



## Science

- 6 Big Idea units with:
  - 4 standards-based weekly lessons
  - 24 activity pages
  - teacher lesson plans
- Content vocabulary, comprehension, and visual literacy practice
- 6 hands-on activities

Name \_\_\_\_\_

## Weekly Question

Day  
3Do we really drink the same  
water that dinosaurs did?

When water vapor is transported to cooler regions—either away from the tropics or higher up into the atmosphere—it cools. As water vapor cools, it gives up its heat energy and changes back into a liquid. We call this process **condensation**. In the atmosphere, condensation takes the form of tiny droplets of water. We see condensation as clouds in the sky or fog near the ground.

When water droplets get so big that air currents can no longer support them, they fall to Earth's surface as rain. This rainfall is called **precipitation**. If the air is cold enough, condensation of water vapor takes form. Snow is another form of

precipitation  
results in  
precipitation

Name \_\_\_\_\_

Day  
2

## Weekly Question

Do we really drink the same  
water that dinosaurs did?

The movement of water between the ocean, air, and land is powered by the sun. Energy from the sun heats liquid water and causes it to **evaporate**, or change into an invisible gas called **water vapor**. Water vapor enters the atmosphere, where it mixes with other gases. We describe the amount of water vapor in the air in terms of **humidity**. When there is more moisture in the air, the humidity is higher.

Most of the evaporation on Earth is from oceans close to the equator, where heating by the sun is greatest. Warm, humid air from the equator



Daily Science

Big  
Idea 3

WEEK 1

## Vocabulary

**condensation**  
KON-den-SAY  
the change from  
gas into a liquid

**precipitation**  
prih-SIP-ih-TAY  
water droplets  
fall to the ground or  
freeze and fall as  
hail.

M

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Enhanced  
E-book

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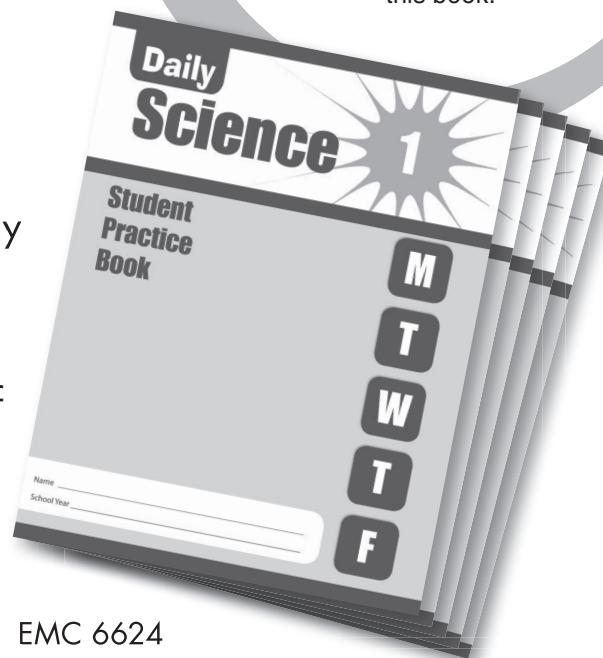
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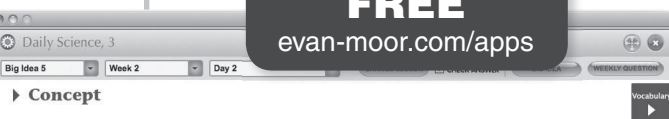


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Grade 3      EMC 6623

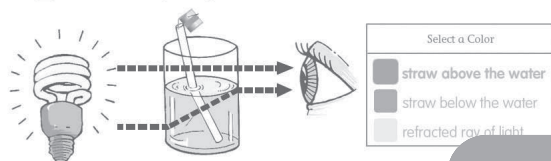
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1. Look at the diagram. Use  to color the straw above the water.
2. Use  to color the straw below the water.
3. Use  to color the ray of light that is refracted.



CHECK ANSWER



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# Daily

# Science

GRADE  
5

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**Vocabulary** *blood vessels, callus, cell, cell membrane, circulatory system, connective tissue, cytoplasm, dermis, digestive system, enzymes, epidermis, epithelial tissue, esophagus, hypodermis, intestines, marrow, muscle tissue, nucleus, organ, plasma, platelets, salivary glands, sebum, stem cells, tissue, villi*

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# What's in This Book?

*Daily Science* provides daily activity pages grouped into six units, called Big Ideas, that explore a wide range of topics based on the national standards for life, earth, and physical sciences. Every Big Idea includes five weekly lessons. The first four weeks each center around an engaging question that taps into students' natural curiosity about the world to develop essential concepts and content vocabulary. The fifth week of each unit offers a hands-on activity and review pages for assessment and extra practice.

The short 10- to 15-minute activities in *Daily Science* allow you to supplement your science instruction every day while developing reading comprehension and practicing content vocabulary.

## Unit Introduction

Key science concepts and national science standards covered in the unit are indicated.

Background information is provided on the topic, giving you the knowledge you need to present the unit concepts confidently.

**Big Idea 1**

Living things are made mostly of cells. Multicellular organisms have different cells that perform specialized functions.

**Key Concept**  
Structure and function in living systems

**National Standard**  
Specialized cells perform specialized functions in multicellular organisms. Groups of specialized cells cooperate to form a tissue, such as a muscle. Different tissues are in turn grouped together to form larger functional units, called organs. Each type of cell, tissue, and organ has a distinct structure and set of functions that serve the organism as a whole.

**Teacher Background**  
All organisms are made of cells, sometimes called the "building blocks of life." Many living things, such as bacteria, are made of a single cell. But most plants and animals are multicellular. Multicellular organisms have specialized cells, each with their own function. When a collection of specialized cells work together to perform a specific function, they form a tissue. The human body contains four types of tissue: connective, which forms bones and blood; epithelial, which lines the body inside and out; nervous, which is found in the brain, spinal cord, and nerves; and muscle tissue, which helps the body move. Different tissues work together to form organs. Organs, in turn, are organized into systems that are responsible for the body's complex functions of digestion, excretion, circulation, respiration, reproduction, and immunity. For specific background information on each week's concepts, refer to the notes on pp. 8, 14, 20, and 26.

**Unit Overview**

**WEEK 1: Why are bones hard and muscles soft?**  
**Connection to the Big Idea:** Muscles and bones are examples of tissues made from cells that perform a specialized function. Students learn that nearly every cell in the human body has similar parts, but they can perform different functions. Muscles and bones are comprised of muscle and connective tissue, respectively. They function to move and provide support for the body.  
**Content Vocabulary:** cell, cell membrane, connective tissue, cytoplasm, muscle tissue, nucleus, tissue

**WEEK 2: Why does skin wrinkle in the bathtub?**  
**Connection to the Big Idea:** Skin is comprised of different tissues that work together to form the body's largest organ. Students learn that skin has three layers and functions to protect the body and move substances in and out.  
**Content Vocabulary:** callus, dermis, epidermis, epithelial tissue, hypodermis, organ, skin

**WEEK 3: What happens if you swallow gum?**  
**Connection to the Big Idea:** The digestive system is a system of organs that work together to digest food, provide the body with nutrients, and expel waste. Students learn that while most foods are broken down in the stomach and small intestine, gum stays mostly intact.  
**Content Vocabulary:** digestive system, enzymes, esophagus, intestines, salivary glands, villi

**WEEK 4: How do people give blood without running out of it?**  
**Connection to the Big Idea:** Blood is a liquid tissue that is part of the circulatory system. Students learn that blood is made up of plasma and cells, provides the rest of the body's cells with oxygen, and carries away carbon dioxide. Blood is constantly being regenerated in the bone marrow, which is why people are able to donate blood.  
**Content Vocabulary:** blood vessels, circulatory system, marrow, plasma, platelets, stem cells

**WEEK 5: Unit Review**  
You may choose to do these activities to review concepts about cells in the body:  
**p. 32: Comprehension** Students answer multiple-choice questions about key concepts in the unit.  
**p. 33: Vocabulary** Students complete a crossword puzzle reviewing key vocabulary.  
**p. 34: Visual Literacy** Students label a flowchart to reinforce their understanding of cells, tissues, organs, and systems.  
**p. 35: Hands-on Activity** Students reenact the digestion process in the stomach, using a food storage bag, soda, bread, and gum. Instructions and materials needed for the activity are listed on the student page.

An overview of the four weekly lessons shows you each weekly question, explains what students will learn, and lists content vocabulary.

Week 5 review activities are summarized.

## Weekly Lessons (Weeks 1–4)

Each week begins with a teacher page that provides additional background information specific to the weekly question.

Ideas are given for presenting the daily activity pages, including content vocabulary and materials needed for any demonstrations or group activities.

**Big Idea 1**

Living things are made mostly of cells. Multicellular organisms have different cells that perform specialized functions.

**Day One**  
Vocabulary: digestive system, esophagus, intestines  
Materials: page 21

**Day Two**  
Vocabulary: enzymes, salivary glands  
Materials: page 22

**Day Three**  
Vocabulary: villi  
Materials: page 23

**Day Four**  
Materials: page 24

**Day Five**  
Materials: page 25

**Week 3**  
**What happens if you swallow gum?**

Most students, at one point or another, have pondered the effects of swallowing their gum, and they may have incorrect assumptions about it. This week, in the process of discovering what actually happens when they swallow gum, students learn how the digestive system works. The digestive system, like other organ systems, is a group of organs that work together to perform a function—specifically, digesting food, absorbing nutrients, and expelling waste. The digestive system begins with the mouth, where saliva and enzymes break down food. From there, food moves to the stomach, where acids and other enzymes break it down even further. The stomach contents get pushed from the stomach into the small intestine, where small finger-like bumps called villi absorb the food's nutrients and help move them into the bloodstream. Finally, the food makes it to the large intestine, where it is compacted with other waste materials and expelled from the body.

Introduce the vocabulary. After students have read the passage, ask them to explain what they think it means to say "gum is largely not digestible" even though it can pass through the body. (It means the gum cannot be broken down.) Tell students that there are other food ingredients, such as seeds and fiber, that are also mostly indigestible. Have students complete the activity. Review the answers together.

Ask students what happens after they chew gum for a long time. (It loses flavor.) Have students read the passage to understand that saliva and enzymes break down gum's sweeteners, so after a while you can't taste them. Have students complete the activities. Review the answers together.

Ask students to predict what they think happens to the gum once it gets to the stomach. Write their answers on the board. After students have finished reading, compare their answers to the information in the passage. Have students complete the activities. Review the answers together.

Have students read the passage. Tell them that despite their name, the small intestine is actually much longer than the large intestine. Then instruct students to complete the activities. Review the answers together.

Have students complete the page independently. Then review the answers together.

The student activity pages for Days 1–4 of each week use an inquiry-based model to help students answer the weekly question and understand fundamental concepts related to the Big Idea.

You may wish to have students complete the pages independently or collaboratively.

## Weekly Lessons, continued

Each student page begins with a short passage.

Activities include a variety of writing, comprehension, vocabulary, critical thinking, visual literacy, and oral language practice.

**Day 2 Weekly Question**  
**What happens if you swallow gum?**

Your digestive system starts with your mouth. When you chew food, you break it up into smaller pieces. As you chew, your **salivary glands** secrete saliva. Saliva moistens the food, and **enzymes** in the saliva start to break down the food's nutrients so that your body can absorb them more easily. When you swallow, muscles move the food down your esophagus to your stomach.

However, when you chew on gum, something different happens. *Saliva and enzymes break down the sweeteners in the gum, but the*

**Big Idea 1**  
**WEEK 3**

**Vocabulary**  
enzymes  
ENR-jums

**Day 3 Weekly Question**  
**What happens if you swallow gum?**

After food passes through your esophagus, it enters the stomach. Here, strong muscles that form the stomach wall churn up the food. The stomach secretes acids and enzymes that help further break down the food. However, a wad of gum remains mostly intact. Even so, it doesn't stay in your stomach for seven years! Usually within hours, the wad of gum gets pushed into the small intestine along with the rest of the stomach contents.

*Questions is completed in the small intestine. The inside of the small intestine is called villi. Villi are finger-like bumps in the small intestine that help move nutrients into the bloodstream.*

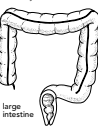
**Big Idea 1**  
**WEEK 3**

**Vocabulary**  
villi  
vill-eye  
finger-like bumps in the small intestine that help move nutrients into the bloodstream

**Day 4 Weekly Question**  
**What happens if you swallow gum?**

After food is digested in the small intestine, anything left over that can't be absorbed as nutrients is moved into the large intestine as waste. The main job of the large intestine is to absorb water from the waste, compact the waste, and expel it from your body. This is ultimately what happens to the gum that you swallow. Since it is not digestible, it passes harmlessly out of your body.

The digestive system works with other systems in your body. For example, water absorbed from the large intestine enters the blood and passes through the organs of the excretory (EKS-uh-TOR-ee) system. Kidneys cleanse the blood and remove dissolved waste, which is stored in the bladder until it is excreted as urine.



**Big Idea 1**  
**WEEK 3**

**A. List the three main jobs of the large intestine.**

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

**B. Check the box next to the words that complete the analogy.**  
Intestine is to \_\_\_\_\_ system as kidney is to \_\_\_\_\_ system.

|                                      |                                      |
|--------------------------------------|--------------------------------------|
| <input type="checkbox"/> circulatory | <input type="checkbox"/> digestive   |
| <input type="checkbox"/> excretory   | <input type="checkbox"/> respiratory |

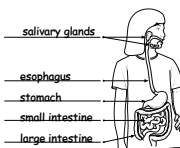
**Big Idea 1 • Week 3** 24

**Day 5 Weekly Question**  
**What happens if you swallow gum?**

**A. Use the words in the box to complete the paragraph.**

\_\_\_\_\_ Your \_\_\_\_\_ starts with your mouth. When you chew food, \_\_\_\_\_ produce saliva to moisten food, and \_\_\_\_\_ help break down the nutrients. The food goes down the \_\_\_\_\_ into the stomach and is broken down further. From there, food is pushed into the small \_\_\_\_\_ where finger-like \_\_\_\_\_ help absorb nutrients and deliver them to the body's bloodstream.

**B. Label the parts of the digestive system, using the words in the box.**



**Big Idea 1 • Week 3** 25

Vocabulary words and definitions are provided for students.

Day 5 reviews the week's key concepts and vocabulary.

## Unit Review (Week 5)

**Visual Literacy:** Students practice skills such as labeling diagrams, reading charts, and sequencing steps in a process.

**Hands-on Activity:** Students participate in a hands-on learning experience.

**Comprehension:** Students review key concepts of the unit by answering literal and inferential comprehension questions.

**Unit Review Comprehension**  
**Use Your Brain Cells**

Fill in the bubble next to the correct answer.

- What is the main function of muscle tissue?  
☐ (A) to help the body move  
☐ (B) to protect the body from disease  
☐ (C) to help the body digest food  
☐ (D) to support the body
- What are the layers of the skin?  
☐ (A) epithelial, thelial, dermothelial  
☐ (B) callus, blood vessels, muscle  
☐ (C) epidermis, dermis, hypodermis  
☐ (D) tissue, dermis, epithelial
- Villi in the \_\_\_\_\_ help move nutrients into the blood.  
☐ (A) esophagus  
☐ (B) large intestine  
☐ (C) stomach  
☐ (D) small intestine
- Blood consists mostly of \_\_\_\_\_.  
☐ (A) blood cells and tissue  
☐ (B) plasma, red blood cells, and platelets  
☐ (C) water, marrow, and platelets  
☐ (D) oxygen, nutrients, and waste
- Two organ systems that work together are the \_\_\_\_\_.  
☐ (A) epithelial and connective systems  
☐ (B) digestive and salivary systems  
☐ (C) digestive and excretory systems  
☐ (D) circulatory and plasma systems
- What is the function of a cell's nucleus?  
☐ (A) to act as a barrier  
☐ (B) to cushion the cell  
☐ (C) to direct the cell's actions  
☐ (D) to form stem cells
- The substance that washes off your skin after a long bath is \_\_\_\_\_.  
☐ (A) epidermis  
☐ (B) epithelial tissue  
☐ (C) callus  
☐ (D) sebum

**Big Idea 1**  
**WEEK 5**

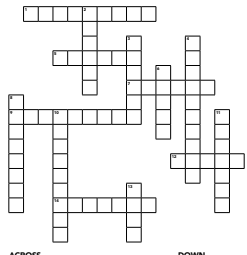
**Unit Review Visual Literacy**  
**Tissues, Organs, & Systems**

Complete the chart below with words from the box to show how the human body is organized and what it is made up of.

|             |            |         |                 |
|-------------|------------|---------|-----------------|
| circulatory | digestive  | heart   | intestines      |
| connective  | epithelial | tissues | red blood cells |

**Unit Review Vocabulary**  
**Get "Organ-ized"**

Use the vocabulary words and the clues below to solve the puzzle.



**ACROSS**

- a jelly-like substance in the cell
- Cells grouped together form this.
- where blood cells come from
- a part of the digestive system between the mouth and the stomach
- finger-like bumps in the small intestine
- chemicals in your salivary glands that break down food

**DOWN**

- This contains dissolved nutrients.
- middle layer of skin
- bottom layer of skin
- Your heart is an \_\_\_\_\_
- something that surrounds the cell
- blood parts that help blood clot
- a cell's control center
- the fundamental unit of life

**Big Idea 1**  
**WEEK 5**

**Unit Review Hands-on Activity**  
**Can You Stomach This?**

During digestion, food passes through the stomach, where it mixes with digestive juices and is churned by muscles forming the stomach wall. In this experiment, your hands provide the muscle, and soda does the job of the stomach acid.

**What You Need**

- see-through, sealable food storage bag
- 1/3 cup carbonated soft drink
- slice of bread
- wad of chewed gum
- measuring cup

- Place the soft drink, bread, and chewed gum in the food storage bag.
- Make sure most of the air is removed from the bag. Then seal the bag.
- Squeeze the bag with your hands for about a minute. Look at the contents of the bag.
- Record your observations.

**What Did You Discover?**

- What happened to the bread?
- What happened to the gum?
- Explain why the gum and the bread reacted the way that they did.

**Big Idea 1**  
**WEEK 5**

**Vocabulary:** Students review the vocabulary presented in the unit.



Living things are made mostly of cells. Multicellular organisms have different cells that perform specialized functions.

### **Key Concept**

Structure and function in living systems

### **National Standard**

Specialized cells perform specialized functions in multicellular organisms. Groups of specialized cells cooperate to form a tissue, such as a muscle. Different tissues are in turn grouped together to form larger functional units, called organs. Each type of cell, tissue, and organ has a distinct structure and set of functions that serve the organism as a whole.

**A**t the beginning of the fifth grade, students should understand what a cell is, although they may not understand how cells work together to perform specific functions. This Big Idea teaches students:

- the structure of cells;
- how cells work together to form tissue;
- the organization of tissue into organs; and
- the grouping of organs into systems necessary for complex functions.

### **Teacher Background**

All organisms are made of cells, sometimes called the “building blocks of life.” Many living things, such as bacteria, are made of a single cell. But most plants and animals are multicellular. Multicellular organisms have specialized cells, each with their own function.

When a collection of specialized cells work together to perform a specific function, they form a tissue. The human body contains four types of tissue: connective, which forms bones and blood; epithelial, which lines the body inside and out; nervous, which is found in the brain, spinal cord, and nerves; and muscle tissue, which helps the body move. Different tissues work together to form organs. Organs, in turn, are organized into systems that are responsible for the body’s complex functions of digestion, excretion, circulation, respiration, reproduction, and immunity.

**For specific background information on each week’s concepts, refer to the notes on pp. 8, 14, 20, and 26.**

## Unit Overview

### WEEK 1: Why are bones hard and muscles soft?

**Connection to the Big Idea:** Muscles and bones are examples of tissues made from cells that perform a specialized function. Students learn that nearly every cell in the human body has similar parts, but they can perform different functions. Muscles and bones are comprised of muscle and connective tissue, respectively. They function to move and provide support for the body.

**Content Vocabulary:** *cell, cell membrane, connective tissue, cytoplasm, muscle tissue, nucleus, tissue*

### WEEK 2: Why does skin wrinkle in the bathtub?

**Connection to the Big Idea:** Skin is comprised of different tissues that work together to form the body's largest organ. Students learn that skin has three layers and functions to protect the body and move substances in and out.

**Content Vocabulary:** *callus, dermis, epidermis, epithelial tissue, hypodermis, organ, sebum*

### WEEK 3: What happens if you swallow gum?

**Connection to the Big Idea:** The digestive system is a system of organs that work together to digest food, provide the body with nutrients, and expel waste. Students learn that while most foods are broken down in the stomach and small intestine, gum stays mostly intact.

**Content Vocabulary:** *digestive system, enzymes, esophagus, intestines, salivary glands, villi*

### WEEK 4: How do people give blood without running out of it?

**Connection to the Big Idea:** Blood is a liquid tissue that is part of the circulatory system. Students learn that blood is made up of plasma and cells, provides the rest of the body's cells with oxygen, and carries away carbon dioxide. Blood is constantly being regenerated in the bone marrow, which is why people are able to donate blood.

**Content Vocabulary:** *blood vessels, circulatory system, marrow, plasma, platelets, stem cells*

### WEEK 5: Unit Review

You may choose to do these activities to review concepts about cells in the body.

**p. 32: Comprehension** Students answer multiple-choice questions about key concepts in the unit.

**p. 33: Vocabulary** Students complete a crossword puzzle reviewing key vocabulary.

**p. 34: Visual Literacy** Students label a flow-chart to reinforce their understanding of cells, tissues, organs, and systems.

**p. 35: Hands-on Activity** Students reenact the digestion process in the stomach, using a food storage bag, soda, bread, and gum. Instructions and materials needed for the activity are listed on the student page.



*Living things are made mostly of cells. Multicellular organisms have different cells that perform specialized functions.*

## Week 1

# Why are bones hard and muscles soft?

Cells are the smallest unit of life. Nearly every cell in the human body has the same three parts: a nucleus, the surrounding cytoplasm, and a cell membrane. While cells can operate on their own, they also group together as tissue to perform specific functions. There are four types of tissues in the human body, and bones and muscles are two of these tissues. Skeletal muscle tissue, the most familiar type of muscle, is composed of long, thin muscle cells. The tissue contracts and releases in order to move the body. Connective bone tissue, on the other hand, is made of star-shaped cells surrounded by calcium and other hard minerals. Soft muscles and hard bones work together to give us strength, structure, and movement.

### Day One

**Vocabulary:** *cell, cytoplasm, cell membrane, nucleus*

**Materials:** page 9

Introduce the vocabulary by reading each definition and having students look at the diagram in activity A to figure out what part of the cell is being referred to. Then have students read the passage and complete the activities. Review the answers together.

### Day Two

**Vocabulary:** *connective tissue, muscle tissue, tissue*

**Materials:** page 10

Introduce the vocabulary. Remind students that cells can function on their own, but they can accomplish more difficult tasks by working together. Walk students through the diagram, pointing out where the muscle tissue and connective tissue are located on the body. Have students complete the activity. Review the answers together.

### Day Three

**Materials:** page 11; rubber band

Demonstrate the properties of muscle by showing students the flexible quality of a rubber band. Tell them that muscle, unlike bone, can be stretched, and that if you pull too hard on a muscle, it can snap just like a rubber band does. After students have finished reading the passage, have them complete the activities. For activity B, you may first want to confirm students' understanding of *voluntary* and *involuntary*.

### Day Four

**Materials:** page 12

Remind students that bone tissue is an example of connective tissue. Inform them that connective tissue not only forms bones, ligaments, tendons, and cartilage, but also blood. Have the students read the passage and complete the activities. Review the answers together.

### Day Five

**Materials:** page 13

Have students complete the page independently. Then review the answers together.

