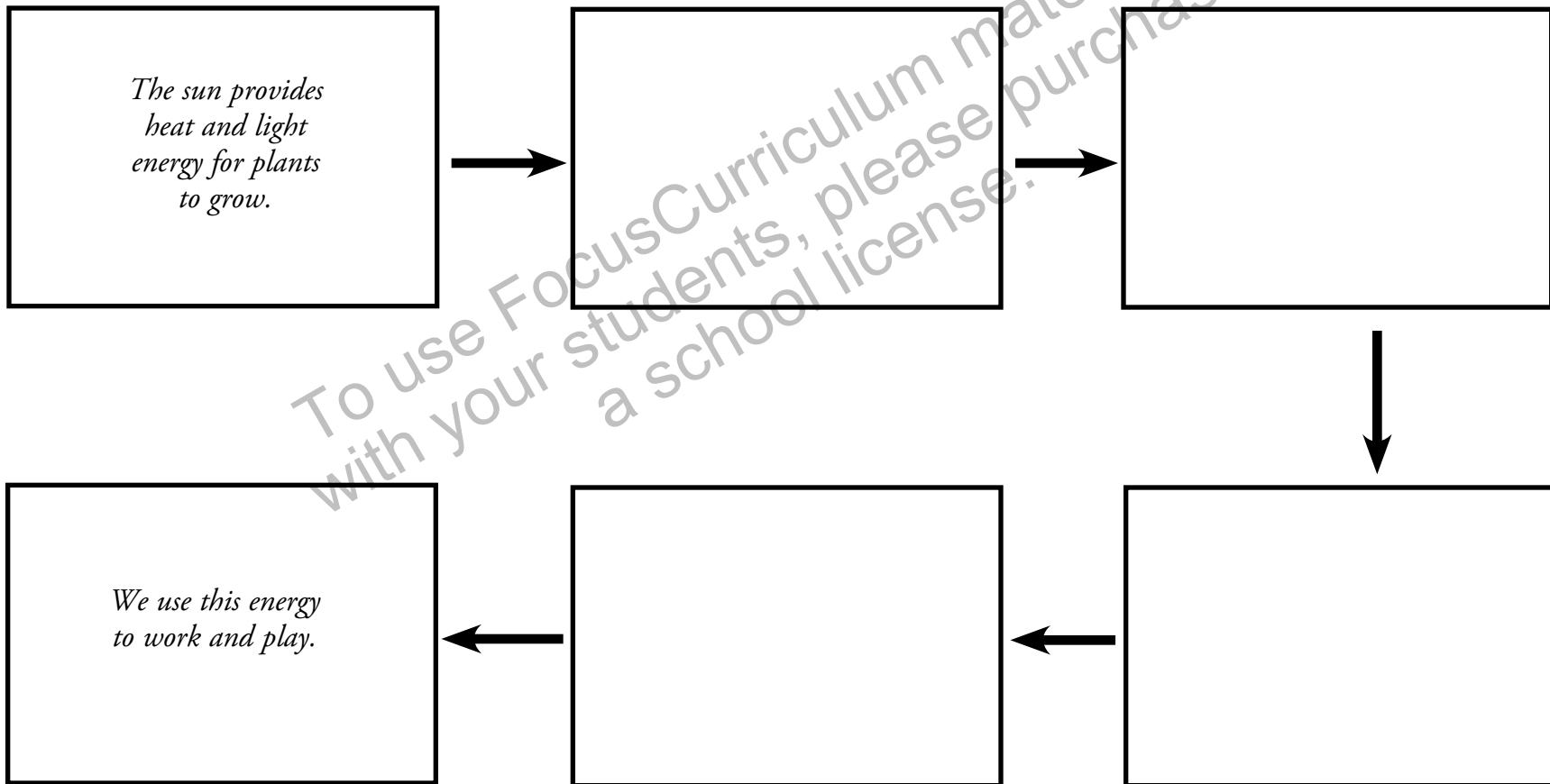
5. A student rubs her hands together on a cool fall day. The heat that warms her hand is caused by?
 - Ⓐ chemical energy
 - Ⓑ mechanical energy
 - Ⓒ electrical energy
 - Ⓓ light energy

What Is Energy?

Check Understanding

Write your answer in the space provided.

6. Light energy from the sun is used by plants to make food. Complete the flow chart below to explain how you use this light energy from the sun to work and play.



What Is Energy?