Name \_\_\_\_\_

**Day  
1**

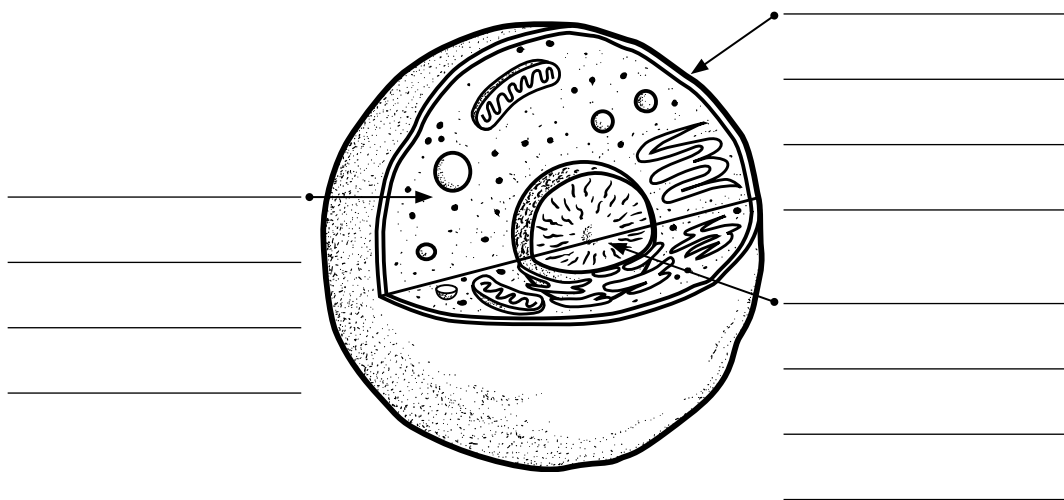
**Weekly Question**

**Why are bones hard  
and muscles soft?**

All organisms are made up of **cells**. A cell is the smallest unit of living matter. Cells grow, reproduce, use energy, and produce waste. Nearly all the cells in your body have the same three parts. The first is the **cell membrane**, which surrounds the cell and acts as a barrier between the cell and the outside world. Inside the cell, a central **nucleus** controls the cell's activities. Between the membrane and the nucleus is the **cytoplasm**, a jelly-like substance that contains the materials and structures necessary for cells to do their job.

Although the cells in your body have similar parts, many of the cells do specific jobs. In order to do these jobs well, the cells look and act different from each other. The cells that make up your muscles are shaped differently and behave differently from those that make up your bones.

- A.** Use the vocabulary words to label the parts of the cell.  
Briefly describe what each part does.



- B.** What do you think the function of muscle cells is? What do you think the function of bone cells is?
- \_\_\_\_\_

**Vocabulary**

**cell**

sel  
the basic unit  
of structure and  
function in living  
organisms

**cytoplasm**

SY-toh-PLAZ-um  
the jelly-like  
substance inside  
a cell

**cell membrane**

MEM-brain  
the thin sack that  
surrounds a cell

**nucleus**

NEW-klee-us  
the part of the  
cell that directs  
all of its activities

Name \_\_\_\_\_

Daily Science

# Big Idea 1

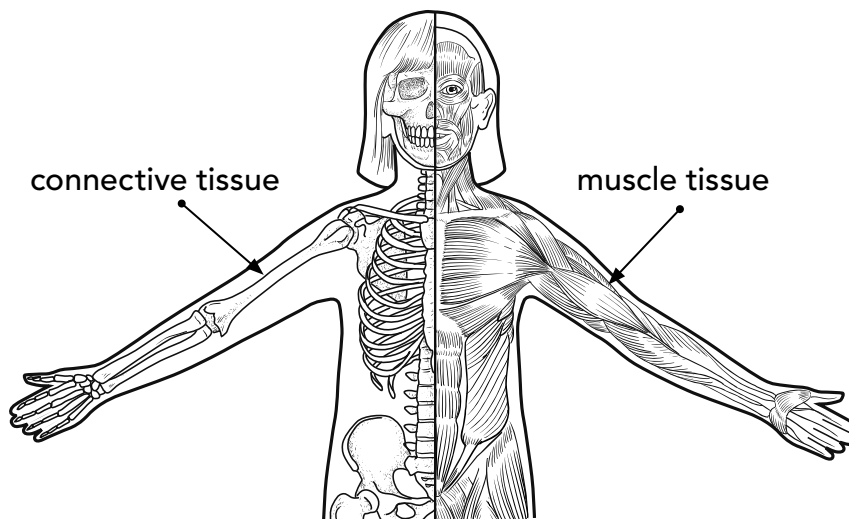
WEEK 1

Day 2

## Weekly Question

# Why are bones hard and muscles soft?

Human beings are multicellular (MUL-tee-SEL-yoo-ler) organisms made of trillions of cells. Specialized cells in multicellular organisms, such as bone or muscle cells, group together to carry out particular functions, such as breathing, digesting, and moving. When similar cells work together, they form a **tissue**. The human body contains four types of tissue. Muscle cells form **muscle tissue**, which is responsible for movement. Bone cells make up part of the body's **connective tissue**, which also includes cartilage, tendons, and ligaments that help connect muscles and bones.



## Vocabulary

### tissue

TIH-shoo

a group of cells that work together to perform a specific function

### connective tissue

kuh-NEK-tiv TIH-shoo

groups of cells that provide structure and support

### muscle tissue

MUSS-ul TIH-shoo

groups of cells that can contract and expand to produce movement

What kind of tissue do you think each body part is mostly made of?

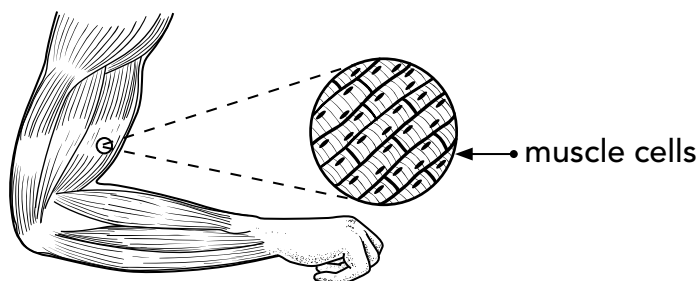
1. your kneecaps \_\_\_\_\_
2. the cartilage in your nose \_\_\_\_\_
3. your heart \_\_\_\_\_
4. your shinbone \_\_\_\_\_
5. your tongue \_\_\_\_\_
6. the biceps in your arms \_\_\_\_\_



**Day  
3****Weekly Question****Why are bones hard  
and muscles soft?**

There are three types of muscle tissue that make up the muscles in your body. One type forms the muscles in your organs. Another type forms your heart muscle. The third type forms the muscles that attach to your skeleton. This skeletal muscle tissue is made up of long, thin cells that look like threads. Unlike most other cells, skeletal muscle cells have more than one nucleus. Muscle cells bundle together to form long, rope-like cords of tissue.

Every time you move, muscle tissue contracts and relaxes. When you “make a muscle” in your arm by flexing, you are actually contracting the muscle tissue, making it shorter and thicker. When you stop flexing, the muscle tissue releases, becoming longer and thinner.

**A. Rewrite each sentence, changing a word or phrase to make the statement true.**

1. The muscle tissue in your heart is made up of long, thin cells.

\_\_\_\_\_

2. Skeletal muscle cells have a nucleus and many cell membranes.

\_\_\_\_\_

3. When you flex your arm, the muscle tissue becomes longer and thinner.

\_\_\_\_\_

**B. Our bodies have some muscles that we can move voluntarily and some that move involuntarily (without us thinking about it). Name an example of each.**

**Voluntary:** \_\_\_\_\_

**Involuntary:** \_\_\_\_\_

Name \_\_\_\_\_

Daily Science

**Big  
Idea 1**

**WEEK 1**

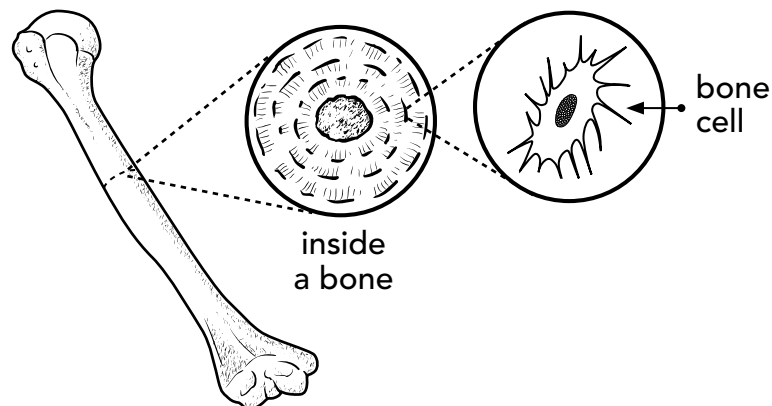
**Day  
4**

**Weekly Question**

## **Why are bones hard and muscles soft?**

Under a microscope, bone cells look very different from muscle cells. Bone cells are star-shaped and contain a nucleus and a thin ring of cytoplasm. Bone tissue is made up of layers of bone cells surrounded by calcium and other minerals. These minerals are what make our bones hard. Bones give our bodies shape and allow us to stand upright.

Hard bones and soft muscles work together to give us strength, form, and movement. Bones cannot move by themselves. They need muscles that contract and release to pull them into motion. But muscles can't contract and release without being attached to something hard and rigid, like bones. In order for our bodies to function, we need both bones and muscles.



- A.** Describe two ways that bone cells and muscle cells are alike and two ways they are different.

**Alike:** \_\_\_\_\_

**Different:** \_\_\_\_\_

- B.** Why do you think nutrition experts recommend that young people eat foods high in calcium?

\_\_\_\_\_  
\_\_\_\_\_

Name \_\_\_\_\_



**Day**  
**5**

**Weekly Question**

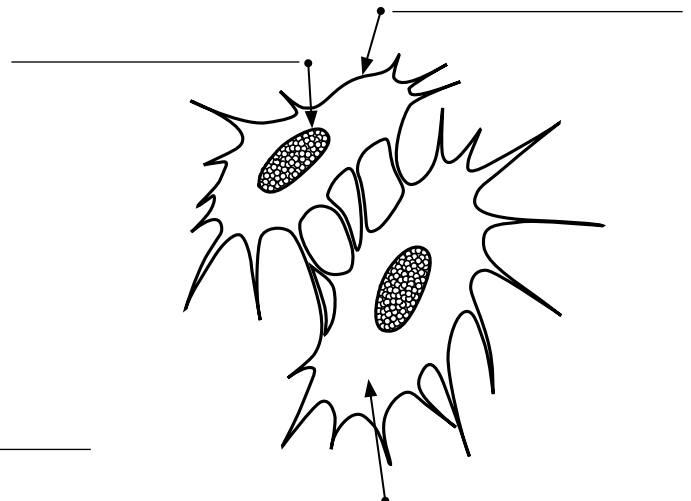
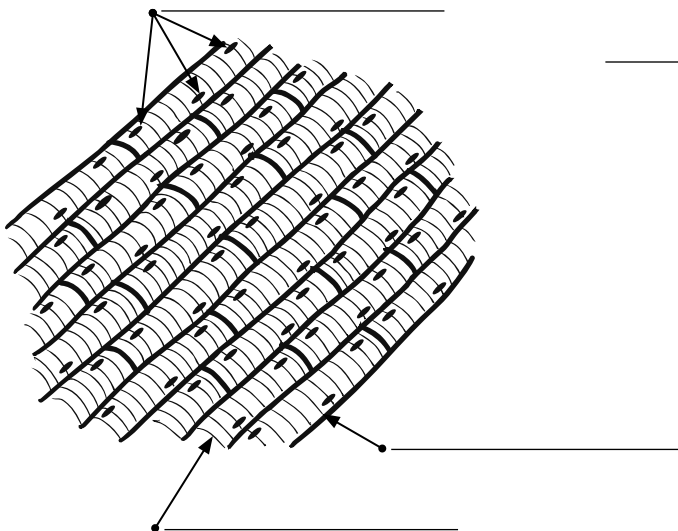
**Why are bones hard  
and muscles soft?**

A. Use the words in the box to complete the paragraph.

membrane    nucleus    muscle tissue    cell  
cytoplasm    tissue    connective tissue

The smallest unit of life is a \_\_\_\_\_. It contains  
a \_\_\_\_\_ that directs all of the cell's activities. It also  
has a \_\_\_\_\_ that acts as a barrier between the cell  
and the outside world. Inside the cell, there is a jelly-like substance called  
\_\_\_\_\_. Cells that group together to carry out a specific  
function are called \_\_\_\_\_. \_\_\_\_\_  
supports the body. \_\_\_\_\_ helps us move.

B. Label the *nucleus* (or *nuclei*), *cytoplasm*, and *cell membrane* of the  
muscle cells and bone cells.





*Living things are made mostly of cells. Multicellular organisms have different cells that perform specialized functions.*

## Week 2

# Why does skin wrinkle in the bathtub?

This week students discover why skin wrinkles by looking at the structure and function of the tissues that make up the layers of the skin. They learn that the skin is the largest organ in the human body. It is composed of two tissues: connective and epithelial tissue. These tissues work together to protect the body, regulate temperature, and move materials through the skin.

The tissues of skin are contained in three layers: the hypodermis, dermis, and epidermis. The epidermis is the layer that swells when soaked in water. Normally, skin is covered by sebum, an oily substance that acts like waterproofing. But after 20 minutes in water, the sebum is washed away and the skin absorbs the water, causing it to swell and wrinkle.

### Day One

**Vocabulary:**  
*epithelial tissue, organ*

**Materials:** page 15

Introduce the vocabulary and review the term *connective tissue* from Week 1 (tissue that supplies structure and support). Remind students that tissues are cells that work together to perform specialized jobs. Then tell them that, in much the same way, organs are tissues that work together. After students have finished reading the passage, have them complete the activities. Review the answers together.

### Day Two

**Vocabulary:**  
*dermis, epidermis, hypodermis*

**Materials:** page 16

Introduce the vocabulary. Invite students to guess what the word root *derma* means. (skin) Then explain that *epi-* is a prefix that means "on top of," and *hypo-* means "below." Ask students if they can name the kind of doctor that specializes in skin care. (dermatologist) After students have finished reading the passage, have them complete the activities. Review the answers together.

### Day Three

**Vocabulary:**  
*callus, sebum*

**Materials:** page 17

Start the day by asking students if they know what a callus is and how they would get one. (a patch of tough skin that develops from rubbing against something constantly) After students have read the passage, have them complete the activities. For the oral activity, pair students together or discuss it as a group.

### Day Four

**Materials:** page 18

After students have read the passage, ask if they can guess why their skin returns to normal several minutes after getting out of the bath. (The water absorbed by the callus dries out, and the epidermis shrinks.) Have them complete the activities and review the answers together.

### Day Five

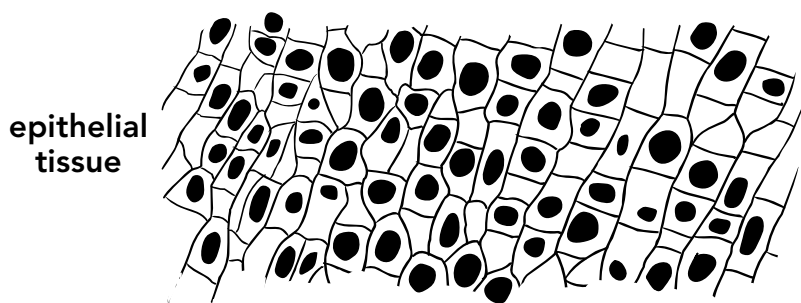
**Materials:** page 19

Have students complete the page independently. Then review the answers together.

**Day  
1****Weekly Question****Why does skin wrinkle  
in the bathtub?**

You may not think of your skin as an **organ**, but it is. In fact, it is the largest organ of your body. As an organ, your skin keeps your body from drying out, helps to keep your temperature constant, and acts as a barrier to disease.

Your skin is made up of two types of tissue: **epithelial tissue** and connective tissue. When you look at your skin, you are seeing epithelial tissue. Epithelial tissue protects your body from the outside world. It does the work of moving materials in and out of the body. It also secretes sweat that keeps us cool.

**Vocabulary****epithelial tissue**

EP-ih-THEEL-ee-ul

TIH-shoo

*tissue that covers  
the inside and  
outside surfaces  
of the body***organ**

OR-gun

*a group of tissues  
that perform  
specific functions*

**A.** Name the two types of tissue that form your skin.

1. \_\_\_\_\_ 2. \_\_\_\_\_

**B.** What are the main jobs of epithelial tissue?

\_\_\_\_\_  
\_\_\_\_\_

**C.** Check the box next to the phrase that completes the analogy.

**Tissue** is to **organ** as \_\_\_\_.

☐ skin is to body

☐ cell is to tissue

☐ epithelial is to connective

☐ barrier is to purpose

Name \_\_\_\_\_

**Day  
2**

**Weekly Question**

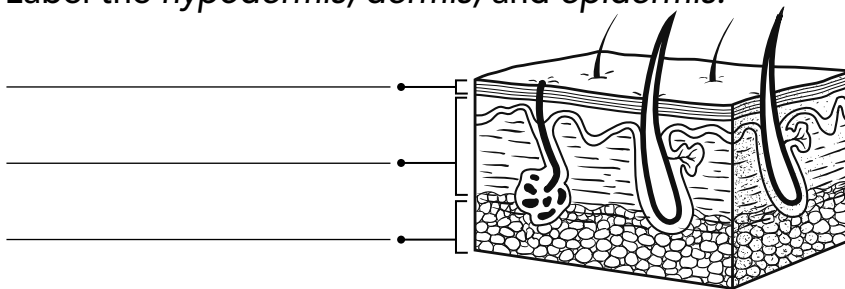
**Why does skin wrinkle  
in the bathtub?**

The tissues of the skin are contained in three layers. The bottom layer, called the **hypodermis**, is a layer of fat and connective tissue that helps connect the skin to muscles and bones.

The middle layer, the **dermis**, is composed mostly of connective tissue and includes hair roots, nerve endings, sweat glands, and blood vessels. The dermis cushions the body, regulates body heat, and registers sensations of pain, temperature, and pressure.

The top layer of your skin is the **epidermis**, which is made of epithelial tissue. The epidermis protects the other layers of your skin and prevents your body from losing water.

**A. Label the hypodermis, dermis, and epidermis.**



**B. Write which layer of skin—the hypodermis, dermis, or epidermis—is described in each statement below.**

1. responsible for sense of touch \_\_\_\_\_
2. protects skin from damage \_\_\_\_\_
3. connects skin to muscle and bone \_\_\_\_\_

**C. The tissues in your skin are also responsible for “goose bumps,” the raised hairs you get when you are chilled. As your skin registers the sensation of cold, tiny muscles attached to your hair roots make the hairs stand up. In which layer of skin do you think this happens? Explain your answer.**

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**Vocabulary**

**dermis**

DER-miss  
middle layer of  
the skin

**epidermis**

EP-ih-DER-miss  
top layer of the  
skin

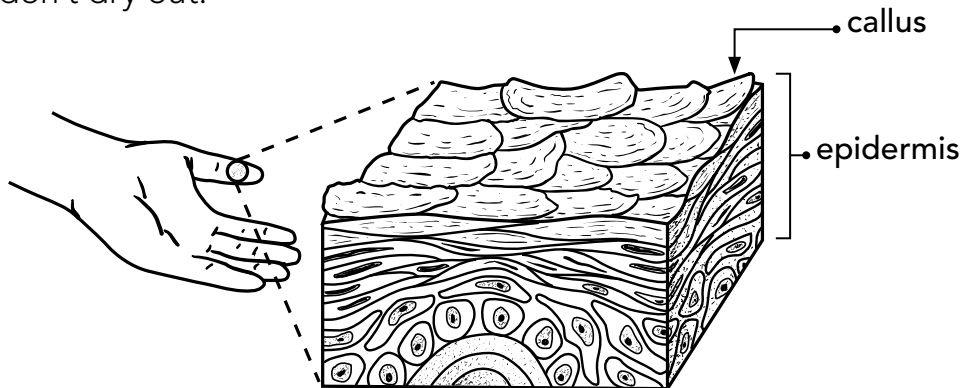
**hypodermis**

HI-poh-DER-miss  
bottom layer of  
the skin

**Day  
3****Weekly Question****Why does skin wrinkle  
in the bathtub?**

As a way of protecting your body, your epidermis contains flattened skin cells called **callus** cells that stack on top of each other like tiles. These cells are dry on the inside and have thick walls. Callus cells are tough and protect skin from damage. When there is a lot of friction on your skin, callus cells build up. This is what we call a callus.

An oily substance called **sebum** also protects your skin. Sebum acts like a natural waterproof seal, keeping your skin from absorbing too much water. Sebum also helps keep water inside skin cells so they don't dry out.

**Vocabulary****callus**

KAL-us

dry, tough skin  
cells**sebum**

SEE-bum

an oily substance  
that covers the  
epidermis

Write whether *callus* or *sebum* would protect your skin more in the situations below.

1. using a shovel to dig \_\_\_\_\_
2. swimming in a lake \_\_\_\_\_
3. staying outside on a hot day \_\_\_\_\_
4. handling a hot pan \_\_\_\_\_

**Talk**

Acne develops when excess sebum, dead skin cells, and bacteria that normally live on the skin plug up hair follicles. How does washing the skin help control acne?

Name \_\_\_\_\_

Daily Science

**Big  
Idea 1**

**WEEK 2**

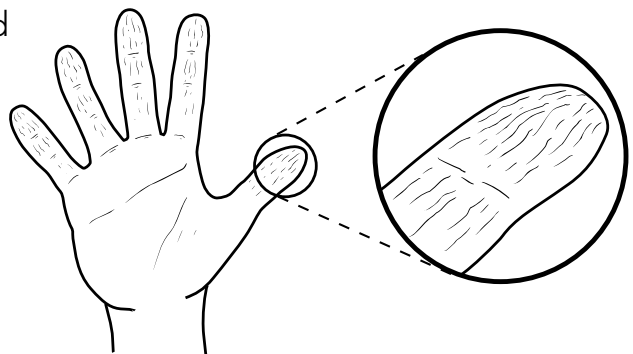
**Day  
4**

**Weekly Question**

## **Why does skin wrinkle in the bathtub?**

Although sebum normally protects your skin from absorbing too much water, when you soak your skin for more than 20 minutes, the sebum can be washed off. When that happens, the callus cells in the epidermis absorb water, and the cells puff up and become soft. Callus cells are thickest on hands and feet, so they swell the most.

So why does skin wrinkle, instead of just puff up, when it expands? The epidermis is firmly attached in some places to the dermis, which doesn't expand when soaked in water. These points of attachment between the layers of skin form the indents of a wrinkle.



### **A. Answer the questions.**

1. Based on the picture above, which part of the hand has the most callus cells?

\_\_\_\_\_

2. Why doesn't your skin wrinkle when you go outside in the rain?

\_\_\_\_\_

3. Why doesn't the skin on your stomach wrinkle after a swim?

\_\_\_\_\_

**B. Ducks' feathers are waterproof, due in part to a gland near their tail. When ducks clean themselves, they spread a substance from this gland over their feathers. How is this substance like sebum? How is it different? Explain your answer.**

\_\_\_\_\_

\_\_\_\_\_



Name \_\_\_\_\_



**Day  
5**

**Weekly Question**

**Why does skin wrinkle  
in the bathtub?**

A. Use the words in the box to complete the paragraph.

sebum    organ    epithelial    hypodermis  
dermis    callus    epidermis

Your skin is the body's largest \_\_\_\_\_. It is made up of connective and \_\_\_\_\_ tissue. The bottom layer of skin, or the \_\_\_\_\_, connects your skin to your muscles and bones. The middle layer, or the \_\_\_\_\_, regulates body temperature and senses pain. The \_\_\_\_\_ protects the other layers of skin from damage. This layer is helped by oily \_\_\_\_\_ and tough \_\_\_\_\_ cells.

B. Write *true* or *false*.

1. Callus cells only protect your skin from water. \_\_\_\_\_
2. Organs are made up of tissues. \_\_\_\_\_
3. The skin is the largest organ in the body. \_\_\_\_\_

C. There are three levels of burns you can get on your skin. First degree burns are the least serious, and third degree burns are the most serious. In which layers of the skin do you think first, second, and third degree burns happen? Explain your answer.

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*Living things are made mostly of cells. Multicellular organisms have different cells that perform specialized functions.*

## Week 3

# What happens if you swallow gum?

Most students, at one point or another, have pondered the effects of swallowing their gum, and they may have incorrect assumptions about it. This week, in the process of discovering what actually happens when they swallow gum, students learn how the digestive system works.

The digestive system, like other organ systems, is a group of organs that work together to perform a function—specifically, digesting food, absorbing nutrients, and expelling waste. The digestive system begins with the mouth, where saliva and enzymes break down food. From there, food moves to the stomach, where acids and other enzymes break it down even further. The stomach contents get pushed from the stomach into the small intestine, where small finger-like bumps called *villi* absorb the food's nutrients and help move them into the bloodstream. Finally, the food makes it to the large intestine, where it is compacted with other waste materials and expelled from the body.

### Day One

**Vocabulary:** *digestive system, esophagus, intestines*

**Materials:** page 21

Introduce the vocabulary. After students have read the passage, ask them to explain what they think it means to say "gum is largely not digestible" even though it can pass through the body. (It means the gum cannot be broken down.) Tell students that there are other food ingredients, such as seeds and fiber, that are also mostly indigestible. Have students complete the activity. Review the answers together.

### Day Two

**Vocabulary:** *enzymes, salivary glands*

**Materials:** page 22

Ask students what happens after they chew gum for a long time. (It loses flavor.) Have students read the passage to understand that saliva and enzymes break down gum's sweeteners, so after a while you can't taste them. Have students complete the activities. Review the answers together.

### Day Three

**Vocabulary:** *villi*

**Materials:** page 23

Ask students to predict what they think happens to the gum once it gets to the stomach. Write their answers on the board. After students have finished reading, compare their answers to the information in the passage. Have students complete the activities. Review the answers together.