Assessment Scoring Guidelines

1. Answer D is correct.
2. Answer C is correct.
3. Answer C is correct.
4. A guitar string at rest is a potential source of kinetic 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.
5. Answer B is correct.
6. 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.

To use FocusCurriculum materials
with your students, please purchase
a school license.



Physical Science

Matter and Energy

Advanced Level

English Language Arts Activities

What Is Energy?

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

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.

Main Ideas and Relevant Details

TRY THE SKILL

Graphic organizers help you understand information by putting it in the form of a chart or table. Often, facts make more sense when you see them in a table.

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

| Kinetic Energy | Potential Energy |
|----------------|------------------|
| Definition | Definition |
| Examples | Examples |

To use FocusCurriculum materials with your students, please purchase a school license.

Make Connections

TRY THE SKILL

You can monitor your understanding and make connections 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.

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?

Cause and Effect

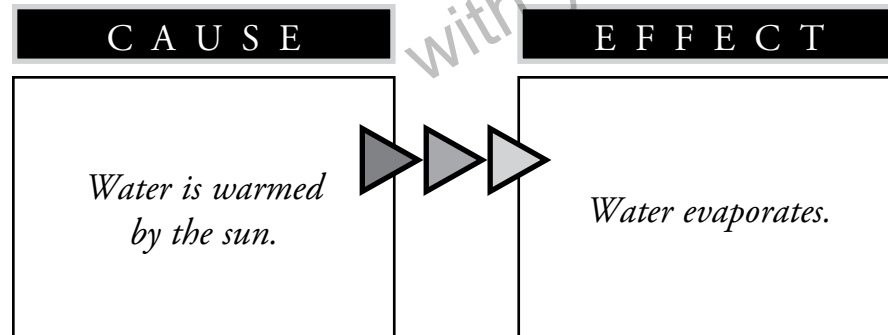
TRY THE SKILL

To find the effect of something, ask, "What happened as a result?" To find the cause of something, ask, "Why did that happen?"

Read this passage from *What Is Energy?*

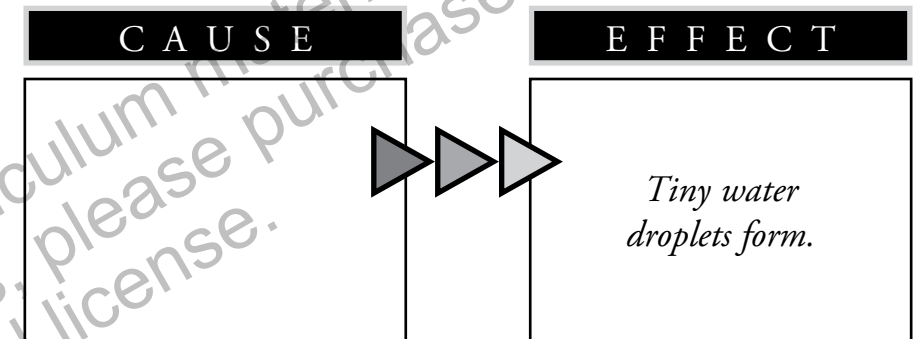
When water is warmed by the sun, it evaporates and rises. As water vapor rises it cools, and tiny water droplets form. When these droplets are packed closely together, they become visible and form a cloud. Clouds are moved over land by wind. When too much water collects in a cloud, the cloud can no longer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

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

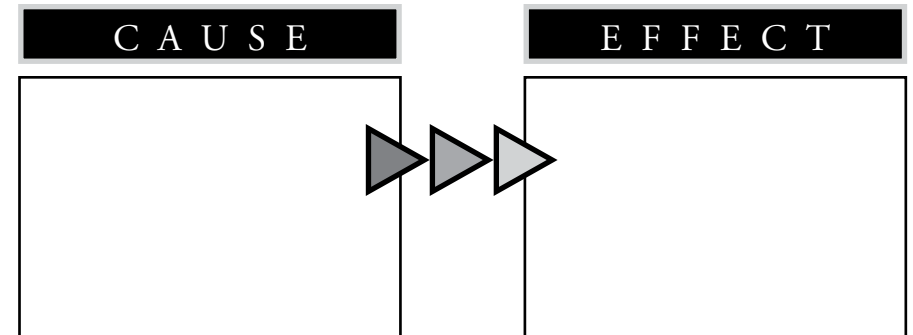


Read the passage again. Then complete each graphic.

1. What causes tiny water droplets to form?



2. What causes a cloud to form?



Answer Key

Context Clues

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

Main Ideas and Relevant Details

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

Make Connections

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.

Cause and Effect

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