### Day Four

**Materials:** page 24

Have students read the passage. Tell them that despite their names, the small intestine is actually much longer than the large intestine. Then instruct students to complete the activities. Review the answers together.

### Day Five

**Materials:** page 25

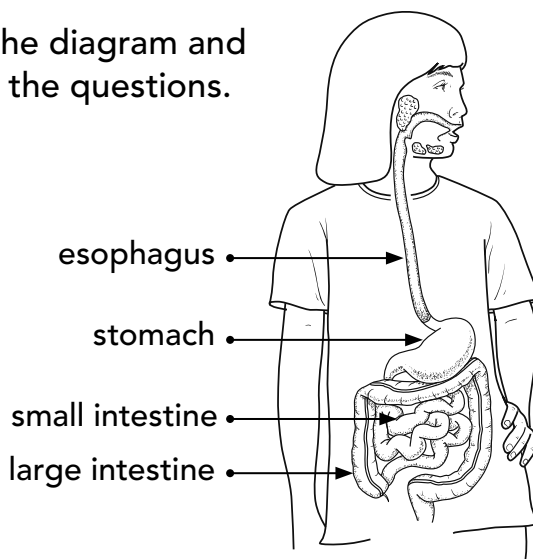
Have students complete the page independently. Then review the answers together.

**Day  
1****Weekly Question****What happens if you swallow gum?**

Have you ever been warned not to swallow gum? Maybe you've been told that gum sticks to your intestines, or that it takes seven years to digest! These stories about gum are so widespread that they have been discussed in actual science articles. But are they true? No, not really. Gum is made from a chewy, rubber-like material that is largely not digestible. However, gum is able to pass through the body because of the body's **digestive system**.

The digestive system is an example of an organ system in which different organs of the body cooperate to perform a function. It is composed of organs such as the **esophagus**, stomach, and small and large **intestines**. These organs work together to break down food, absorb nutrients from food, and expel waste.

Use information from the diagram and the passage to answer the questions.



1. Which organ receives food first, the esophagus or the stomach? \_\_\_\_\_
2. Which organ is between the stomach and large intestine? \_\_\_\_\_
3. What are the three functions of the digestive system?  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Vocabulary****digestive system**

dy-JESS-tiv  
SISS-tum  
a group of organs that work together in the body to digest food

**esophagus**

ih-SAH-fuh-gus  
a tube that connects the mouth and the stomach

**intestines**

in-TESS-tinz  
a set of tube-like organs that form part of the digestive track

Name \_\_\_\_\_

Daily Science

**Big  
Idea 1**

**WEEK 3**

**Day  
2**

### Weekly Question

## What happens if you swallow gum?

Your digestive system starts with your mouth. When you chew food, you break it up into smaller pieces. As you chew, your **salivary glands** secrete saliva. Saliva moistens the food, and **enzymes** in the saliva start to break down the food's nutrients so that your body can absorb them more easily. When you swallow, muscles move the food down your esophagus to your stomach.

However, when you chew on gum, something different happens. Saliva and enzymes break down the sweeteners in the gum, but the rest of the gum stays in one wad. If you happen to swallow it, it will move to the stomach in one piece.

### Vocabulary

#### enzymes

EN-zymz  
*chemicals that aid reactions in the body*

#### salivary glands

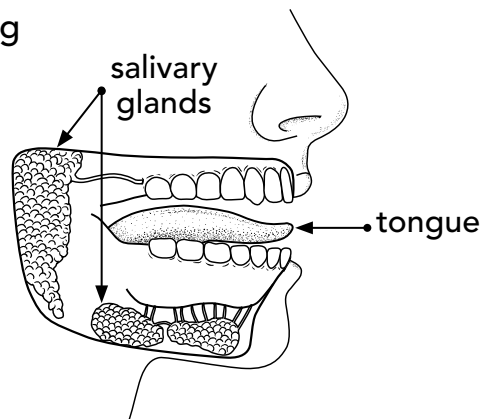
SAL-ih-VAIR-ee  
glandz  
*glands that secrete saliva enzymes*

- A. Write a caption for the diagram, explaining the role that chewing and saliva play in digestion.**

---

---

---



- B. Answer the questions.**

1. How are enzymes similar to chewing, and how are they different?

---

---

2. What are two possible problems with swallowing food before you chew it properly?

a. \_\_\_\_\_

b. \_\_\_\_\_

Name \_\_\_\_\_

**Day  
3**

**Weekly Question**

**What happens if you swallow gum?**

**Daily Science**

**Big  
Idea 1**



**WEEK 3**

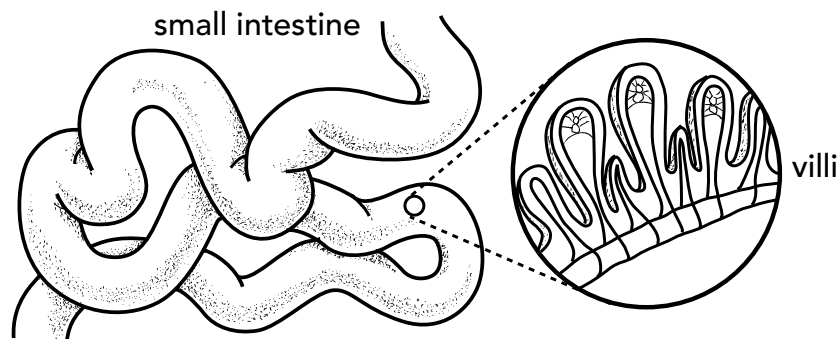
After food passes through your esophagus, it enters the stomach. Here, strong muscles that form the stomach wall churn up the food. The stomach secretes acids and enzymes that help further break down the food. However, a wad of gum remains mostly intact. Even so, it doesn't stay in your stomach for seven years! Usually within hours, the wad of gum gets pushed into the small intestine along with the rest of the stomach contents.

Digestion is completed in the small intestine. The inside of the small intestine is lined with small, finger-like bumps called **villi**. Nutrients from the digested food are absorbed through the villi and passed into the bloodstream. The blood then carries the nutrients to cells throughout the body.

**Vocabulary**

**villi**

VIL-eye  
finger-like bumps  
in the small  
intestine that help  
move nutrients into  
the bloodstream



**A. Complete the sentences below, using words from the passage.**

1. Enzymes and \_\_\_\_\_ break down food in the stomach.
2. Nutrients enter the bloodstream with the help of \_\_\_\_\_.
3. Digestion is completed in the \_\_\_\_\_.

**B. Sometimes when you are ill or eat something spoiled, your brain sends a signal to your stomach to force its contents out of your body. What works in your stomach to make this happen?**

\_\_\_\_\_

Name \_\_\_\_\_

Daily Science

**Big  
Idea 1**

**WEEK 3**

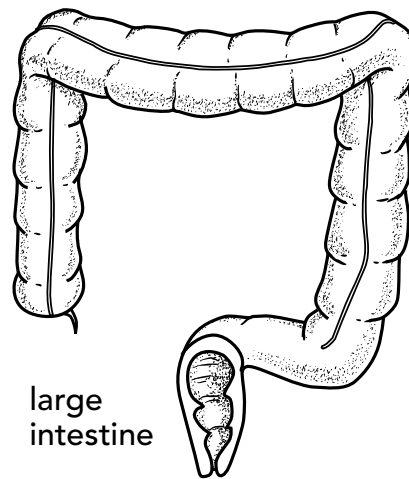
**Day  
4**

**Weekly Question**

## What happens if you swallow gum?

After food is digested in the small intestine, anything left over that can't be absorbed as nutrients is moved into the large intestine as waste. The main job of the large intestine is to absorb water from the waste, compact the waste, and expel it from your body. This is ultimately what happens to the gum that you swallow. Since it is not digestible, it passes harmlessly out of your body.

The digestive system works with other systems in your body. For example, water absorbed from the large intestine enters the blood and passes through the organs of the excretory (EKS-krih-TOR-ee) system. Kidneys cleanse the blood and remove dissolved waste, which is stored in the bladder until it is excreted as urine.



**A. List the three main jobs of the large intestine.**

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

**B. Check the box next to the words that complete the analogy.**

**Intestine** is to \_\_\_\_\_ **system** as **kidney** is to \_\_\_\_\_ **system**.

☐ circulatory, voluntary

☐ digestive, nervous

☐ digestive, excretory

☐ respiratory, digestive

Name \_\_\_\_\_



**Day  
5**

**Weekly Question**

**What happens if you  
swallow gum?**

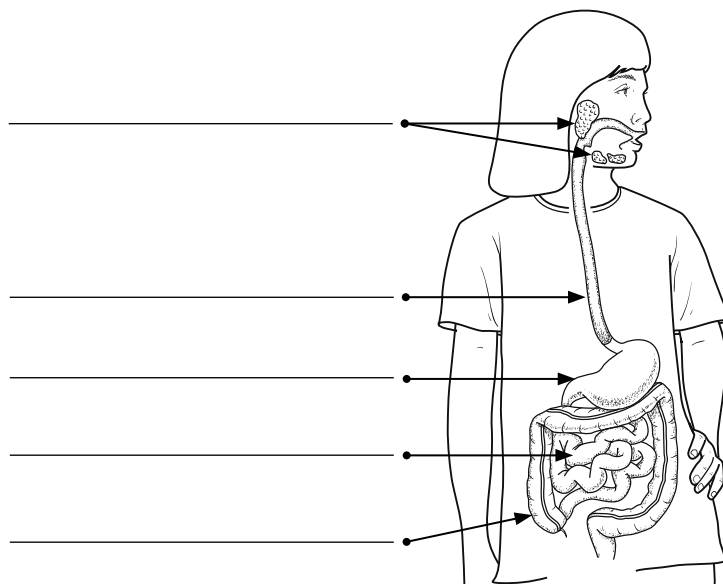
**A.** Use the words in the box to complete the paragraph.

esophagus      digestive system      enzymes  
intestine      salivary glands      villi

Your \_\_\_\_\_ starts with your mouth.

When you chew food, \_\_\_\_\_ produce saliva to  
moisten food, and \_\_\_\_\_ help break down the  
nutrients. The food goes down the \_\_\_\_\_ into the  
stomach and is broken down further. From there, food is pushed into the  
small \_\_\_\_\_, where finger-like \_\_\_\_\_  
help absorb nutrients and deliver them to the body's bloodstream.

**B.** Label the parts of the digestive system, using the words in the box.



stomach  
esophagus  
large intestine  
salivary glands  
small intestine



*Living things are made mostly of cells. Multicellular organisms have different cells that perform specialized functions.*

## Week 4

# How do people give blood without running out of it?

This week students learn about the body's blood supply by first examining blood's function as part of the circulatory system. The circulatory system is made up of organs such as the heart and blood vessels, which include the arteries, veins, and capillaries. The heart pumps blood to the body, and blood vessels bring nutrients and oxygen to all of the body's cells. Blood is made up of plasma and cells. Liquid plasma contains dissolved nutrients and waste. Red blood cells deliver oxygen and remove carbon dioxide. White blood cells fight infection, and platelets help blood clot. However, although blood circulates in the circulatory system, it is actually produced in the bone marrow. Marrow produces stem cells, which become the cells in blood.

### Day One

**Vocabulary:** *blood vessels, circulatory system*

**Materials:** page 27

Introduce the vocabulary. Point out that the word *vessel* can refer to a ship or to an object that holds food or drink. Ask students what these things have in common with blood vessels. (They all hold or carry something.) Remind students that blood carries nutrients from the digestive system and also picks up oxygen in the lungs, which are part of the respiratory system. After students have finished reading the passage, direct them to complete the activities. Review the answers together.

### Day Two

**Vocabulary:** *plasma, platelets*

**Materials:** page 28

Introduce the vocabulary and inform students that plasma is made mostly of water. If necessary, review the term *connective tissue* before students read the passage. Tell them to refer to the illustrations as they read. After students have finished reading, have them complete the activity. Review the answers together.

### Day Three

**Vocabulary:** *marrow, stem cells*

**Materials:** page 29

Introduce the vocabulary. Explain to students that stem cells have the potential to turn into any number of specialized cells, and not just blood cells. This is why scientists have such an interest in studying them. After students have read the passage, have them complete the activities. Review the answers together.

### Day Four

**Materials:** page 30

Ask students if they know anyone who has ever given blood. Explain that only the blood of healthy people can be donated. This is so that diseases are not transmitted when the blood is used. After students finish reading, you may want to read the chart as a group before they complete the activity independently. Review the answers together.

### Day Five

**Materials:** page 31

Have students complete the page independently. Then review the answers together.

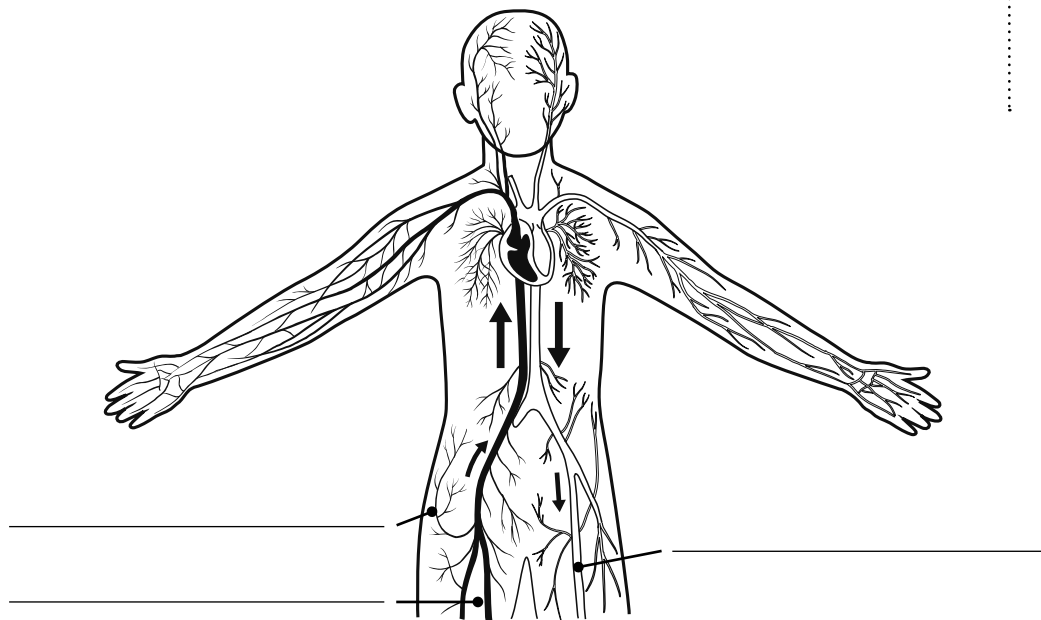


**Day  
1****Weekly Question****How do people give blood without running out of it?**

Blood is the link between every cell in your body. Working together with the heart, lungs, muscles, brain, and digestive system, blood transports oxygen and nutrients everywhere they are needed. Blood also shuttles the waste products produced by cells to places in the body where the waste can be eliminated.

Blood is part of your body's **circulatory system**. This system includes the heart, which pumps blood throughout the body, and the **blood vessels**, such as the arteries and veins. Blood leaves your heart through the arteries. Tiny vessels called capillaries (KAP-ih-LAIR-eez) allow blood to reach each cell and connect the arteries to the veins, which return blood to the heart.

- A.** Judging by the direction that the blood is flowing in the diagram, label the *artery*, *capillary*, and *vein*.



- B.** Name the two main functions of blood.

1. \_\_\_\_\_
2. \_\_\_\_\_

**Vocabulary****blood vessels**

BLUD VESS-ulz  
tubes that transport  
blood throughout  
the body

**circulatory  
system**

SER-kew-lih-tor-ee  
SISS-tum  
the system of  
organs that pump  
blood throughout  
the body

Name \_\_\_\_\_

Daily Science

**Big  
Idea 1**

**WEEK 4**

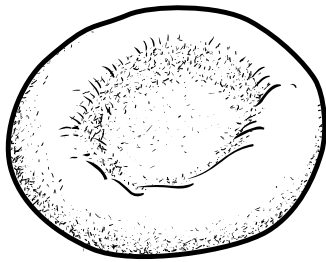
**Day  
2**

### Weekly Question

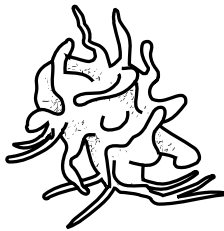
## How do people give blood without running out of it?

Blood is a liquid connective tissue made of cells suspended in a watery fluid called **plasma**. Plasma brings dissolved nutrients to cells and carries the cells' waste products away.

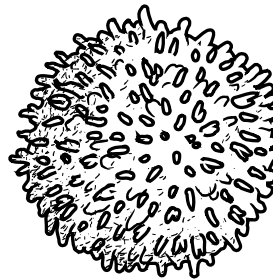
Blood contains three types of cells. Red blood cells, which give blood its color, account for 99% of all blood cells. Red blood cells transport oxygen to all body cells. White blood cells, on the other hand, are far fewer in number but have the important job of attacking infection. **Platelets**, which are the third type of blood cell, are not really cells at all but are fragments of larger blood cells. These small, irregularly shaped bodies collect at the site of an injury and help blood to clot, or form a scab.



red blood cell



platelet



white blood cell

### Vocabulary

#### **plasma**

PLAZ-muh  
fluid containing  
dissolved nutrients  
and waste

#### **platelets**

PLAYT-lits  
particles in blood  
that help make  
blood clot

Answer the questions.

1. Which part of your blood transports nutrients? \_\_\_\_\_
2. Which cells help you get over a cold? \_\_\_\_\_
3. Which cells help heal a cut? \_\_\_\_\_
4. Why is blood red? \_\_\_\_\_
5. What would happen to someone without platelets? \_\_\_\_\_

Name \_\_\_\_\_

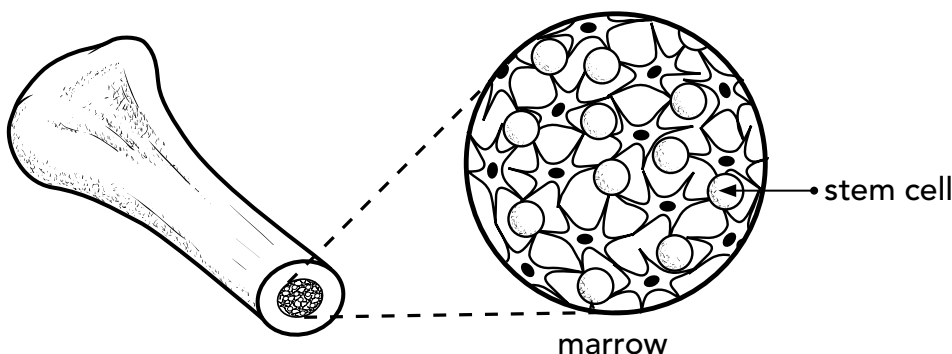
**Day  
3**

**Weekly Question**

**How do people give blood  
without running out of it?**

Blood is essential for life. So what happens when we lose blood? Our bodies actually lose blood all the time—not just from cuts and injuries, but also because blood cells in the body live only for a few days or, at most, a few months. Because of this, our bodies are continuously producing new blood.

Blood cells start out as **stem cells** located in your bone **marrow**. Bone marrow is a spongy, gel-like material inside certain bones, such as your leg and hip bones. Bone-marrow stem cells become the red blood cells, white blood cells, and blood platelets you need to stay healthy. More than 100 billion new blood cells are created in the bone marrow every day.



**Vocabulary**

**marrow**

MARE-oh  
soft tissue found  
inside certain  
bones

**stem cells**

STEM selz  
cells that can  
become other  
types of cells

**A. Write true or false.**

1. Plasma starts out as stem cells. \_\_\_\_\_
2. Bone marrow is contained in all the bones of the body. \_\_\_\_\_
3. Blood cells can die after a few days. \_\_\_\_\_

**B. If the body makes 100 billion new blood cells each day,  
approximately how many blood cells can it make each hour?** \_\_\_\_\_

**C. Use words from the passage to complete the sentence.**

Bone \_\_\_\_\_ contains \_\_\_\_\_ cells, which become \_\_\_\_\_ cells.

Name \_\_\_\_\_



**Day  
4**

**Weekly Question**

**How do people give blood without running out of it?**

Even though blood is constantly replenished in the body, losing too much blood suddenly can endanger a person's life. That's why people donate blood, which can be stored and used for such emergencies.

The human body contains about 5 quarts of blood. Blood donors typically give 1 unit, which is about 1 pint, or 10% of the blood they have. Their body is able to replace the blood fairly quickly. Liquid plasma is fully restored within a day or two. The blood cells take a few weeks to regenerate in the bone marrow and return to normal levels.

Donating blood gives the gift of health. For some people, it is the gift of life.

Use the chart to answer the questions about how donated blood is used.

| Reason for Needing Blood | Blood Parts Needed |             |             |
|--------------------------|--------------------|-------------|-------------|
|                          | Red blood cells    | Platelets   | Plasma      |
| Accident                 | 4–100 units        | none        | none        |
| Liver transplant         | 10–40 units        | 10–30 units | 20–25 units |
| Open-heart surgery       | 2–6 units          | 1–10 units  | 2–4 units   |
| Cancer treatment         | 10–20 units        | 10–15 units | none        |

- Which part of donated blood is most frequently used? \_\_\_\_\_
- Which medical event can require the most units of blood? \_\_\_\_\_
- How many total units of blood parts does a liver transplant require? \_\_\_\_\_
- What is the minimum number of blood parts needed for open-heart surgery? \_\_\_\_\_

Name \_\_\_\_\_



**Day**  
**5**

**Weekly Question**

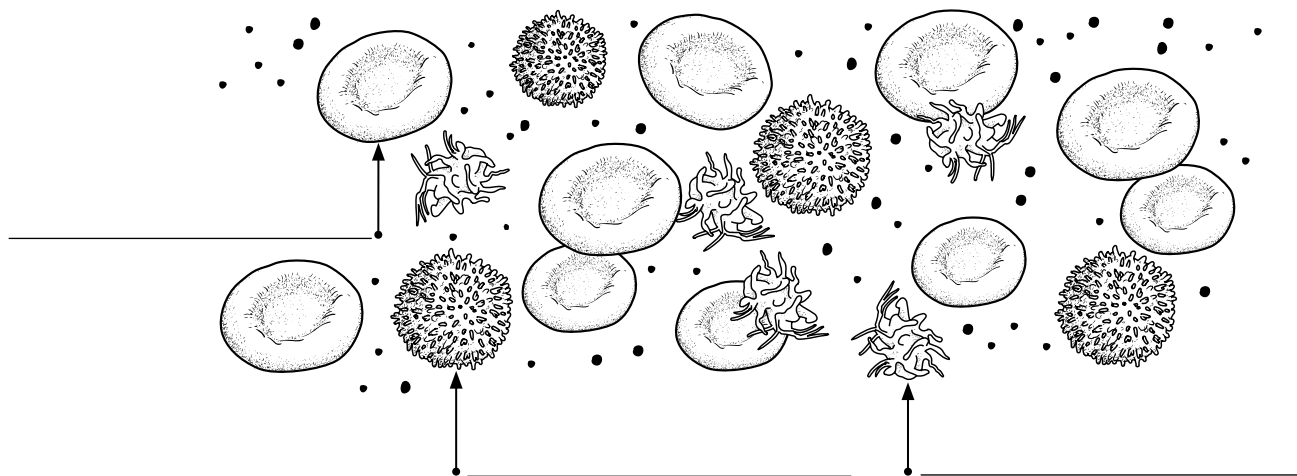
**How do people give blood  
without running out of it?**

A. Use the words in the box to complete the paragraph.

marrow      stem cells      blood vessels  
plasma      platelets      circulatory system

Blood is pumped through the body's \_\_\_\_\_,  
which is made up of \_\_\_\_\_ such as veins, arteries, and  
capillaries. Blood contains a liquid substance called \_\_\_\_\_,  
as well as red blood cells, white blood cells, and \_\_\_\_\_.  
Blood is made in the bone \_\_\_\_\_ and comes from  
non-specialized cells called \_\_\_\_\_.

B. Label a *red blood cell*, *white blood cell*, and *platelet*.



C. Why is it important for people to donate blood?

\_\_\_\_\_

Name \_\_\_\_\_

**Unit  
Review**

**Comprehension**

**Use Your Brain Cells**



Fill in the bubble next to the correct answer.

1. What is the main function of muscle tissue?  
Ⓐ to help the body move  
Ⓑ to protect the body from disease  
Ⓒ to help the body digest food  
Ⓓ to support the body
2. What are the layers of the skin?  
Ⓐ epithelial, thelial, dermothelial  
Ⓑ callus, blood vessels, muscle  
Ⓒ epidermis, dermis, hypodermis  
Ⓓ tissue, dermis, epithelial
3. Villi in the \_\_\_\_\_ help move nutrients into the blood.  
Ⓐ esophagus  
Ⓑ large intestine  
Ⓒ stomach  
Ⓓ small intestine
4. Blood consists mostly of \_\_\_\_\_.  
Ⓐ blood cells and tissue  
Ⓑ plasma, red blood cells, and platelets  
Ⓒ water, marrow, and platelets  
Ⓓ oxygen, nutrients, and waste
5. Two organ systems that work together are the \_\_\_\_\_.  
Ⓐ epithelial and connective systems  
Ⓑ digestive and excretory systems  
Ⓒ digestive and salivary systems  
Ⓓ circulatory and plasma systems
6. What is the function of a cell's nucleus?  
Ⓐ to act as a barrier  
Ⓑ to cushion the cell  
Ⓒ to direct the cell's actions  
Ⓓ to form stem cells
7. The substance that washes off your skin after a long bath is \_\_\_\_\_.  
Ⓐ epidermis  
Ⓑ callus  
Ⓒ epithelial tissue  
Ⓓ sebum

Name \_\_\_\_\_

# Unit Review

## Vocabulary

### Get "Organ-ized"

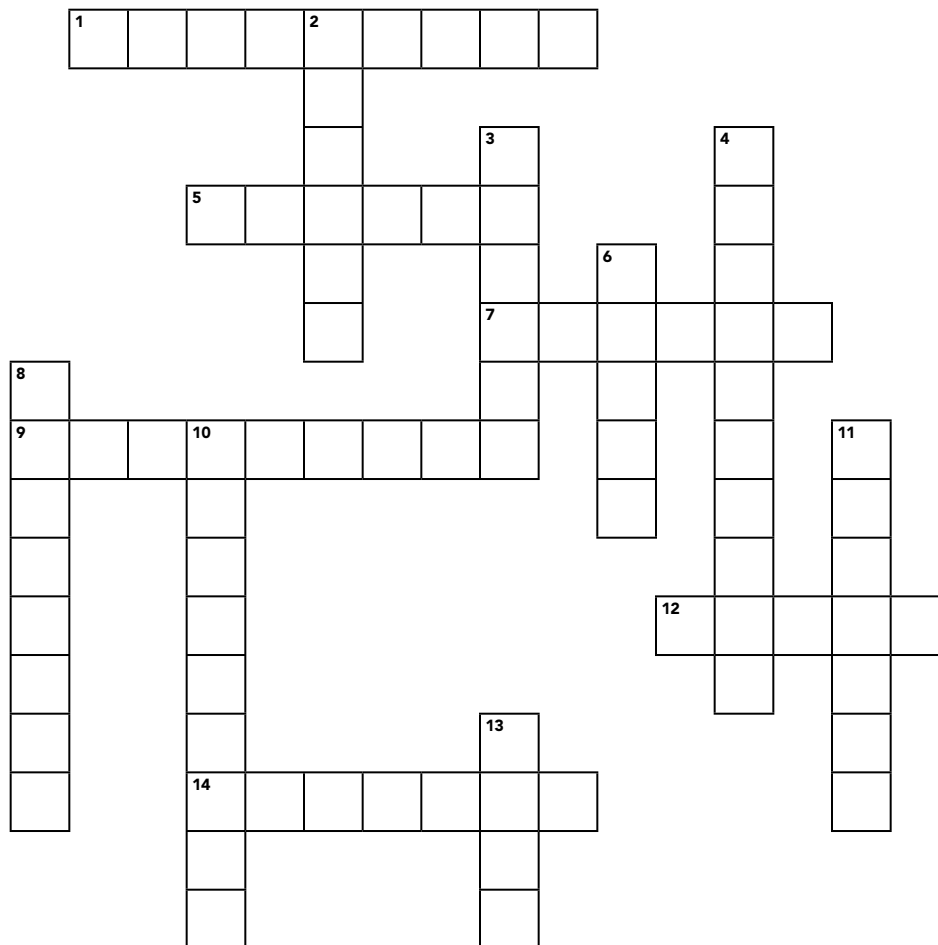
Daily Science

**Big  
Idea 1**



**WEEK 5**

Use the vocabulary words and the clues below to solve the puzzle.



cell  
cytoplasm  
dermis  
enzymes  
esophagus  
hypodermis  
marrow  
membrane  
nucleus  
organ  
plasma  
platelets  
tissue  
villi

#### ACROSS

1. a jelly-like substance in the cell
5. Cells grouped together form this.
7. where blood cells come from
9. a part of the digestive system between the mouth and the stomach
12. finger-like bumps in the small intestine
14. chemicals in your salivary glands that break down food

#### DOWN

2. This contains dissolved nutrients.
3. middle layer of skin
4. bottom layer of skin
6. Your heart is an \_\_\_\_\_.
8. something that surrounds the cell
10. blood parts that help blood clot
11. a cell's control center
13. the fundamental unit of life

Name \_\_\_\_\_

**Unit  
Review**

**Visual Literacy**

**Tissues, Organs, & Systems**

Daily Science

**Big  
Idea 1**

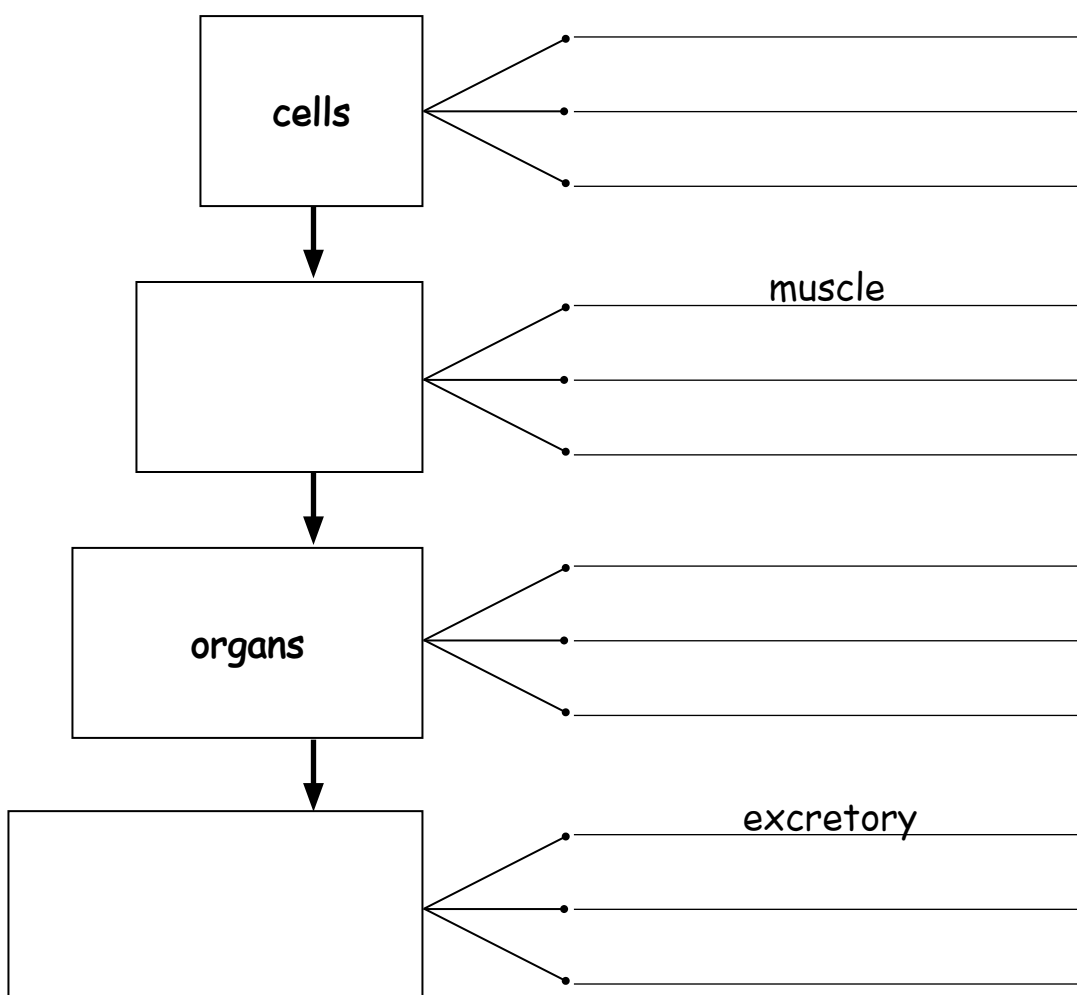
**WEEK 5**

Complete the chart below with words from the box to show how the human body is organized and what it is made up of.

circulatory    digestive    heart    intestines  
connective    epithelial    tissues    red blood cells  
esophagus    platelets    systems    white blood cells

**Organization**

**Examples**





Name \_\_\_\_\_

**Unit  
Review**

**Hands-on Activity**

**Can You Stomach This?**

Daily Science

**Big  
Idea 1**

**WEEK 5**

During digestion, food passes through the stomach, where it mixes with digestive juices and is churned by muscles forming the stomach wall. In this experiment, your hands provide the muscle, and soda does the job of the stomach acid.

**What You Need**

- see-through, sealable food storage bag
- $\frac{1}{3}$  cup carbonated soft drink
- slice of bread
- wad of chewed gum
- measuring cup

1. Place the soft drink, bread, and chewed gum in the food storage bag.
2. Make sure most of the air is removed from the bag. Then seal the bag.
3. Squeeze the bag with your hands for about a minute. Look at the contents of the bag.
4. Record your observations.

**What Did You Discover?**

1. What happened to the bread?

\_\_\_\_\_

2. What happened to the gum?

\_\_\_\_\_

3. Explain why the gum and the bread reacted the way that they did.

\_\_\_\_\_



An ecosystem is a community in which every living thing fills a role.

**Key Concept**

Roles of organisms in ecosystems

**National Standard**

Populations of organisms can be categorized by the function they serve in an ecosystem.

By fifth grade, students should be familiar with the concept of organisms and their natural habitats. However, they are probably not aware of the ways that organisms interact within their habitats to form ecosystems. In this unit, students learn that:

- in the soil ecosystem, earthworms act as decomposers;
- polar bears and pandas are consumers that have evolved adaptations to survive in their different ecosystems;
- lions are predators at the top of their food chain in the savanna ecosystem; and
- plants are producers that compete for sunshine in the rainforest ecosystem.

**Teacher Background**

An ecosystem is made up of a group of organisms interacting with one another and their environment. This natural community can encompass the entire planet or be contained in a single drop of water. Each organism plays an important role in its ecosystem, regardless of its size or shape. From lowly earthworms to kingly lions, all species contribute to the health of their ecosystem and may even be connected to the health of the planet.

In this Big Idea, students will learn about the roles of producers, consumers, and decomposers in their ecosystems by studying familiar plant and animal species. Producers, consumers, and decomposers are connected to one another through the transfer of energy. Producers provide energy for the consumers that eat them. And prey organisms provide energy for the predators that hunt them. When those organisms die, they supply energy for the decomposers that recycle organic material for the producers to use again. This transfer of energy sustains every ecosystem on Earth.

**For specific background information on each week's concepts, refer to the notes on pp. 38, 44, 50, and 56.**

## Unit Overview

### WEEK 1: Why do earthworms like dirt?

**Connection to the Big Idea:** Earthworms are decomposers that recycle organic matter and benefit the health of the soil ecosystem. Students learn that soil is the ideal habitat for earthworms because it is moist and dark. But earthworms also help the soil by aerating it and providing nutrients for plants, which are in turn eaten by animals.

**Content Vocabulary:** *aerate, castings, decomposer, ecosystem, exposure, hydrated*

### WEEK 2: Why do pandas eat plants but polar bears eat meat?

**Connection to the Big Idea:** Giant pandas and polar bears are consumers that have evolved distinct adaptations to survive in their habitats. Students learn that these bears are related species but live in such different ecosystems that they have evolved adaptations for completely separate diets.

**Content Vocabulary:** *adaptation, carnivore, consumer, herbivore, omnivore*

### WEEK 3: Is the lion really the king of the jungle?

**Connection to the Big Idea:** Lions are top predators of the savanna ecosystem. Students learn that this ecosystem, as well as others, contains food chains that overlap to form complex food webs. Although lions are at the top of their own food chains, they share the top predator spot with hyenas and cheetahs in the savanna food web.

**Content Vocabulary:** *competition, food chain, food web, predator, prey, savanna*

### WEEK 4: How can so many different plants live in the rainforest?

**Connection to the Big Idea:** Plants of the rainforest, like all plants, are producers. Students learn that competition for sunlight among primary producers has resulted in a multilayered ecosystem that rises hundreds of feet above the ground.

**Content Vocabulary:** *canopy, diversity, epiphyte, overstory, producer, rainforest, understory*

### WEEK 5: Unit Review

You may choose to do these activities to review concepts about organisms' roles in their ecosystems.

**p. 62: Comprehension** Students answer multiple-choice questions about key concepts in the unit.

**p. 63: Vocabulary** Students write vocabulary words from the unit to match clues.

**p. 64: Visual Literacy** Students match organisms of the rainforest with their roles in the ecosystem.

**p. 65: Hands-on Activity** Students watch as earthworms mix soil and fulfill their role as decomposers. Instructions and materials needed for the activity are listed on the student page.



*An ecosystem is a community in which every living thing fills a role.*

## Week 1

# Why do earthworms like dirt?

The natural habitat of earthworms is soil. But it's not just a place for the worm to live. Soil is also an ecosystem—a community of organisms and the environment that they inhabit. A healthy soil ecosystem provides nutrients for plants that grow in the soil, as well as animals that eat the plants.

This week students learn that earthworms fulfill an integral role in the soil's ecosystem. They act as decomposers, ingesting soil and all its contents, and excreting nutrient-rich castings. Worms also improve the quality of soil by burrowing. They pull top layers filled with organic matter down into the soil, creating a balanced mixture. Their burrowing aerates the soil and allows for water drainage. Soil provides earthworms advantages as well. Not only does it contain the worms' food, but it also keeps them hydrated and helps regulate their body temperature.

### Day One

**Vocabulary:**  
*decomposer, ecosystem*

**Materials:** page 39

Discuss with students the difference between a habitat (the environment in which an organism lives) and an ecosystem (a collection of organisms and the habitat they share). Tell them that soil is a habitat because it's where the earthworms live. Then explain that it's also an ecosystem because it contains many living things that share the habitat. Have students complete the activities. Review the answers together.

### Day Two

**Vocabulary:** *exposure, hydrated*

**Materials:** page 40

Introduce the vocabulary. Point out the illustration of the worm, and have students examine the structures of its body. Ask them to find differences in the worm's organs from our own. (Worms have five hearts and one long intestine that runs from mouth to anus.) After students have read the passage, have them complete the activities.

### Day Three

**Vocabulary:** *aerate, castings*

**Materials:** pages 40 and 41

Refer back to the illustration on page 40 and point out the worm's digestive tract. Explain that earthworms ingest soil at one end, extract the organic nutrients, and expel the rest out the other end. Then introduce the vocabulary. After students have read the passage, have them complete the activities. Review the answers together.

### Day Four

**Materials:** page 42

Have students read the passage. Point out that not only do organisms play a role in their particular ecosystem, but ecosystems play a role in supporting other ecosystems. Have students complete the activities and review the answers together.

### Day Five

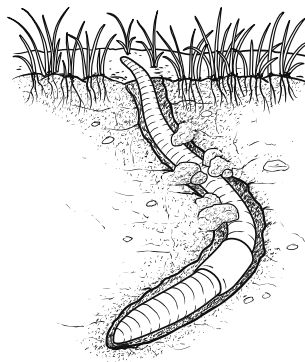
**Materials:** page 43

Have students complete the page independently. Then review the answers together.

**Day  
1****Weekly Question****Why do earthworms like dirt?**

If you have ever dug in a garden, you've probably found a lot more than just dirt. A closer look might have revealed ants and centipedes, or perhaps a network of plant roots. And although you might not have seen them, soil teems with microorganisms. An ounce of soil can contain 100,000 algae, 1,000,000 fungi, and 100,000,000 bacteria!

In a sense, healthy soil is "alive," crawling with worms, insects, and microscopic life. Soil is an **ecosystem** that includes not only the minerals in the dirt but also all the organisms that make the soil their habitat. In the soil ecosystem, earthworms play the role of **decomposers**. Earthworms break down and recycle matter mostly from dead plants.

**Vocabulary****decomposer**

DEE-kom-POH-zer  
*an organism that feeds on dead plant or animal matter*

**ecosystem**

EE-koh-SIS-tum  
*a group of organisms and the environment in which they live*

- A.** Check the box next to the phrase that completes the analogy.

**Home** is to **community** as \_\_\_\_.

☐ **earthworm** is to **algae**

☐ **habitat** is to **ecosystem**

☐ **ecosystem** is to **soil**

☐ **earthworm** is to **habitat**

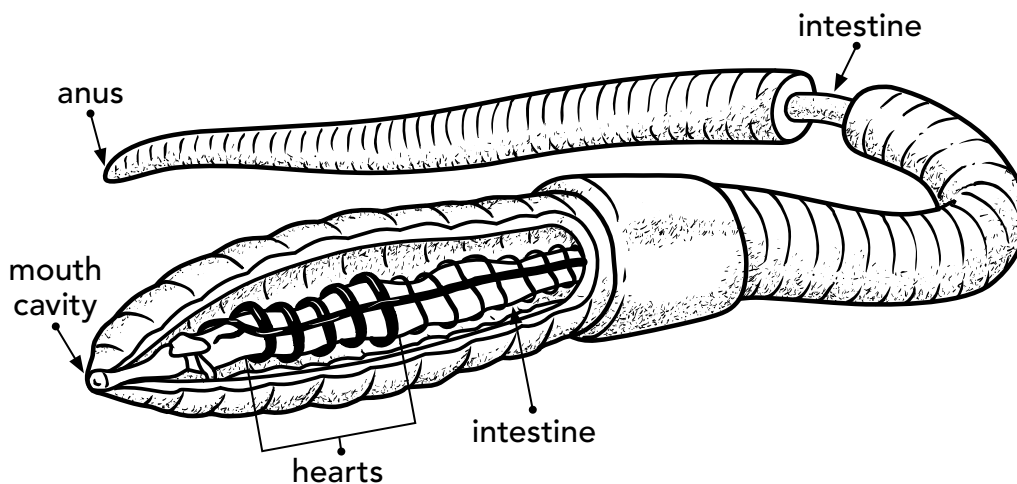
- B.** Complete the paragraph with words from the passage.

Garden soil contains worms, insects, and thousands upon thousands of tiny \_\_\_\_\_, including algae and bacteria. These living things share the same environment, making soil their \_\_\_\_\_. The combined elements of the organisms and their environment functioning together form an \_\_\_\_\_. Earthworms play a critical role in this tiny world. As \_\_\_\_\_, they break down dead or decaying plant material and help renew the soil.

**Day  
2****Weekly Question****Why do earthworms like dirt?**

Soil has many properties that attract earthworms. One reason earthworms like dirt is because it contains their food. The worms ingest dead and decaying plant matter that falls into the soil. Earthworms also graze on tiny living organisms in the soil, such as bacteria and fungi.

Another reason earthworms like dirt is because it shields their soft bodies from **exposure**. Earthworms have no protective shell or tough skin to keep in moisture. By staying underground, earthworms avoid being dried out by the sun's hot rays. The damp, cool earth keeps the worms **hydrated**. The soil also helps the worms maintain a lower body temperature, which keeps them alive.

**Vocabulary****exposure**

eks-POH-zhur  
*being exposed, or  
unprotected from  
harsh weather  
conditions*

**hydrated**

HI-dray-tid  
*maintaining enough  
fluid*

**A. Describe three ways soil benefits earthworms.**

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

**B. Write a sentence about earthworms, using the words *exposure* and *hydrated*.**

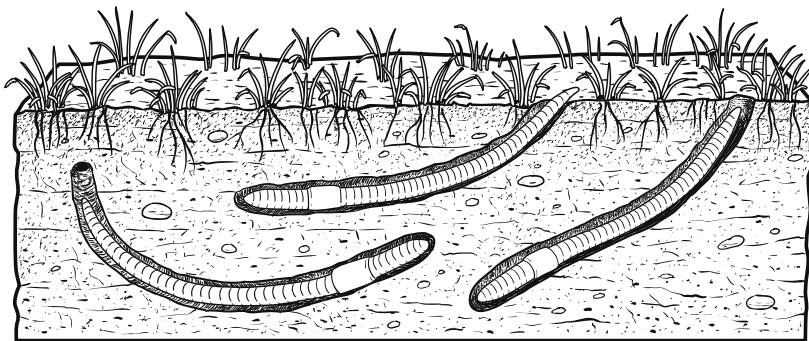
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**Day  
3****Weekly Question****Why do earthworms like dirt?**

Not only is soil good for earthworms, but earthworms are good for the soil. When earthworms eat, they swallow small pieces of dirt along with plant and animal matter. The worms break this material down into smaller pieces and expel it in the form of **castings**, which are rich in minerals and nutrients that are beneficial to plants and other organisms.

In addition to enriching the soil with their castings, earthworms also burrow into the soil and **aerate** it, allowing oxygen to enter. By burrowing, the worms bring organic-rich top layers to the soil deeper down. Burrowing also improves drainage by helping water penetrate the soil.

**Vocabulary****aerate**

AIR-ate

to expose to air

**castings**

KASS-tingz

the waste expelled  
by earthworms**A. Write true or false.**

1. When earthworms burrow, they remove nutrients from the soil. \_\_\_\_\_
2. Castings contain the nutrients other organisms need to survive. \_\_\_\_\_
3. Earthworms prevent water and oxygen from getting too deep in the soil. \_\_\_\_\_

**B. Describe three ways earthworms improve soil.**

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

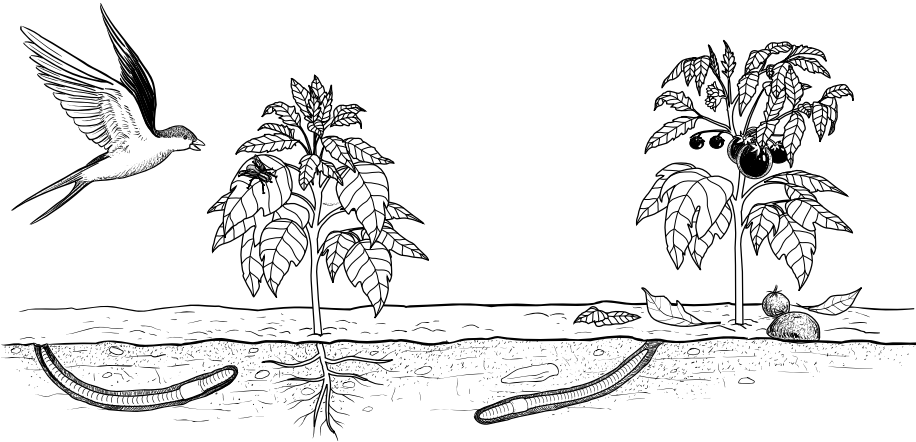
Name \_\_\_\_\_

**Day  
4**

**Weekly Question**

## **Why do earthworms like dirt?**

Earthworms are just one of the necessary parts of a garden ecosystem. Nutrients and water in garden soil allow plants, such as tomatoes or lettuce, to grow. Plants provide food for insects and animals that wander into the garden. Animals, in turn, are consumed by other animals. Ultimately, the wastes and remains of plants and animals return to the garden soil. In this way, all the plants and animals make their contribution to the garden ecosystem and allow worms to do their job as decomposers and recyclers.



**A.** Number the events below in the correct order to show the cycle that occurs in a garden ecosystem. The first step is given.

- \_\_\_ Insects and other animals eat plants.
- \_\_\_ Nutrients help plants grow.
- 1 Worm castings enrich the soil with nutrients.
- \_\_\_ Worms decompose plant material.
- \_\_\_ Animals and plants die.

**B.** What do you think would happen to the garden ecosystem if there were no more earthworms?

\_\_\_\_\_

**Daily Science**

**Big  
Idea 2**

**WEEK 1**



Name \_\_\_\_\_

**Day  
5**

**Weekly Question**

## **Why do earthworms like dirt?**

**A.** Use the words in the box to complete the paragraph.

castings      hydrated      decomposers  
aerate      exposure      ecosystem

Soil and all the living things in it make up an \_\_\_\_\_.  
Earthworms act as \_\_\_\_\_, eating decaying matter in the  
soil and expelling it in the form of nutrient-rich \_\_\_\_\_.  
The worms also \_\_\_\_\_ the soil, which helps circulate  
oxygen. In return, the cool, moist soil protects earthworms from  
\_\_\_\_\_ and keeps them \_\_\_\_\_.

**B.** Many people separate kitchen waste from their garbage to create  
compost, a mixture of decaying organic matter used to improve soil.  
Earthworms are often added to the mixture. Use this information to  
answer the questions below.

**1.** How do you think earthworms help the process of composting?

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**2.** Why can't *all* trash be used to make compost?

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Daily Science

**Big  
Idea 2**



**WEEK 1**



*An ecosystem is a community in which every living thing fills a role.*

## Week 2

# Why do pandas eat plants but polar bears eat meat?

Giant pandas and polar bears are both members of the bear family. However, although they are related, pandas and polar bears have wildly different habitats and diets. This week students learn that both of these types of bears have special adaptations that help them survive in their particular ecosystems. Pandas have an extra “thumb” and flat molars that help them eat bamboo, the staple of their diet. Polar bears, on the other hand, have adaptations that allow them to hunt seals in the Arctic.

Because of their specific adaptations, neither species adjusts well to changes in the environment. Recent decline in the numbers of pandas and polar bears may be related to loss of habitat. The dwindling populations of pandas and polar bears serve as a reminder to us about the vulnerability of ecosystems and the consequences of habitat destruction.

### Day One

**Vocabulary:** *adaptation, consumer*

**Materials:** page 45

To activate prior knowledge, have students name some similarities and differences between pandas and polar bears. (e.g., both are bears, both have fur; polar bears hunt seals, pandas eat bamboo) Then introduce the vocabulary. For *consumer*, you might discuss the meaning of this word as it relates to people (i.e., “buyers of products”). After students have finished reading the passage, direct them to complete the activities.

### Day Two

**Vocabulary:** *herbivore, omnivore*

**Materials:** page 46

Introduce the vocabulary and have students read the passage. Confirm students’ understanding of how molars help pandas chew by asking students to describe the difference between their own molars and their other teeth. (Molars are flat, wide, and in the back of the mouth; other teeth are sharp, thin, and in the front of the mouth.) Have students complete the activities. Then review the answers together.

### Day Three

**Vocabulary:** *carnivore*

**Materials:** page 47

Introduce the vocabulary word. Then ask: **Are humans *carnivores*, *herbivores*, or *omnivores*?** (Humans are omnivores, although some people choose not to eat meat.) After students have finished reading, have them complete the activities. Review the answers together.

### Day Four

**Materials:** page 48

After students have read the passage, have them complete the activities. For the oral activity, you may want to pair students or discuss the question as a group. If necessary, prompt students to consider such ideas as replanting bamboo forests, breeding polar bears and pandas in zoos, reducing causes of global warming, etc.

### Day Five

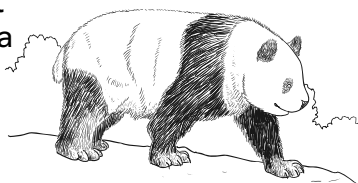
**Materials:** page 49

Have students complete the page independently. Then review the answers together.

**Day  
1****Weekly Question****Why do pandas eat plants  
but polar bears eat meat?**

Giant pandas and polar bears are both members of the bear family. Although they are related, pandas and polar bears live in very different ecosystems. Giant pandas live in the rainy, mountainous forests of central China. They have a diet that is almost entirely made up of bamboo. Polar bears live on the flat, barren ice of the Arctic Circle. They hunt a type of seal that also lives there.

Because pandas and polar bears rely on other organisms in their ecosystem for food, they are **consumers**. To fit their unique diets and ecosystems, both giant pandas and polar bears have special **adaptations** to help them survive.

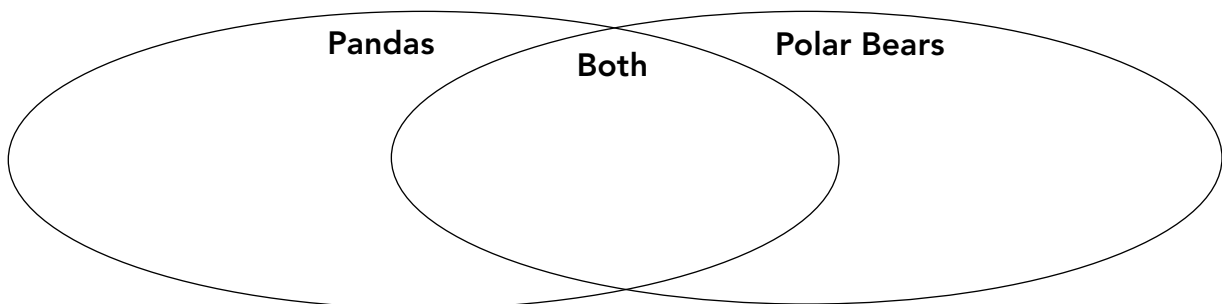
giant  
pandapolar  
bear**Vocabulary****adaptation**

AD-ap-TAY-shun  
*changes in an organism to become more suited to its environment*

**consumer**

kon-SOO-mer  
*an organism that relies on other plants and animals for food*

- A. Use information from the passage to fill in the diagram below, comparing pandas to polar bears. Include where they live and what they eat.



- B. Explain how you think each animal's adaptation helps the animal survive in its particular ecosystem.

1. dolphin's blowhole: \_\_\_\_\_
2. camel's long eyelashes: \_\_\_\_\_
3. monkey's tail: \_\_\_\_\_

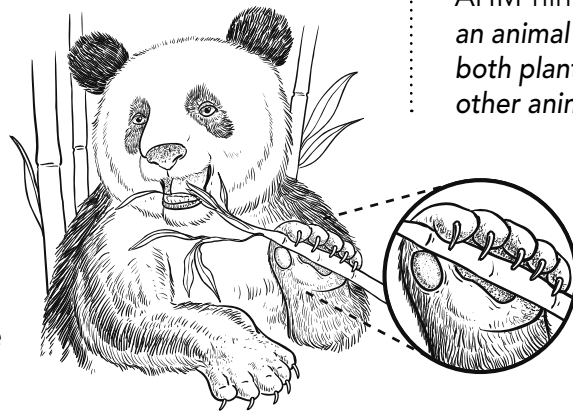
**Day  
2****Weekly Question****Why do pandas eat plants  
but polar bears eat meat?**

Giant pandas live in a very small mountain region in central China. This area has plenty of rain, mild summers, and cool winters. The climate is good for the bamboo plant, which grows densely in the mountain forests. And *this* is good for pandas.

Although most bears are **omnivores**, pandas are **herbivores**. They spend about 12 hours every day eating bamboo! Why so much? It's because bamboo isn't very nutritious and their digestive systems can't digest it well. So pandas have to consume huge amounts for their bodies to absorb enough nutrients.

In order to eat bamboo, pandas have developed certain adaptations. One adaptation is flat molars that help pandas grind the plant material. Pandas also have a long bone that extends from their wrist, which allows them to better grasp bamboo shoots and leaves.

Nobody knows for sure why the pandas eat bamboo instead of other plants. But some scientists think it is because bamboo grows so densely, and the pandas don't have to compete with other animals for it.

**Vocabulary****herbivore**

HER-bih-vor  
*an animal that eats  
only plants*

**omnivore**

AHM-nih-vor  
*an animal that eats  
both plants and  
other animals*

**A. Describe two adaptations that help pandas survive on a diet of bamboo.**

1. \_\_\_\_\_

2. \_\_\_\_\_

**B. Rewrite each sentence, changing or adding words as needed to make the statement true.**

1. Most bears are herbivores. \_\_\_\_\_

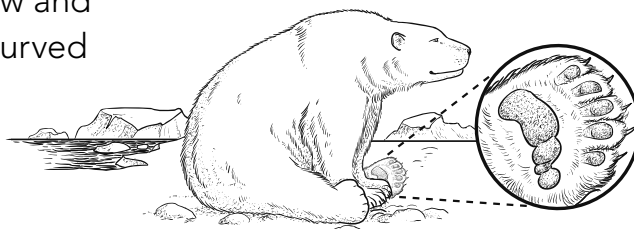
2. Pandas easily digest bamboo. \_\_\_\_\_

3. A panda's habitat is hot and dry. \_\_\_\_\_

**Day  
3****Weekly Question****Why do pandas eat plants  
but polar bears eat meat?**

Far north in the Arctic Circle, polar bears live on the sea ice, swim in the frigid waters, and inhabit nearby islands and coastlines. Their habitat is frozen most of the year, and plants do not survive in these extreme conditions. So polar bears have adapted by becoming **carnivores**. They rely on a diet that consists entirely of meat—specifically, seals. Polar bears rarely catch the seals on land or in the open water, however. Instead, the bears hunt seals by waiting on the edges of holes in the ice, where the seals surface to breathe.

Polar bears have special adaptations for living on the ice and hunting the seals. To keep from slipping, the bears have small, soft bumps on the bottom of each paw and tufts of fur between their toes. Their thick, curved claws grip the ice, as well as catch and hold their prey. In addition, a polar bear's toes are slightly webbed, which helps it swim between pieces of ice.

**Vocabulary****carnivore**

KAR-nih-vor

*an animal that  
eats other animals***A. Explain how each feature of a polar bear's paw helps it survive.**

1. webbed toes: \_\_\_\_\_
2. thick, curved claws: \_\_\_\_\_
3. bumps on pads: \_\_\_\_\_

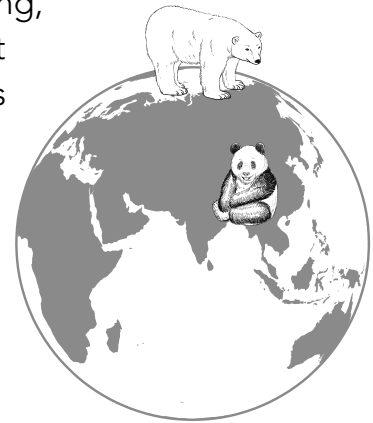
**B. Answer the questions.**

1. Why are polar bears carnivores, and not omnivores like other bears?  
\_\_\_\_\_
2. Polar bears have certain adaptations that most other bears don't have, including two layers of fur and a thick layer of fat called blubber. What do you think these adaptations are for?  
\_\_\_\_\_

**Day  
4****Weekly Question****Why do pandas eat plants  
but polar bears eat meat?**

Polar bears and pandas have very specific needs for survival. Polar bears depend on the presence of sea ice in order to hunt and breed. Giant pandas depend on a single plant for almost all their food. However, these animals are now being threatened with extinction. Pandas are in danger because large parts of their habitats are being destroyed, which means less bamboo for them to eat. Polar bears are at risk because the polar ice caps are melting, leaving the bears with fewer pieces of solid ice from which to hunt seals. If these changes continue, it is likely that neither polar bears nor pandas will survive.

What would be the impact of this loss on the bears' ecosystems? Scientists are currently studying this to find out more. But the good news is that the bears' shrinking populations have increased people's awareness of habitat loss and some of its causes. And this, in turn, has helped us understand the relationship between all living and nonliving things within any ecosystem—including our own.



Write *true* or *false*.

1. Melting sea ice is making it easier for polar bears to hunt seals. \_\_\_\_\_
2. Pandas depend on one kind of animal for their food. \_\_\_\_\_
3. Because of habitat loss, polar bears and pandas could possibly become extinct. \_\_\_\_\_
4. An ecosystem can be affected by changes to one habitat. \_\_\_\_\_

**Talk**

Many people are making efforts to try to save pandas and polar bears from possible extinction. What kinds of things do you think people could do to help these animals survive?

Name \_\_\_\_\_



**Day  
5**

**Weekly Question**

**Why do pandas eat plants  
but polar bears eat meat?**

A. Use the words in the box to complete the paragraph.

omnivores    carnivores    adaptations  
consumers    herbivores    habitats

Pandas and polar bears are both \_\_\_\_\_. However, unlike other bear species, which eat both plants and animals, neither pandas nor polar bears are \_\_\_\_\_. Pandas are \_\_\_\_\_ and polar bears are \_\_\_\_\_. Both pandas and polar bears have developed \_\_\_\_\_ that allow these animals to consume the food sources available in their particular \_\_\_\_\_.

B. Would a polar bear be able to survive in a panda's habitat?  
Explain why or why not.

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C. Name three characteristics of, or things found in, the ecosystem of pandas. Then name three in the polar bear ecosystem.

**Panda ecosystem:**

1. \_\_\_\_\_ 2. \_\_\_\_\_ 3. \_\_\_\_\_

**Polar bear ecosystem:**

1. \_\_\_\_\_ 2. \_\_\_\_\_ 3. \_\_\_\_\_



*An ecosystem is a community in which every living thing fills a role.*

## Week 3

# Is the lion really the king of the jungle?

Lions are majestic beasts that have been a symbol of royalty and power in human lore from earliest times. This week students discover that lions do not live in the jungle but are part of a grassland ecosystem in which they play the role of top predator. Lions prey on a variety of animals, including zebras, buffalos, impalas, wildebeests, and giraffes. Lions compete against other carnivores for their food, and even though they are large animals that dominate their prey by utilizing a cooperative hunting style, they still share the top predator position with hyenas and cheetahs.

As is the case with most ecosystems, the savanna ecosystem is complex and consists of many food chains overlapping to form a food web. Lions, hyenas, and cheetahs are all kings of the savanna, if not the jungle.

### Day One

**Vocabulary:** predator, prey

**Materials:** page 51; photos of animals listed in the passage (optional)

Ask students if they can think of any examples in literature, TV, or movies of lions portrayed as kings or rulers. (*The Lion, the Witch, and the Wardrobe*; *The Lion King*; etc.) Remind students that lions are in the *feline*, or cat, family. Introduce the vocabulary and show students any photos you have of animals that live in the lion's habitat. Then have students read the passage and complete the activities. Review the answers together.

### Day Two

**Vocabulary:** food chain, savanna

**Materials:** page 52; world map

Introduce the vocabulary. Then help students find East Africa on the map, and explain that much of the region is covered in savanna grasslands. After students have read the passage, have them complete the activities. For activity A, explain that the arrows point from the organism that is consumed to the organism that does the consuming. Review the answers together.

### Day Three

**Vocabulary:** competition, food web

**Materials:** page 53

Ask students what they think about when they hear the word *competition*. (e.g., sporting events, spelling bees, reality TV) Point out that animals compete in the wild, but for very different reasons. Introduce the vocabulary. After students have finished reading, have them complete the activities. Review the answers together.

### Day Four

**Materials:** page 54

After students have read the passage, have them complete the activities. For activity B, you may want to work as a group and inform students that the rabbit population in Australia is now completely out of control. The rabbits are suspected of being responsible for the loss of many other plant and animal species.

### Day Five

**Materials:** page 55

Have students complete the page independently. Then review the answers together.



**Day  
1****Weekly Question****Is the lion really the king  
of the jungle?**

In literature, art, and folklore, lions have long been the symbol of kings and royalty. Their very appearance suggests strength and power. They are the largest of all felines and are one of the top **predators** in their ecosystem. Adult lions generally weigh 300 to 400 pounds and stand about 3½ feet tall from their shoulders to the ground. With powerful legs, a strong jaw, and sharp teeth and claws, lions can kill **prey** even bigger than themselves.

In fact, lions can hunt and kill nearly any species they encounter. But they prefer to eat hoofed animals, such as zebras, impalas, wildebeests, and water buffalos. They have also been known to feast on smaller mammals, such as wart hogs and hares. However, lions will generally avoid animals that can fight back or injure them, such as hippos and porcupines.

**Vocabulary****predator**

PRED-ih-ter

*an animal that kills  
and eats other  
animals*

**prey**

pray

*an animal hunted  
or caught for food  
by another animal*

**A. Complete the analogy, using the vocabulary words.**

**Lion** is to \_\_\_\_\_ as **zebra** is to \_\_\_\_\_.

**B. Name four characteristics that make lions good predators.**

- |          |          |
|----------|----------|
| 1. _____ | 3. _____ |
| 2. _____ | 4. _____ |

**C. Write *true* or *false*.**

- |                                                               |       |
|---------------------------------------------------------------|-------|
| 1. Lions are capable of killing every species they encounter. | _____ |
| 2. Lions are in the feline family.                            | _____ |
| 3. Hippos and porcupines can injure lions.                    | _____ |

Name \_\_\_\_\_

Daily Science

## Big Idea 2

WEEK 3

Day 2

### Weekly Question

## Is the lion really the king of the jungle?

Despite being known as the “king of the jungle,” lions do not actually live in a jungle. They are found mostly in the **savannas** of East Africa. The savannas are wide grasslands dotted with scattered shrubs and trees. This habitat is very warm and usually dry, except for a short rainy season.

In the savanna ecosystem, lions are at the top of the **food chain**. They eat the zebras, wildebeests, impalas, and other animals that in turn eat the grasses and shrubs. Although the idea of a food chain may seem simple enough, the relationship between predators and prey in an ecosystem can be complex. For example, lions can kill and eat crocodiles, but crocodiles have been known to eat lions, too.

### Vocabulary

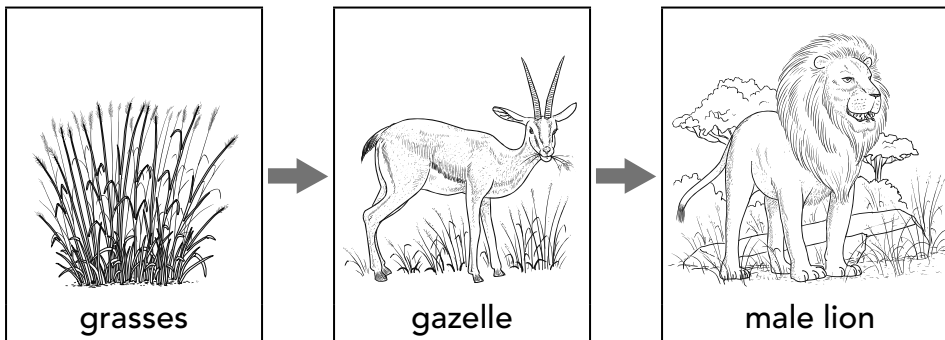
#### food chain

FOOD chayn  
a sequence of organisms in a community in which each member feeds on the one below it

#### savanna

suh-VAN-uh  
hot, often dry  
grassland with scattered trees

- A. Write a caption explaining the diagram below. Use the terms *food chain* and *savanna* in your caption.



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- B. List three characteristics of a lion's habitat.

1. \_\_\_\_\_

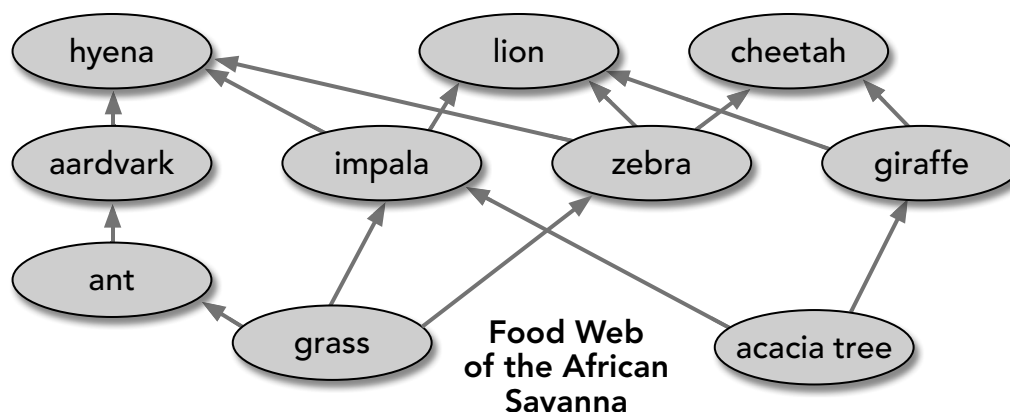
2. \_\_\_\_\_

3. \_\_\_\_\_

**Day  
3****Weekly Question****Is the lion really the king  
of the jungle?**

Lions are at the top of more than one food chain. They eat not just the hoofed animals that eat the grass, but they may also eat small mammals that in turn feed on trees, seeds, or insects. In addition, lions are in **competition** with other predators, such as hyenas and cheetahs, who are at the top of their own food chains. These overlapping and interconnected food chains all make up a giant **food web**.

Although the lions compete with other top predators, they have advantages. One advantage is their size. Often, it is the largest carnivore that wins a battle over food. Also, lions hunt their prey in groups called *prides*. Teamwork helps the lions defend their kill from other carnivores.

**Vocabulary****competition**

KOM-peh-TISH-un  
a struggle between  
two or more  
organisms for a  
limited resource

**food web**

FOOD web  
a network of  
interconnected  
food chains

- A.** What are three food chains you see in the food web above? Fill in the blanks below to show three different chains. (There may be more than one way to complete each chain.)

1. acacia tree → \_\_\_\_\_ → lion

2. \_\_\_\_\_ → \_\_\_\_\_ → cheetah

3. \_\_\_\_\_ → ant → \_\_\_\_\_ → \_\_\_\_\_

- B.** Cheetahs might be smaller than lions, but they have another competitive advantage. What do you think it is? How does it help them?
- \_\_\_\_\_

Name \_\_\_\_\_

Daily Science

**Big  
Idea 2**

**WEEK 3**

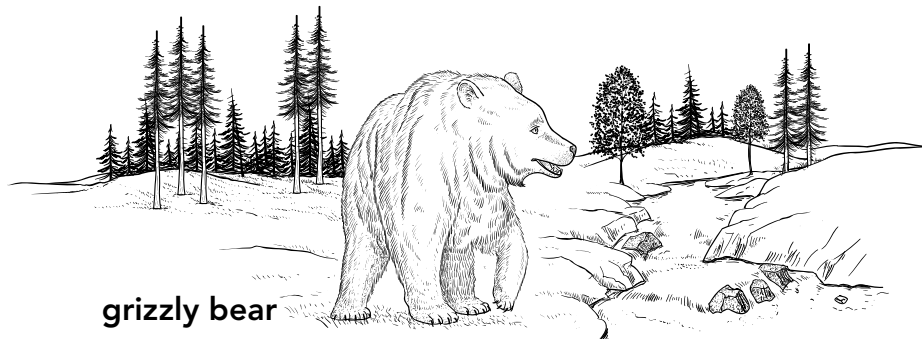
**Day  
4**

**Weekly Question**

## Is the lion really the king of the jungle?

Every ecosystem has its own particular food web. In Alaska, the grizzly bear and the wolf are top predators that compete for salmon, elk, rabbits, and other prey. The rabbits and elk eat plants found on land, while the salmon feed on plankton and small fish.

The grizzlies in Alaska, the lions in East Africa, and in fact, all the top predators in any ecosystem play the important role of controlling the number of animals below them in the food web. Without predators, other animal populations could greatly increase. And with so many populations competing for limited food and water, these animals could perish from starvation. So every organism, no matter where it is in the food web, helps every other one.



grizzly bear

- A.** Complete two Alaskan food chains, using information from the passage. Write the names of the organisms in the spaces provided.

1.  →  →

2.  →  →

- B.** Humans introduced rabbits to Australia in the 1700s. However, there are not many predators in the Australian food web. What do you think happened to the rabbits? What impact do you think this had on vegetation?

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Name \_\_\_\_\_



**Day  
5**

**Weekly Question**

**Is the lion really the king  
of the jungle?**

A. Use the words in the box to complete the paragraph.

food chain      food web      prey  
competition      predators      savanna

Lions are part of the ecosystem of the African \_\_\_\_\_,  
where they act as top \_\_\_\_\_. They hunt \_\_\_\_\_  
such as zebras and antelope. Lions are in \_\_\_\_\_ with other  
carnivores, but they still sit at the top of their own \_\_\_\_\_.  
Lions belong to more than one food chain, so they are part of a  
\_\_\_\_\_.

B. Explain the difference between a food chain and a food web.

---

---

C. Check the box next to the phrase that completes each analogy.

1. **Lion** is to **zebra** as \_\_\_\_\_.

☐ cheetah is to savanna

☐ mouse is to lizard

☐ hyena is to gazelle

☐ grass is to seeds

2. **East Africa** is to **lion** as \_\_\_\_\_.

☐ grizzly bear is to salmon

☐ Alaska is to grizzly bear

☐ gazelle is to East Africa

☐ Alaska is to hyena



*An ecosystem is a community in which every living thing fills a role.*

## Week 4

# How can so many different plants live in the rainforest?

Almost 100 years ago, American naturalist William Beebe saw the rainforest as “another continent of life [yet] to be discovered, not upon the Earth, but one to two hundred feet above it.” This week students learn that the rainforest contains hundreds of thousands of plant species, the vast majority of which are located high above the forest floor. Each of these rainforest plant species, like all plants, plays the role of producer in its ecosystem.

The conditions of the rainforest—12 hours of sunlight every day and abundant rainfall—support a rich diversity of plant life. And those plants support a wide variety of animal life as well. In fact, it is estimated that nearly 50 percent of all plant and animal species on Earth are contained within the rainforest. Nonetheless, scientists are only beginning to unlock the secrets of this complex ecosystem.

### Day One

**Vocabulary:** *producer, rainforest*

**Materials:** page 57

After introducing the vocabulary, you may want to review the process of photosynthesis with students before they read the passage. (Plants convert water and carbon dioxide into food using sunlight, and release oxygen as a byproduct.) Instruct students to read the passage and complete the activities. After they have finished, review the answers together.

### Day Two

**Vocabulary:** *canopy, overstory, understory*

**Materials:** page 58

Ask students what they think of when they hear the word *canopy*. (cover over a bed, tent, etc.) Tell them that rainforest trees create a canopy of leaves that shades plants below. Then introduce the vocabulary. After students have read the passage, have them complete the activities. Review the answers together.

### Day Three

**Vocabulary:** *epiphyte*

**Materials:** page 59; pictures of epiphytes (optional)

Introduce the vocabulary word and show students the pictures of various species of epiphytes (e.g., ferns, orchids, and mosses) if you have them. After students have finished reading the passage, have them complete the activities. Review the answers together.

### Day Four

**Vocabulary:** *diversity*

**Materials:** page 60

Introduce the vocabulary word. Ask students if they can think of applications of the word *diversity* outside of the rainforest. (people, cultures, etc.) Have students read the passage and complete the activities. Review the answers together.

### Day Five

**Materials:** page 61

Have students complete the page independently. Then review the answers together.

Name \_\_\_\_\_

**Day  
1**

**Weekly Question**

**How can so many different plants live in the rainforest?**

When you think of a **rainforest**, you might imagine tangles of tall trees and exotic plants showered in rain. This rain is, in fact, what gives rainforests their name. An average rainforest can receive more than 100 inches of rain in a year. By comparison, a desert gets 10 or fewer inches of rain annually.

The majority of the world's rainforests are near the equator, so they are always warm and humid. Being near the equator also means that they get about 12 hours of sunlight every day of the year. These tropical conditions of regular sun and rain are ideal for plant growth.

Plants of the rainforest ecosystem, like all plants, are **producers**. They make their own food through the process of photosynthesis. With so much sun and rain available, hundreds of thousands of plant species are able to thrive in the rainforest.

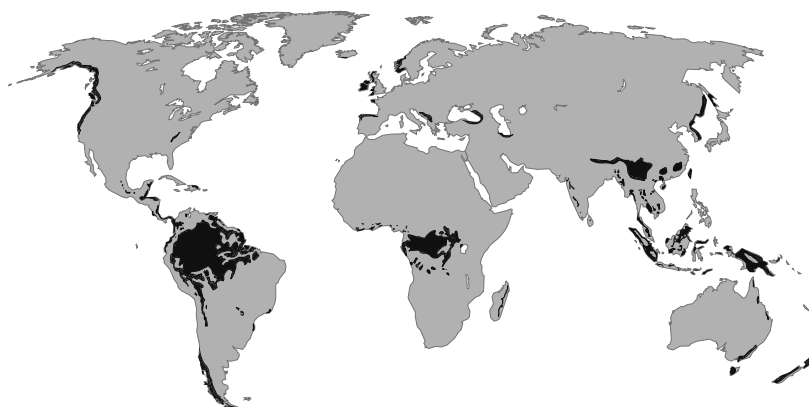
**Vocabulary**

**producer**

pro-DOO-sur  
an organism that makes its own food

**rainforest**

RANE-for-ist  
a forest with at least 80 inches of rainfall every year



The dark areas on the map show where the world's rainforests are.

**A. List three physical characteristics of a tropical rainforest.**

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

**B. Which of these inhabitants of the rainforest is *not* a producer?**  
Fill in the correct bubble.

- (A) fern      (B) banana tree      (C) monkey      (D) passionflower

**Day  
2****Weekly Question****How can so many different plants live in the rainforest?**

Although water is readily available in a rainforest, sunlight is harder to find. Plants must compete for sunlight, literally climbing over one another to reach it. Plants that grow the tallest reach the most light, while those that are on the ground receive very little.

The rainforest is divided into four layers of plants that have adapted to different levels of sunlight. At the top, rising more than 200 feet into the air, are the scattered giant trees that make up the forest **overstory**. While the overstory gets direct sun, its trees can also be subjected to hot, drying wind. The next layer is the forest **canopy**. The canopy is a dense ceiling of closely-spaced trees and plants. This layer traps humidity, and it also captures most of the sunlight.

Only 5% of sunlight reaches the third layer, which is called the **understory**. The understory includes shorter trees and shrubs with large leaves that help catch the available light. Below the understory is the forest floor. You would need a flashlight to explore this layer! Yet there are still a few plants that are able to grow here.

**Vocabulary****canopy**

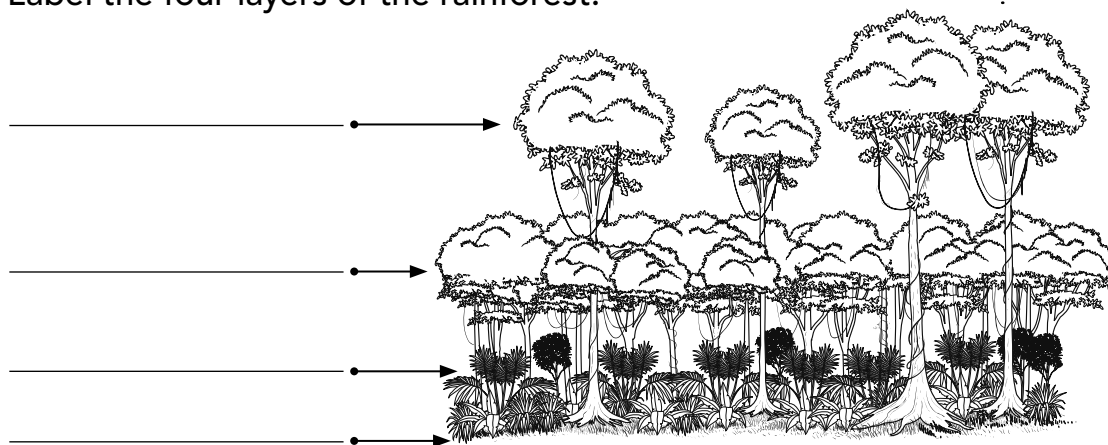
KAN-uh-pee  
dense upper layer  
of rainforest foliage

**overstory**

OH-ver-STOR-ee  
tallest layer of  
rainforest trees

**understory**

UN-der-STOR-ee  
layer of rainforest  
plants that grow  
beneath the canopy

**A. Label the four layers of the rainforest.****B. Based on the information in the passage, which layer do you think has the largest amount of trees and plants? Explain your answer.**

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**Day  
3****Weekly Question****How can so many different plants live in the rainforest?**

The heart of the rainforest community lies far above the ground, in the canopy. This is where the greatest concentration of plant life is, because of the many plants that have evolved adaptations in order to grow closer to the sunlight.

Some plants, called **epiphytes**, grow on the trunks and branches of trees in the canopy. These rootless plants include species of ferns, mosses, and orchids. Instead of reaching down into the soil for nutrients, most epiphytes rely on dead organic matter that falls from above. Other plants called *lianas* (lee-AH-nuhs) have roots on the forest floor. These woody vines grow up the sides of trees in order to reach the sun.

**Vocabulary****epiphyte**

EH-pih-fite

a plant that grows above the ground, supported by another plant

**A. Write true or false.**

1. Orchids get most of their nutrients from the soil. \_\_\_\_\_
2. Epiphytes are a type of woody vine. \_\_\_\_\_
3. The canopy of the rainforest contains more plants than the understory does. \_\_\_\_\_
4. Lianas grow up the sides of trees to get sunlight. \_\_\_\_\_

**B. Describe two ways that plants in the canopy find nutrients.**

1. \_\_\_\_\_
2. \_\_\_\_\_

Name \_\_\_\_\_

Daily Science

**Big  
Idea 2**

**WEEK 4**

**Day  
4**

**Weekly Question**

**How can so many different plants live in the rainforest?**

The rainforest is home not only to many thousands of plant species but also to an abundance of animal life, including monkeys, snakes, lizards, birds, and insects. In the rainforest ecosystem, these animals act as consumers, feeding on plants and other animals. But the animals also help the plants survive. They pollinate flowers, help scatter seeds, and provide nutrients to plants when the animals die or produce waste.

Probably no other environment on Earth houses the richness and **diversity** of life as the rainforest does. According to some estimates, the rainforest is home to about 50% of all living things on Earth! Yet we are only beginning to explore this amazingly complex ecosystem. In fact, some scientists believe that there could be millions of species in the rainforest that we have yet to discover.

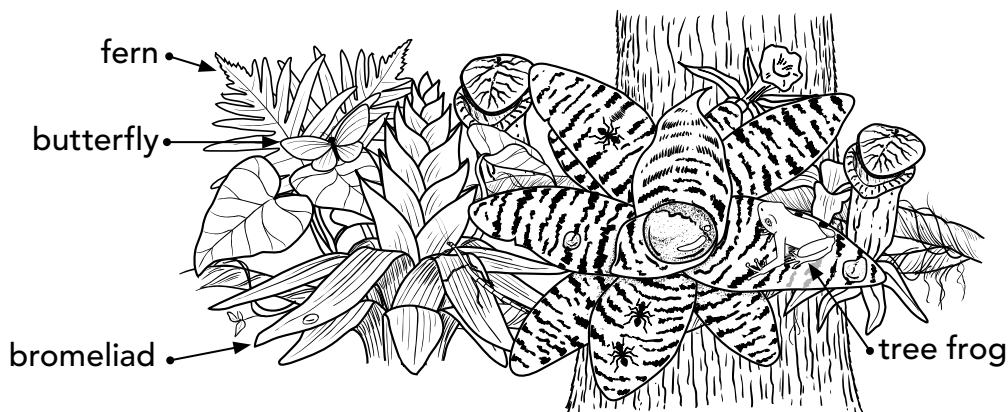
**Vocabulary**

**diversity**

dy-VER-sih-tee

variety

**A. Write a caption to go with the picture below. Use the word *diversity*.**



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**B. List three ways that the animals of the rainforest help plants survive.**

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

**Day  
5****Weekly Question****How can so many different plants live in the rainforest?**

A. Use the words in the box to complete the paragraph.

epiphytes   producers   understory   canopy  
rainforest   diversity   overstory

With so much sunlight and rain, the \_\_\_\_\_ ecosystem supports a wide \_\_\_\_\_ of life. Plants play the role of \_\_\_\_\_ within the rainforest. Since it is too hot and dry in the \_\_\_\_\_, and too dark in the \_\_\_\_\_, most of the rainforest plant species live in the \_\_\_\_\_. Here, plants called \_\_\_\_\_ reach sunlight by growing on the branches and trunks of trees.

B. Use the picture of the rainforest to answer the questions.

1. In which layer do the decomposers live?

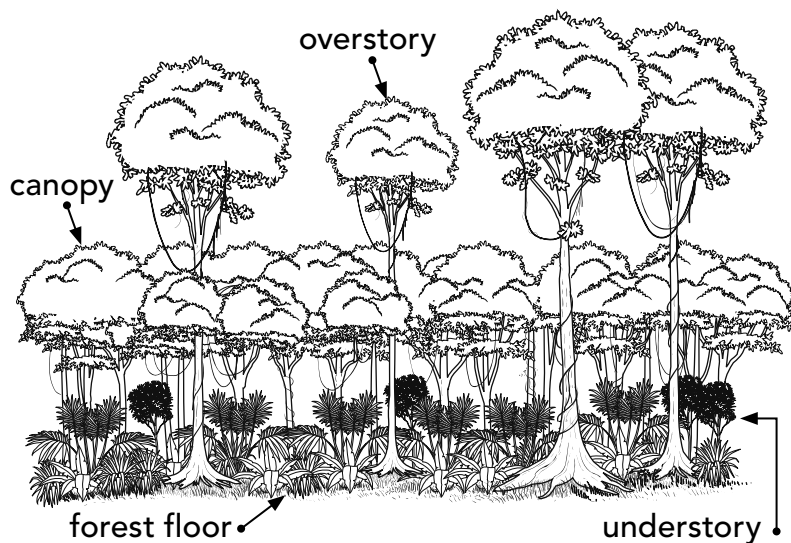
\_\_\_\_\_

2. In which layer are most of the epiphytes?

\_\_\_\_\_

3. Which layer gets the most direct sunlight?

\_\_\_\_\_



Name \_\_\_\_\_

**Unit  
Review**

**Comprehension**  
**Ecosystems**



**A. Fill in the bubble next to the correct answer.**

1. The savanna habitat is characterized by \_\_\_\_\_.  
Ⓐ seasonal ice covering a cold ocean  
Ⓑ lush forest with an understory of bamboo  
Ⓒ open grasslands with scattered trees  
Ⓓ dense, humid jungle
2. Polar bears are \_\_\_\_\_, while pandas are \_\_\_\_\_.  
Ⓐ predators, prey  
Ⓑ carnivores, herbivores  
Ⓒ omnivores, carnivores  
Ⓓ producers, decomposers
3. The relationship between a predator and its prey is an example of \_\_\_\_\_.  
Ⓐ a food chain  
Ⓑ an ecosystem  
Ⓒ competition  
Ⓓ diversity
4. Which rainforest layer has the most diversity of life?  
Ⓐ overstory  
Ⓑ forest floor  
Ⓒ understory  
Ⓓ canopy
5. The polar bear's webbed feet are an example of an \_\_\_\_\_.  
Ⓐ environment  
Ⓑ adaptation  
Ⓒ ecosystem  
Ⓓ omnivore
6. Earthworms are \_\_\_\_\_.  
Ⓐ producers  
Ⓑ consumers  
Ⓒ decomposers  
Ⓓ epiphytes

**B. List two ways in which earthworms are good for soil.**

1. \_\_\_\_\_ 2. \_\_\_\_\_

Name \_\_\_\_\_

**Unit  
Review**

**Vocabulary**

**Word Connections**

Daily Science

**Big  
Idea 2**



**WEEK 5**

Write the word from the box that matches or completes each clue.

|           |          |          |            |             |
|-----------|----------|----------|------------|-------------|
| diversity | predator | aerate   | herbivore  | competition |
| carnivore | epiphyte | canopy   | producer   | decomposer  |
| omnivore  | hydrated | savanna  | consumer   |             |
| exposure  | food web | castings | adaptation |             |

1. a synonym for *variety* \_\_\_\_\_
2. These are made by worms. \_\_\_\_\_
3. This organism lives on dead plants or animals. \_\_\_\_\_
4. A panda's molars are an example of this. \_\_\_\_\_
5. an ecosystem found in East Africa \_\_\_\_\_
6. You need water to stay this way. \_\_\_\_\_
7. You'll find the \_\_\_\_\_ between the overstory and the understory.
8. This animal eats both plants and meat. \_\_\_\_\_
9. This animal would never eat bamboo. \_\_\_\_\_
10. This rainforest plant doesn't have roots. \_\_\_\_\_
11. When earthworms burrow through soil, they \_\_\_\_\_ it.
12. being unprotected from harsh weather \_\_\_\_\_
13. This organism relies on other organisms for food. \_\_\_\_\_
14. A \_\_\_\_\_ is made up of interconnected food chains.
15. This organism makes its own food. \_\_\_\_\_
16. the opposite of *prey* \_\_\_\_\_
17. Grizzly bears are in \_\_\_\_\_ with wolves.
18. A \_\_\_\_\_ would never eat another animal.

Name \_\_\_\_\_

**Unit  
Review**

**Visual Literacy**

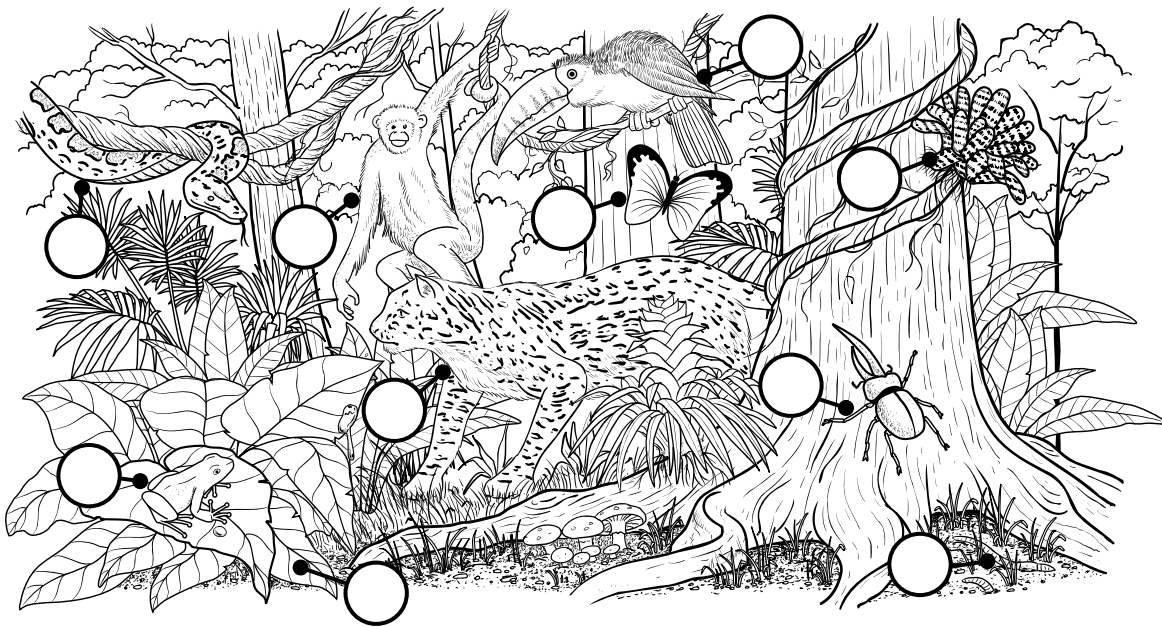
**Rainforest Role Call**

Daily Science

**Big  
Idea 2**

**WEEK 5**

This illustration shows just a few of the organisms in the rainforest ecosystem. In the circle next to each plant or animal, write the letter of the description that best matches the role of that organism.



- a. a decomposer living in the soil
- b. a rootless producer that grows on trees
- c. a six-legged decomposer that ingests rotting wood
- d. a consumer that is a large carnivore and lives on the ground
- e. a small carnivore that breeds in water gathered on plants
- f. a winged herbivore that flits through the canopy
- g. a large-billed omnivore that flies and perches in the canopy
- h. an omnivore that swings from branches in the canopy
- i. a predator that slithers through the understory and canopy
- j. a producer that obtains nutrients from the soil

Name \_\_\_\_\_

**Unit  
Review**

**Hands-on Activity**

**Movers and Shakers**



Here's how to make a mini-ecosystem for earthworms, using a soda bottle and a little creativity.

**What You Need**

- 4 earthworms (available in bait and tackle shops, pet stores, or most gardens)
- dark, moistened potting soil
- dampened sand
- moist, light-colored mulch
- 2 2-liter soda bottles with the top third of each bottle cut off (Save the tops.)
- shredded lettuce
- tape and aluminum foil

1. Pour the sand, then the mulch, and then the potting soil into each bottle.
2. Place the shredded lettuce on top of the soil.
3. Put earthworms into only one of the bottles.
4. Tape the top portion back onto each bottle.
5. Cover both bottles with aluminum foil and keep them in a cool place away from sunlight.
6. Check your bottle ecosystems every day over the next week. Keep the soil moist and add more lettuce as needed.

**What Did You Discover?**

1. Compare what happened to the lettuce in the two ecosystems.

\_\_\_\_\_

2. Compare what happened to the soil layers.

\_\_\_\_\_

3. Based on your observations, how do earthworms benefit the soil?

\_\_\_\_\_



Water covers most of Earth's surface. It circulates between oceans and land in a process called the water cycle.

### **Key Concept**

The Water Cycle

### **National Standard**

Water, which covers the majority of the Earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the "water cycle." Water evaporates from the Earth's surface, rises and cools as it moves to higher elevations, condenses as rain or snow, and falls to the surface where it collects in lakes, oceans, soil, and rocks underground.

**B**y fifth grade, students have learned about the water cycle but may not understand how the processes of the water cycle affect the water we use. This Big Idea teaches students:

- how water is continuously recycled;
- that fresh water is stored beneath Earth's surface as groundwater;
- how the forces of weather and the shape of the land determine where precipitation falls; and
- that fresh water is a limited resource we must conserve.

### **Teacher Background**

The amount of water on Earth is constant. The water we have now is the water we had 350 million years ago, and it is the same water we will have millions of years from now. This is because of the vital process of the water cycle. The sun's rays evaporate surface water, the water vapor cools and condenses into clouds, those clouds release precipitation back to the surface, and the cycle continues.

There is concern, however, that we may be experiencing what some call a water crisis. While the amount of water is constant, the human population keeps growing. And usable fresh water from lakes, rivers, and groundwater, which is limited to begin with, is becoming more and more polluted due to human activities. Fortunately, new water cleansing and conservation techniques are now being developed to ensure the quality and availability of this most valuable resource.

**For specific background information on each week's concepts, refer to the notes on pp. 68, 74, 80, and 86.**



## Unit Overview

### WEEK 1: Do we really drink the same water that dinosaurs did?

**Connection to the Big Idea:** Water moves from ocean to atmosphere to land by way of the water cycle. Students learn that through the processes of evaporation, condensation, and precipitation, water is constantly being recycled on Earth.

**Content Vocabulary:** *condensation, evaporate, humidity, precipitation, water cycle, water vapor*

### WEEK 2: Why don't rivers and lakes soak into the ground?

**Connection to the Big Idea:** Precipitation can penetrate Earth's surface and collect underground as groundwater. Students learn that, in fact, water in rivers and lakes does soak into the ground. When the ground is fully saturated with water, the water then collects above the ground.

**Content Vocabulary:** *aquifer, groundwater, irrigation, porous, surface water, water table*

### WEEK 3: What makes deserts so dry?

**Connection to the Big Idea:** Patterns of wind and topography determine how much rain a particular region gets. Students learn that prevailing winds blow moisture inland, but mountains often block precipitation, creating a rain shadow where deserts form. Students also discover the ways in which people survive and even thrive in deserts by using reservoirs and groundwater.

**Content Vocabulary:** *monsoon, oasis, prevailing winds, rain shadow, reservoir, watershed*

### WEEK 4: Can we run out of water?

**Connection to the Big Idea:** Fresh water is a limited resource that needs to be conserved. Students learn that human populations are growing and contaminating water supplies. However, through processes of reclamation, desalination, and conservation, people can restore usable water supplies.

**Content Vocabulary:** *conservation, contaminate, desalination, drought, reclamation*

### WEEK 5: Unit Review

You may choose to do these activities to review concepts about Earth's water supply.

**p. 92: Comprehension** Students answer multiple-choice questions about key concepts in the unit.

**p. 93: Vocabulary** Students write vocabulary words from the unit to match clues.

**p. 94: Visual Literacy** Students label a diagram to reinforce their understanding of the water cycle.

**p. 95: Hands-on Activity** Students create their own water cycle in a plastic container. Instructions and materials needed for the activity are listed on the student page.



*Water covers most of Earth's surface. It circulates between oceans and land in a process called the water cycle.*

## Week 1

# Do we really drink the same water that dinosaurs did?

Seen from space, Earth is a bright blue planet capped by polar ice and marbled by swirls of white clouds. Liquid water covers 71% of Earth's surface, and although most of Earth's water is in the oceans, water is also present in the atmosphere, on land, and in the ground. This week students learn that water moves between land, sea, and air through a process called the water cycle. Sun heats the liquid water, which evaporates and mixes with the atmosphere. As water vapor rises and cools, it condenses into a liquid and eventually falls back to the ground as precipitation.

For the most part, all the water on Earth today is the same water that has been here for billions of years. We drink the same water as the dinosaurs did, and, more importantly, the same—and only—water that future generations will drink.

### Day One

**Vocabulary:** water cycle

**Materials:** page 69; globe

Introduce the vocabulary word. Ask students to name the three different states of matter that water can form. (solid, liquid, gas) Point out that water moves through the water cycle in all three of these states. After students have read the passage, use the globe to help them visualize the large percentage of Earth's surface that is ocean water. Then have students complete the activities and review the answers together.

### Day Two

**Vocabulary:** evaporate, humidity, water vapor

**Materials:** page 70

Introduce the vocabulary. Ask students to describe what the air feels like on a humid day. (warm, wet, heavy, etc.) Have them read the passage and complete the activities. Review the answers together.

### Day Three

**Vocabulary:** condensation, precipitation

**Materials:** page 71; hand mirrors

Introduce the vocabulary. Distribute hand mirrors and have students "fog" the mirror with their breath. Ask them to describe what is happening. (Water vapor from their warm breath is condensing on the cooler glass.) After students have read the passage, have them complete the activities. Review the answers together.

### Day Four

**Materials:** page 72

Inform students that plants and animals are part of the water cycle because they drink, retain, and excrete water from their systems. After students have finished reading, have them complete the activities and review the answers together.

### Day Five

**Materials:** page 73

Have students complete the page independently. Then review the answers together.

Name \_\_\_\_\_

**Day  
1**

**Weekly Question**

**Do we really drink the same water that dinosaurs did?**

Earth is often called the Blue Planet. That's because almost three fourths of Earth's surface is covered by water. Most of that water is salt water found in the world's oceans. Salt water contains dissolved minerals and is not drinkable. Less than 3% of all the water on Earth is fresh water, the kind we drink.

Although you might think that most of the fresh water on Earth is found in lakes and rivers, in fact, only a small fraction can be found in these places. Most of the fresh water is frozen in polar ice caps and glaciers. The rest exists in the atmosphere as gas or clouds, or is located underground. Even though water is found in different places and in different forms, all of the water on Earth is constantly interacting. Water travels from oceans to air to land and back to sea in a continuous process called the **water cycle**.

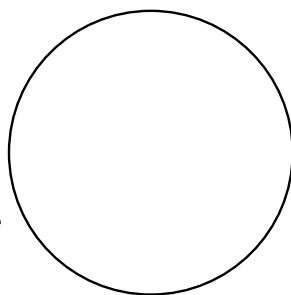
**Vocabulary**

**water cycle**

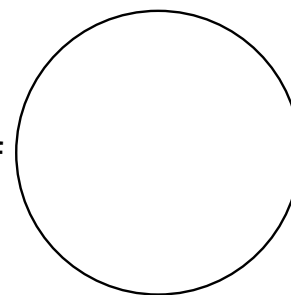
WAH-ter SY-kul  
the continuous movement of water on, above, and below Earth's surface

- A.** Fill in the two circles below to create pie charts, one showing the percentage of water on Earth, and one showing the percentages of salt water and fresh water.

Percentage of  
Earth's surface  
covered by water



Percentage of  
salt water vs.  
fresh water



- B.** Write *true* or *false*.

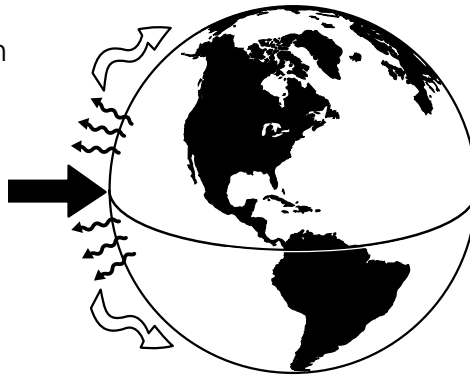
1. Fresh water can occur as a gas, liquid, or solid. \_\_\_\_\_
2. A small fraction of fresh water is frozen in polar ice caps. \_\_\_\_\_
3. Water from the ocean can end up in the air or on land. \_\_\_\_\_
4. Three quarters of Earth's water is salt water. \_\_\_\_\_

- C.** If all of Earth's water was represented by 100 milliliters, how many milliliters of fresh water would there be? \_\_\_\_\_

**Day  
2****Weekly Question****Do we really drink the same water that dinosaurs did?**

The movement of water between the ocean, air, and land is powered by the sun. Energy from the sun heats liquid water and causes it to **evaporate**, or change into an invisible gas called **water vapor**. Water vapor enters the atmosphere, where it mixes with other gases. We describe the amount of water vapor in the air in terms of **humidity**. When there is more moisture in the air, the humidity is higher.

Most of the evaporation on Earth is from oceans close to the equator, where heating by the sun is greatest. Warm, humid air from the equator then moves long distances, traveling by wind and weather to anywhere in the world.

**Vocabulary****evaporate**

ih-VAP-ur-AYT  
to change from a liquid into a gas

**humidity**

hew-MID-ih-tee  
the amount of moisture in the air

**water vapor**

WAH-ter VAY-per  
the gaseous form of water

**A.** Number the steps below in the correct order to show how water evaporates in the water cycle.

- \_\_\_\_ Wind transports water vapor to other parts of the world.
- \_\_\_\_ Water evaporates and turns into water vapor.
- \_\_\_\_ Sun heats the water.
- \_\_\_\_ Water vapor mixes with other gases to become part of the atmosphere.

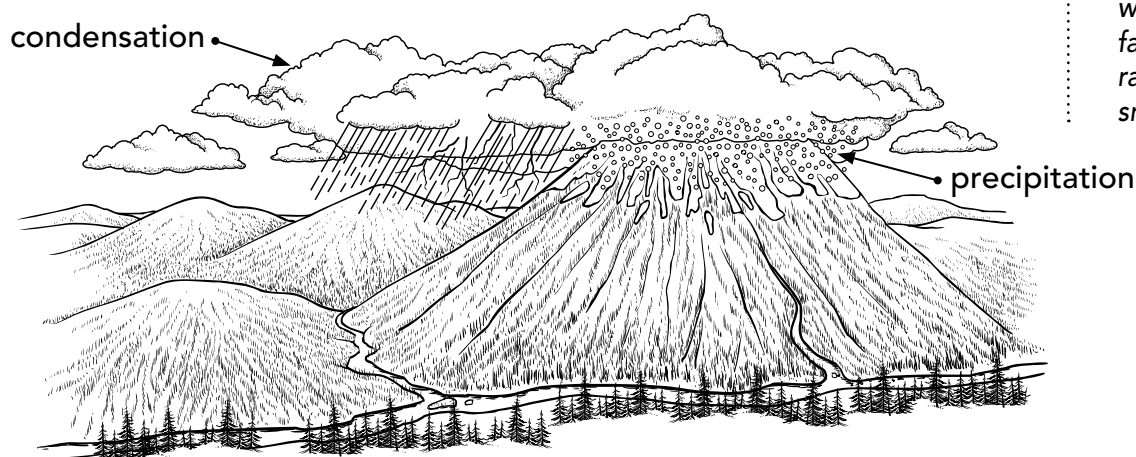
**B.** Use the vocabulary words to complete the sentences.

1. Heating by the sun causes water to \_\_\_\_\_.
2. The more \_\_\_\_\_ in the air, the higher the \_\_\_\_\_.

**Day  
3****Weekly Question****Do we really drink the same water that dinosaurs did?**

When water vapor is transported to cooler regions—either away from the tropics or higher up into the atmosphere—it cools. As water vapor cools, it gives up its heat energy and changes back into a liquid. We call this process **condensation**. In the atmosphere, condensation takes the form of tiny droplets of water. We see condensation as clouds in the sky or fog near the ground.

When water droplets get so big that air currents can no longer support them, they fall to Earth's surface as rain. This rainfall is called **precipitation**. If the air is cold enough, condensation of water vapor results in freezing, and snowflakes form. Snow is another form of precipitation, as are hail and sleet.

**Vocabulary****condensation**

KON-den-SAY-shun  
the change from a gas into a liquid

**precipitation**

prih-SIP-ih-TAY-shun  
water droplets that fall to the ground as rain, hail, sleet, or snow

- A.** What is the difference between *condensation* and *precipitation*?  
Use both words in your answer.

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- B.** Which one of these scenarios is *not* an example of condensation?

☐ frost on the window

☐ dew on the grass in the morning

☐ fog forming in a valley at night

☐ boiling water

Name \_\_\_\_\_

Daily Science

**Big  
Idea 3**

**WEEK 1**

**Day  
4**

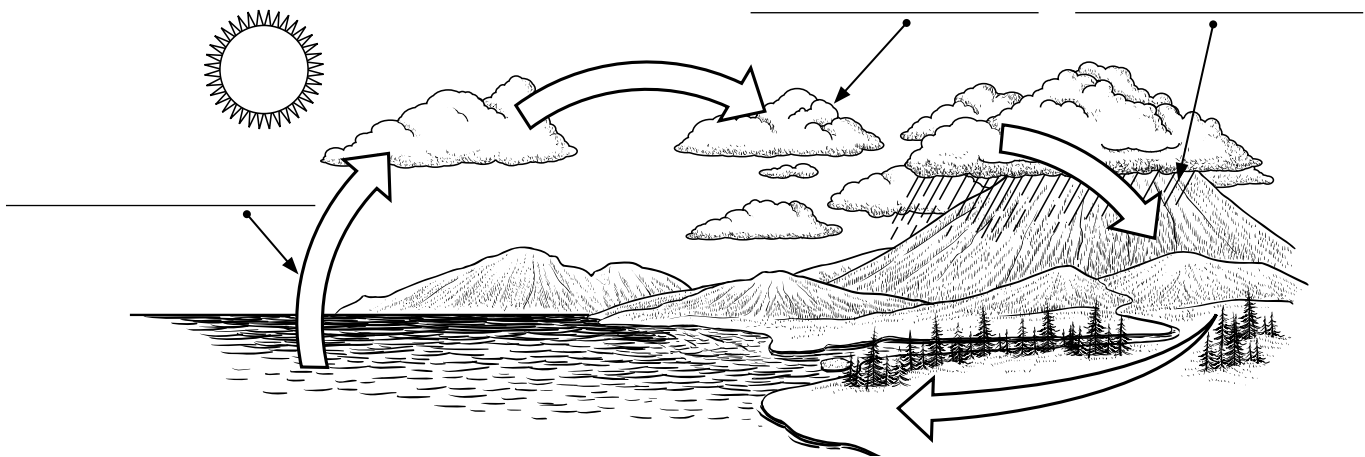
**Weekly Question**

## **Do we really drink the same water that dinosaurs did?**

Once water returns to Earth's surface as precipitation, some of it soaks into the ground, and the rest may collect in streams, rivers, lakes, and seas. Water runs downhill, and ultimately much of the water that falls as precipitation returns to the ocean. From there, the water is evaporated, and the water cycle starts again. However, if precipitation falls as snow in a cold place, it may remain frozen there until temperatures change and the snow or ice melts.

The processes of evaporation, condensation, and precipitation have recycled the water on our planet for billions of years. In fact, every living thing is composed of water, and is thus a part of the water cycle, too. That means that not only do we drink the same water that dinosaurs drank, we also might be made up of the same water they were!

- A.** Label the stages of the water cycle in the diagram below, using the words *evaporation*, *condensation*, and *precipitation*.



- B.** When seawater evaporates, the salt is left behind. You might think this would make the remaining water saltier. But in fact, overall, the ocean is not getting saltier. Why do you think that is?

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Name \_\_\_\_\_



**Day  
5**

**Weekly Question**

**Do we really drink the same water that dinosaurs did?**

A. Use the words in the box to complete the paragraph.

evaporate      condensation      water cycle  
water vapor      precipitation      humidity

All of the water on Earth is constantly recycled in a process called the \_\_\_\_\_. First, the sun heats the water and causes it to \_\_\_\_\_. This changes the water from a liquid into gas, or \_\_\_\_\_, which mixes with other gases in the atmosphere. You can measure the amount of moisture in the atmosphere as \_\_\_\_\_. As the vapor moves to cooler areas, it cools and changes back into liquid in a process called \_\_\_\_\_. When the water droplets get too big, they fall to the ground as \_\_\_\_\_.

B. If a dinosaur once lived in Mexico, and you now live in Arkansas, could you still be drinking the same water as the dinosaur did? Explain why or why not.

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*Water covers most of Earth's surface. It circulates between oceans and land in a process called the water cycle.*

## Week 2

# Why don't rivers and lakes soak into the ground?

If you were to ask students—and many adults, for that matter—where our supply of fresh water comes from, most would likely answer rivers and lakes. However, what people often don't realize is that the most abundant fresh water resource is groundwater. Groundwater is created when rainfall soaks into the ground and moves downward through porous rock and soil. This downward movement continues until water reaches the water table, the depth at which the rock is fully saturated. In places where the water table meets the surface of the ground, water collects in rivers and lakes as surface water. In this sense, rivers and lakes do soak into the ground—until the ground is saturated, that is.

Because rivers and lakes make up only a tiny percentage of available fresh water, groundwater is an important water source. However, pollution and overuse threaten the health of our groundwater.

### Day One

**Vocabulary:**  
*groundwater, irrigation*

**Materials:** page 75

Introduce the vocabulary. Before students read the passage, remind them that ocean water contains salt and therefore cannot be used for drinking or for watering plants or crops. Have students read the passage and complete the activities. Then review the answers together.

### Day Two

**Vocabulary:** *aquifer, porous, water table*

**Materials:** page 76

Ask students where they think groundwater comes from. (rainfall, melted snow, etc.) Then introduce the vocabulary. For *porous*, you might point out that it contains the root word *pore*. After students have read the passage, have them complete the activities. If students have trouble with activity B, give them hints such as, **You use this to wash dishes** (sponge) or, **You put lotion on this so it doesn't dry out** (skin).

### Day Three

**Vocabulary:**  
*surface water*

**Materials:** page 77;  
glass jar, sand, water

Introduce the vocabulary word and have students read the passage. Then, to help students visualize the water table's relationship to surface water, pour water into the sand-filled jar a little at a time until the sand is saturated and water begins to collect at the surface. After each pour, ask students where the water table is. (at the top of the darker sand, or above the sand) Have them complete the activities and review the answers together.

### Day Four

**Materials:** page 78

Have students read the passage. Explain that once groundwater gets polluted, it can take thousands of years to become clean again. Then instruct students to complete the activities. Review the answers together.

### Day Five

**Materials:** page 79

Have students complete the page independently. Then review the answers together.



**Day  
1****Weekly Question****Why don't rivers and lakes  
soak into the ground?**

Remember that less than 3% of all the water on Earth is fresh water, and only a tiny fraction of that is available for us to use. Most of Earth's fresh water occurs as ice in the polar ice caps and in glaciers. These regions are far from where most people live, and water in these areas is not easy to use. Unlike liquid water that can flow through pipelines, frozen water is hard to transport. Because of this, people use fresh water from rivers and lakes near populated areas.

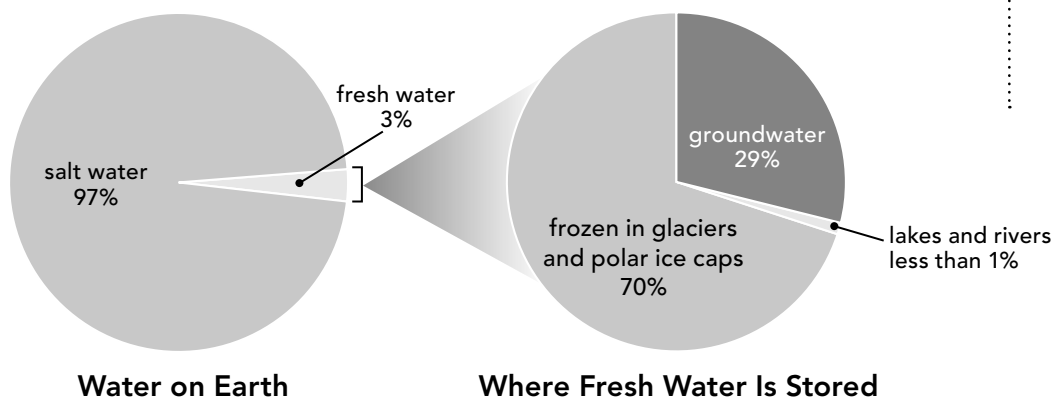
The second-greatest store of fresh water on Earth is in the ground. This type of water is called **groundwater**. Places that don't have access to fresh water from rivers and lakes depend on groundwater for drinking, **irrigation**, manufacturing, and industry.

**Vocabulary****groundwater**

GROWND-wah-ter  
fresh water  
that exists  
underground

**irrigation**

EER-ih-GAY-shun  
a method of  
supplying dry  
land with water  
artificially

**A. Look at the diagram and answer the questions.**

1. About what percentage of Earth's fresh water is found in groundwater, rivers, and lakes? \_\_\_\_\_
2. Why is most of Earth's fresh water difficult to use?  
\_\_\_\_\_

**B. Use the vocabulary words to complete the sentences.**

1. A farmer uses an \_\_\_\_\_ system to water his crops.
2. The farmer is not near a river, so he uses \_\_\_\_\_ instead.

**Day  
2****Weekly Question****Why don't rivers and lakes  
soak into the ground?**

To understand groundwater, it is important to know that some of the rock and soil that covers Earth is **porous**. Ground that is porous contains spaces within soil and inside rocks that allow for movement of water. When it rains, water soaks into the ground by seeping into these tiny spaces. Water moves downward until it reaches a level where all the spaces are filled with water. This depth is referred to as the top of the **water table**. During dry times, the water table may move lower. During wet seasons, the water table can rise.

The rock or sand layer below the water table that holds a lot of groundwater is called an **aquifer**. People obtain groundwater by drilling wells into aquifers and pumping out the water.

**Vocabulary****aquifer**

AH-kwih-fur

*an underground  
layer of rock or soil  
that contains water*

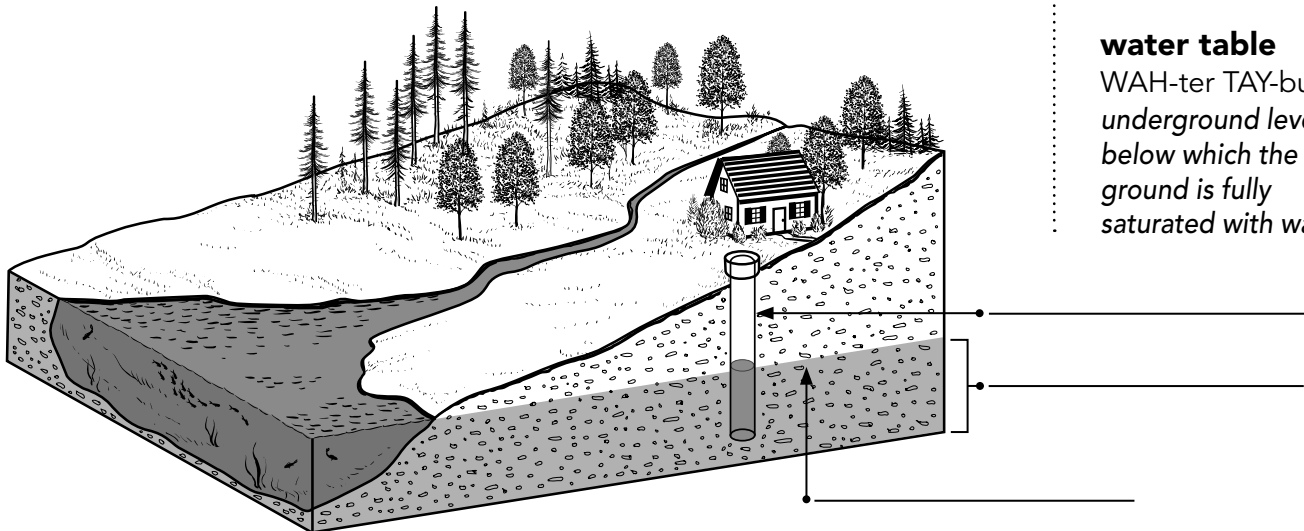
**porous**

POR-us

*able to absorb water*

**water table**

WAH-ter TAY-bul  
*underground level  
below which the  
ground is fully  
saturated with water*

**A. Label the *aquifer*, *water table*, and *well*.****B. Porous** is a word that can apply to other objects or materials besides rock. What are two other things that you think are porous?

1. \_\_\_\_\_ 2. \_\_\_\_\_

**C. During periods of extended dryness, water in wells can completely disappear. Explain why this is so.**

\_\_\_\_\_

**Day  
3****Weekly Question****Why don't rivers and lakes  
soak into the ground?**

Groundwater in the aquifer is replenished by rainfall in a process called *recharge*. But not all rainfall soaks into the ground. Some rain collects in rivers, lakes, and streams as **surface water**.

So why doesn't all surface water soak into the ground? Beneath some rivers and lakes, the rock layer isn't porous. If there are no pores to soak up the water, then the water simply collects above the ground. In places where the rock is porous, the ground beneath rivers, lakes, or streams is already saturated. So when rain falls, the ground cannot hold any more water, and it builds up on the surface.

**Vocabulary**

**surface water**  
SIR-fiss WAH-ter  
water that does  
not soak into the  
ground

- A.** The diagrams below show two ways surface water can form. Underneath each diagram, write a caption that describes what is happening with the water.

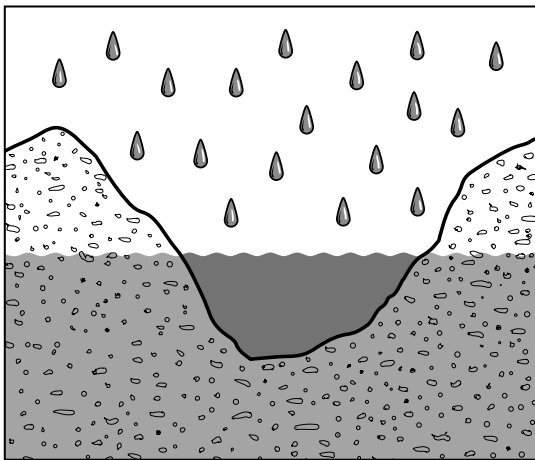


diagram 1

\_\_\_\_\_  
\_\_\_\_\_

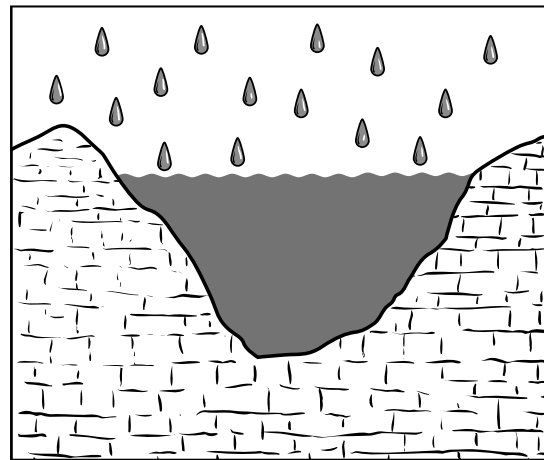


diagram 2

\_\_\_\_\_  
\_\_\_\_\_

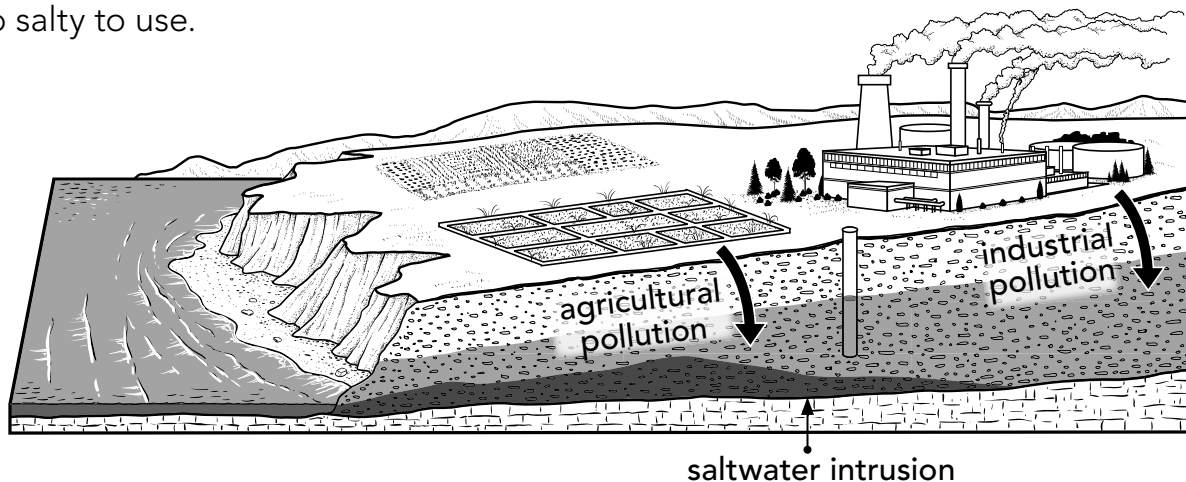
- B.** Describe the difference between surface water and groundwater.

\_\_\_\_\_  
\_\_\_\_\_

**Day  
4****Weekly Question****Why don't rivers and lakes  
soak into the ground?**

There is more fresh water available as groundwater than in all the world's rivers and lakes combined. Yet, the fact that groundwater is stored underground does not protect it from pollution. Fertilizers or other chemicals that are used in farming can dissolve in water, which then seeps into the ground during the irrigation process. Also, waste materials that spill or leak from industrial facilities can get carried into an aquifer by rainwater during recharge.

Overuse is another threat to groundwater. When communities use more groundwater than is replaced by rain or other sources, the water table can drop below the reach of wells. This drop can also cause communities near the ocean to experience saltwater intrusion, or the flow of seawater into an aquifer to replace the fresh water that has been pumped out. The result is groundwater that has become too salty to use.



**A.** What are the two main threats to the availability of usable groundwater?

1. \_\_\_\_\_ 2. \_\_\_\_\_

**B.** What are two results of overuse of groundwater?

1. \_\_\_\_\_  
2. \_\_\_\_\_

Name \_\_\_\_\_

Daily Science

**Big  
Idea 3**



**WEEK 2**

**Day  
5**

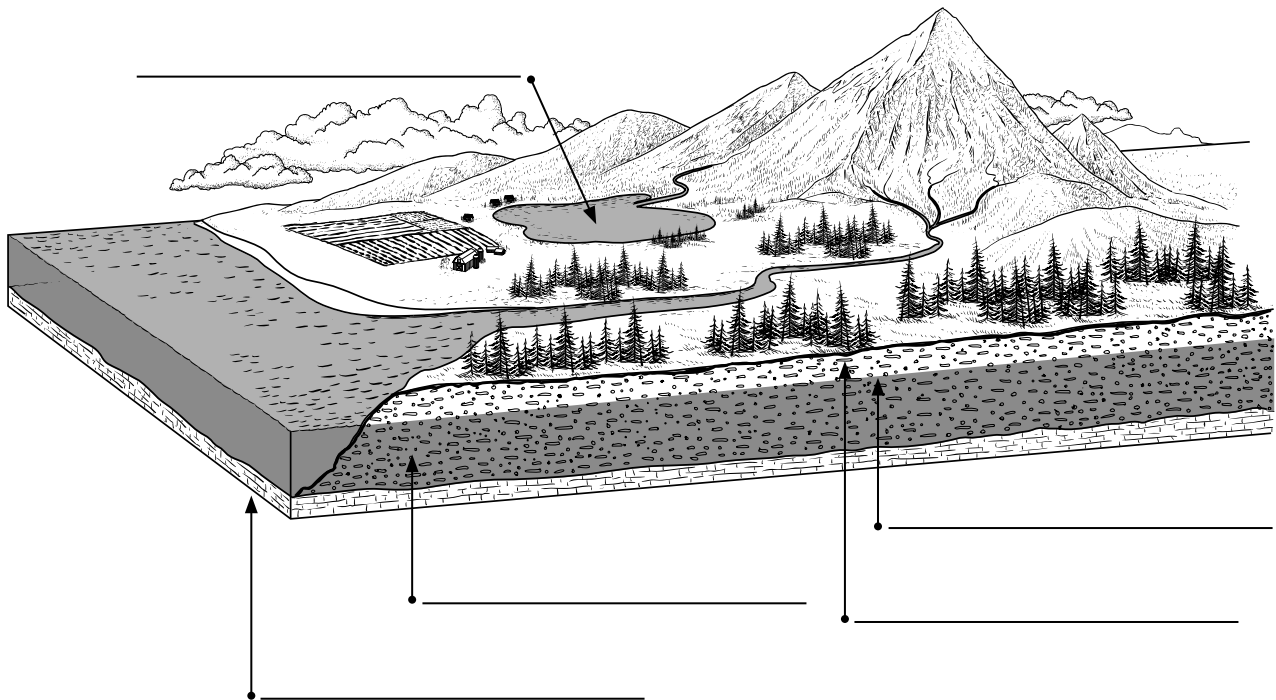
**Weekly Question**

## Why don't rivers and lakes soak into the ground?

**A.** Next to each word, write the letter of its definition.

- |                       |                                                    |
|-----------------------|----------------------------------------------------|
| 1. ____ aquifer       | a. water under Earth's surface                     |
| 2. ____ groundwater   | b. artificially watering dry land                  |
| 3. ____ porous        | c. a level below which the ground is full of water |
| 4. ____ irrigation    | d. water in rivers and lakes                       |
| 5. ____ surface water | e. a layer of saturated rock                       |
| 6. ____ water table   | f. filled with tiny holes                          |

**B.** Label the *groundwater*, *surface water*, *porous rock*, *nonporous rock*, and *water table*.





*Water covers most of Earth's surface. It circulates between oceans and land in a process called the water cycle.*

## Week 3

# What makes deserts so dry?

This week students learn that a desert is not defined by hot sun and blowing sand, but by how little rainfall it receives. In fact, the largest desert on Earth is not the Sahara Desert in Africa, as many people assume, but the cold ice fields of Antarctica.

The extent and distribution of deserts around the world is related to patterns of precipitation. Those patterns are determined by prevailing winds, humidity, and proximity to the ocean, as well as topographical features such as mountains. Some deserts do receive heavy rainfall for short periods when the prevailing winds switch directions. These events are called monsoons. Other deserts feature small, fertile oases as a result of natural deposits of groundwater or water pumped from reservoirs.

### Day One

Materials: page 81

After students have read the passage, explain that polar deserts are found in Antarctica and the Arctic Circle, which includes northern Canada, Alaska, Greenland, and Russia. Then instruct students to complete the activities. For activity A, you may want to review the seven continents. (North America, South America, Europe, Asia, Africa, Antarctica, and Australia)

### Day Two

Vocabulary: *prevailing winds, rain shadow, watershed*

Materials: page 82; regional physical map (optional)

Introduce the vocabulary and, if necessary, clarify that a watershed is an area that sheds, not collects, water. Using the physical map, help students identify your community's watershed. Then explain to students what the word *prevailing* means. (widespread or most usual) Have students read the passage and complete the activities. Review the answers together.

### Day Three

Vocabulary: *monsoon*

Materials: page 83

Introduce the vocabulary word and explain that *monsoon* is derived from the Arabic word *mausim*, which means "season" or "wind shift." Ask students if they know the country that is most associated with monsoons. (India) Tell them that monsoons can bring heavy rains that cause flash flooding in the deserts. Then have students read the passage and complete the activities. Review the answers together.

### Day Four

Vocabulary: *oasis, reservoir*

Materials: page 84

Introduce the vocabulary. Ask students why they think oases were, in the past, important for trade routes through the desert. (They provided points where travelers could stop for water.) After students have read the passage, have them complete the activities. For activity B, if students need help, point out that the word contains *reserv*, which includes the root *serve*.

### Day Five

Materials: page 85

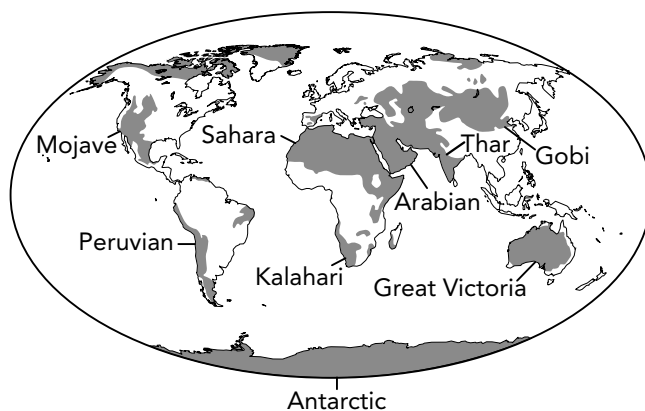
Have students complete the page independently. Then review the answers together.

**Day  
1****Weekly Question****What makes deserts so dry?**

Deserts can be found anywhere in the world, from the Mojave (moh-HAH-vee) Desert in California to the Gobi (GOH-bee) Desert in Asia. When you picture these places, you probably imagine long stretches of barren sand dunes with a burning sun overhead. But did you know that the largest desert on Earth isn't the famous Sahara in Africa, but the frigid ice fields of Antarctica?

The fact is that deserts are determined by how much water they receive, not how hot they are. On average, a desert gets less than 10 inches of rainfall per year. Since the North and South Poles receive very little precipitation, these places are considered to be deserts.

- A.** The shaded areas on the map below represent the world's deserts. Use the map to answer the questions.



1. On how many continents are there deserts? \_\_\_\_\_
  2. Besides Antarctica, which continent is made up almost entirely of desert? \_\_\_\_\_
- B.** Check the box next to each word or phrase that correctly completes the sentence.

Deserts are found in places that are \_\_\_\_\_.

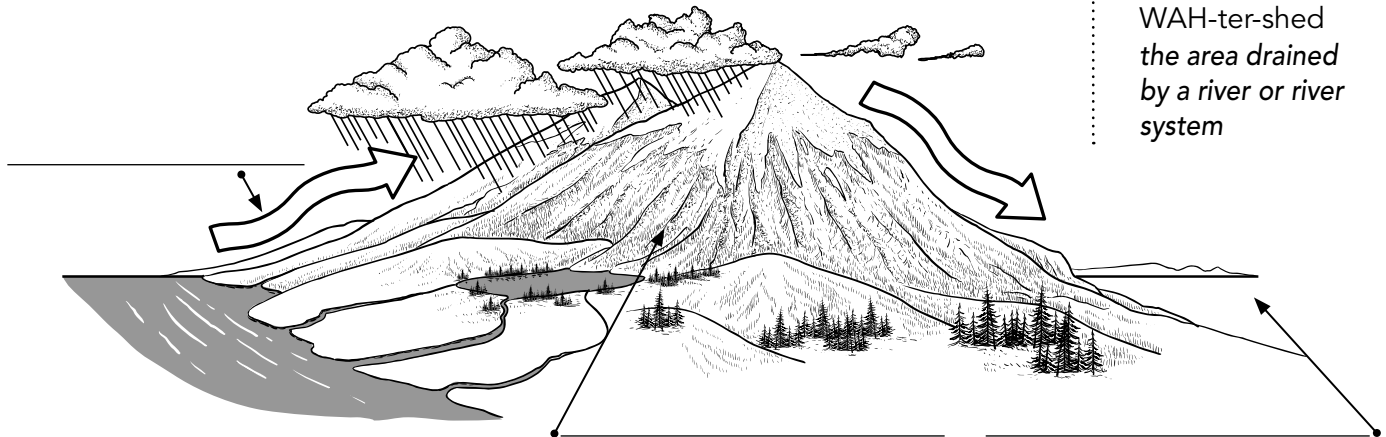
☐ hot☐ near the ocean☐ cold☐ far from the ocean

**Day  
2****Weekly Question****What makes deserts so dry?**

To understand why deserts have so little rainfall, it's important to know how wind, along with the shape of the land, determines where precipitation falls. **Prevailing winds** carry moisture from the oceans inland. The water vapor typically condenses over areas of high elevation, such as a mountain. As the clouds rise in elevation, they release their moisture as rain. By the time they reach the top of the mountain, however, there is very little moisture left.

The rain that is released drains down one side of the mountain through a **watershed** that distributes moisture throughout the area. The other side of the mountain, however, is in a **rain shadow**, meaning that little rain reaches it because the mountain itself is in the way. Many deserts are the result of rain shadows. These deserts are dry because the wind that finally passes over them doesn't contain a lot of moisture.

**A. Label the prevailing winds, watershed, and rain shadow.**

**Vocabulary****prevailing winds**

prih-VAY-ling WINDZ  
winds that blow in one direction for most of the time

**rain shadow**

RAYN SHA-doh  
an area that has little rain due to the effect of a barrier

**watershed**

WAH-ter-shed  
the area drained by a river or river system

**B. Fill in the bubble next to the word or phrase that completes each sentence.**

1. In a rain shadow, there is very little \_\_\_\_\_.

- (A) sunlight      (B) soil      (C) precipitation      (D) elevation

2. Deserts are *not* located in a \_\_\_\_\_.

- (A) watershed      (B) windy area      (C) rain shadow      (D) cold climate



**Day  
3****Weekly Question****What makes deserts so dry?**

Not all deserts are formed by a rain shadow behind a mountain. Some regions, such as the Sahara Desert, have very low moisture because the air is too warm for water to condense. The sun shines directly on the ground and heats up the land, evaporating any moisture. Other regions, such as the Tengger Desert in China, are impacted by dry prevailing winds that blow over land instead of water. The winds have already dropped all their moisture by the time they reach these regions.

Some deserts do receive seasonal rainfall, however. This happens when the prevailing winds reverse direction. A wind that changes direction with the seasons is called a **monsoon**. Monsoons bring rainfall for a certain period of time to areas that are otherwise dry. The Thar Desert in India is a monsoon desert that receives some rainfall from June to September, during India's monsoon season.

**Vocabulary****monsoon**

mon-SOON

a wind that  
reverses direction  
when the seasons  
change



- A. During winter in the Thar Desert, the winds blow from the dry Himalaya Mountains and Siberia. Why do you think it rains so much when the winds switch direction in the summer? Use the map above to help you.

---

- B. Name two reasons that deserts form, besides rain shadows.

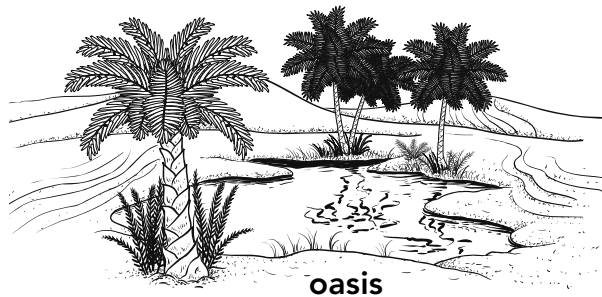
1. \_\_\_\_\_

2. \_\_\_\_\_

**Day  
4****Weekly Question****What makes deserts so dry?**

Even though deserts contain very little water, people are still able to live in them. That's because many desert communities are formed near an **oasis**. An oasis is a small, isolated area where vegetation grows because there is an underground water source. Oases (oh-AY-seez, the plural of oasis) usually form where the water table is just below the surface. Water bubbles up through the ground in natural springs, or can easily be reached by wells.

People in desert communities also survive dry seasons by pumping water from sources that are farther away, such as **reservoirs**. The water is transported from the reservoirs to desert towns in canals called *aqueducts*. Even in the driest desert climates, reservoirs can provide enough fresh water to build thriving cities. In fact, Phoenix, Arizona, is one of the United States' biggest cities, and it is located in the middle of the Sonoran Desert!

**Vocabulary****oasis**

oh-AY-siss  
a fertile place in the desert

**reservoir**

REH-zih-vwar  
an artificial body of water stored for future use

**A.** Which of the following statements do you think are true based on what you just read? Check all that apply.

- ☐ Desert animals can often be found near an oasis.
- ☐ Phoenix, Arizona, does not get a lot of rain.
- ☐ A reservoir must be built someplace dry and warm.
- ☐ Natural springs are common throughout the desert.

**B.** Look at the word *reservoir*. What other words do you know that might be related to it, based on their spellings and meanings? Write two related words and their definitions.

1. \_\_\_\_\_

2. \_\_\_\_\_

Name \_\_\_\_\_

**Day  
5**

**Weekly Question**

## **What makes deserts so dry?**

**A.** Use the words in the box to complete the paragraphs.

reservoir

watershed

prevailing winds

oasis

monsoons

rain shadow

Many deserts are formed by a \_\_\_\_\_, an area behind a mountain that receives very little rain. \_\_\_\_\_ bring moisture from the ocean inland, but that moisture is deposited only on the ocean side of the mountain, resulting in a \_\_\_\_\_. Still, some deserts do receive rain when the winds change and bring seasonal \_\_\_\_\_.

Water is also present in deserts under the ground. In some spots, an \_\_\_\_\_ forms, allowing vegetation to grow and people and animals to live there. People also live in deserts by bringing water from a \_\_\_\_\_ into the region, using an aqueduct.

**B.** Name two ways that deserts form.

1. \_\_\_\_\_

2. \_\_\_\_\_

**C.** Describe what happens during a monsoon.

\_\_\_\_\_  
\_\_\_\_\_

Daily Science

**Big  
Idea 3**

**WEEK 3**



*Water covers most of Earth's surface. It circulates between oceans and land in a process called the water cycle.*

## Week 4

# Can we run out of water?

Fresh water is our most valuable resource. We rely on water for a wide variety of important uses, from drinking to agriculture to sanitation. But water is also a limited resource. With a finite amount of fresh water available and a growing human population, there is concern that we may eventually run out of usable water. This concern is compounded by the fact that people often contaminate water with waste materials and chemicals. Some regions have already experienced the strain of dwindling water supplies when they have undergone periods of drought.

This week students will learn that while it is possible for us to run out of water, we are making efforts to make sure this doesn't happen. Although there is no way to create new water, we have begun to conserve our existing supply. Processes of desalination and reclamation are allowing us to use water supplies that would otherwise be unavailable. And new irrigation techniques are saving even more water, as are increased conservation and awareness of the limited nature of our usable water.

### Day One

Materials: page 87

Before students read the passage, refresh their memory about the amount of salt water on the planet (97%) and how the majority of fresh water is trapped in ice. Then have them complete the activities. You may want to model how to read the graph before students complete activity A.

### Day Two

Vocabulary:  
*contaminate, drought*

Materials: page 88

After introducing the vocabulary, have students read the passage and complete the activities. If students have trouble with activity B, ask them what they think having no water would do to a farmer's crops (agricultural effect), or someone running a business that uses a lot of water (economic effect). Review the answers together.

### Day Three

Vocabulary: *desalination, reclamation*

Materials: page 89

Before students read the passage, explain that Earth's water came from massive volcanic eruptions and comets, the "dirty snowballs" of the solar system that crashed billions of years ago. Today, there is no substantial amount of water that is produced this way on Earth. Introduce the vocabulary and have students complete the activities. Review the answers together.

### Day Four

Vocabulary: *conservation*

Materials: page 90

After introducing the vocabulary word, ask students: **What are some other things besides water that people conserve?** (food, gas, money, etc.) Have students read the passage and complete the activities. For the oral activity, pair students or work as a group to brainstorm ways to conserve water at home or at school.

### Day Five

Materials: page 91

Have students complete the page independently. Then review the answers together.

Name \_\_\_\_\_

**Day  
1**

**Weekly Question**

## Can we run out of water?

Daily Science

**Big  
Idea 3**

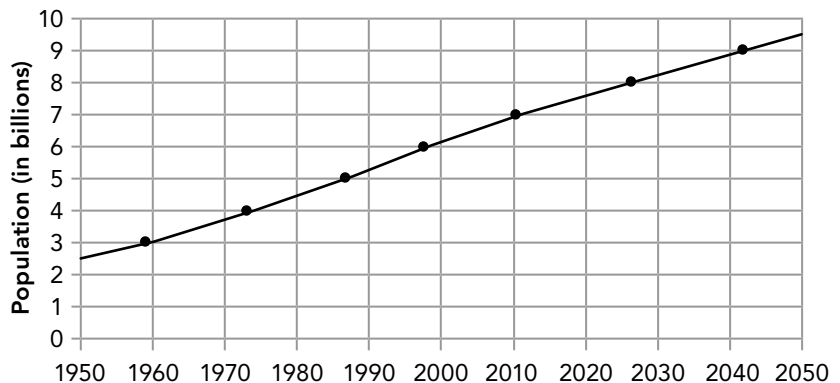
**WEEK 4**

A quick glance at a map of Earth reminds you how much more water there is than land on our planet. You would think, therefore, that we have more water than we could ever use. But Earth has a limited supply of usable water. Remember that only about 3% of Earth's water is fresh water. And of that fresh water, less than 30% is freely available in rivers, lakes, and groundwater.

While the amount of water on Earth doesn't change, the human population is growing. There are now nearly 7 billion people in the world. On average, each of us uses about 12 gallons of water per day for drinking, cleaning, and growing and preparing food. Plants and animals also rely on water. Some scientists think we are using an amount of water that we cannot sustain, which will lead to a global water shortage.

- A.** This graph shows Earth's population from 1950 to today, and how much it is likely to grow by 2050. Use the graph to answer the questions.

**World Population: 1950–2050**



1. About how many billion people will there be on the planet by the year 2050? \_\_\_\_\_
2. About how many more people were on Earth in the year 2000 than in 1960? \_\_\_\_\_
3. About how many more people will there be in 2050 than there were in 2000? \_\_\_\_\_

- B.** If a person uses about 12 gallons of water per day, how many gallons of water does that person use per year, on average? \_\_\_\_\_

Name \_\_\_\_\_

**Day  
2**

**Weekly Question**

## **Can we run out of water?**

Some areas of the world have less water available to them than others. Changes in the water cycle can impact the amount of water that certain regions receive. When a region receives less precipitation than normal for an extended period of time, the area experiences a **drought**. Droughts can negatively affect agriculture, availability of drinking water, and even a community's economy.

In some places, the concern is not drought or a limited supply of water, but lack of clean water. This is because the water supply in some areas is **contaminated**, meaning it has become polluted and is harmful to use. Water can be contaminated by cleaning products, oils, and other waste that is washed down the drain. Chemicals and disease-causing bacteria can also make their way into water. By some estimates, as much as 20% of Earth's population has no access to water clean enough to drink.

**A.** Cross out the word or phrase in each sentence that makes the statement false. Then rewrite the sentence correctly.

1. A drought is caused by less sunlight than usual.

\_\_\_\_\_

2. In some places, water is too clean to drink.

\_\_\_\_\_

**B.** In what ways do you think a drought could negatively impact agriculture, drinking water, and the economy? Write one example for each.

**Agriculture:** \_\_\_\_\_

**Drinking water:** \_\_\_\_\_

**Economy:** \_\_\_\_\_

Daily Science

**Big  
Idea 3**



**WEEK 4**

### **Vocabulary**

**contaminate**

kun-TAM-ih-NAYT  
to pollute or make  
impure

**drought**

drowt  
a long period of  
unusually low rainfall

**Day  
3****Weekly Question****Can we run out of water?**

Unfortunately, there is no way to create new water on Earth. But we can make better use of the water we have. Some communities recycle their used water through the process of **reclamation**. Water that has been contaminated can be cleaned up for reuse at treatment plants. At these plants, the heaviest waste material is separated from the water. Then the water is filtered to remove smaller particles, and chemicals are added to kill off any remaining microorganisms. Reclaimed water is not as clean as fresh water, so it cannot be used for drinking. But it can be used for things such as watering crops, fighting fires, and cleaning.

People have also found a way to tap into our largest water supply—the ocean. **Desalination** plants remove salt from seawater, turning it into fresh water. This makes the sea a great source of potential fresh water, but there are drawbacks. For one thing, desalination is an expensive process. Also, desalinated water is only easily available to people who live near the coast.

**Vocabulary****desalination**

dee-SAL-ih-NAY-shun  
the removal of salt  
from seawater

**reclamation**

REH-kloh-MAY-shun  
the recovery of  
useful substances  
from waste products

**A. Number the events in the correct order to show how reclamation works.**

- \_\_\_\_\_ Waste materials are separated from the water.
- \_\_\_\_\_ Chemicals are added to the water to kill off microorganisms.
- \_\_\_\_\_ Waste water is collected at a treatment plant.
- \_\_\_\_\_ Recycled water is returned to a community's water system.
- \_\_\_\_\_ Small particles are filtered from the water.

**B. What are two reasons why desalination alone can't solve our water shortage problem, even though there is plenty of water in the ocean?**

1. \_\_\_\_\_
2. \_\_\_\_\_

**Day  
4****Weekly Question****Can we run out of water?**

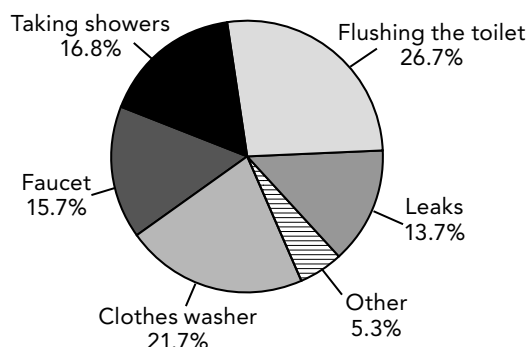
One of the best ways to address the problem of shrinking water supplies is to practice **conservation** of water. This is especially true in agriculture, which is our biggest use of water. Unfortunately, when crops are irrigated, more than 40% of that water can be wasted due to evaporation. But today, more farmers are conserving water by using a method called drip irrigation, which distributes the water slowly so that more of it soaks into the ground instead of evaporating.

Many people are also starting to conserve water in their everyday lives, such as by taking shorter showers or turning off the water while brushing their teeth. Some homeowners are cutting back on watering their lawns. Yes, it is possible that we may one day run out of drinkable water. But if we can conserve water and cut back on pollution, we will have a better chance of surviving with the water we've got.

**Vocabulary****conservation**

KON-sir-VAY-shun  
*the careful use  
of something to  
preserve it or keep  
it from running out*

This pie chart shows the daily percentage of water that is typically used by various appliances or activities in American homes. Use the chart to answer the questions.



1. In which room of the house do people use the most water? \_\_\_\_\_
2. According to the chart, "other" activities account for more than 5% of people's home water use. What might these be? Name two other ways you use water besides the ways noted in the chart.  
\_\_\_\_\_

**Talk**

What are some things you might do to conserve water? Work with a partner to make a list of the ways you can cut back on water usage.



**Day  
5**

**Weekly Question**

**Can we run out of water?**

- A.** Write the word from the box that could replace the underlined word or phrase in each sentence.

conservation    reclamation    drought  
desalination    contaminate

1. In order to protect our water supply, people have practiced the preservation of water. \_\_\_\_\_
2. The process of water recovery allows people to recycle used water. \_\_\_\_\_
3. People can pollute water by dumping waste materials or chemicals into it. \_\_\_\_\_
4. The process of salt removal allows people to use seawater for drinking. \_\_\_\_\_
5. Many farmers' businesses suffer during a rain shortage. \_\_\_\_\_

**B.** Write *true* or *false*.

1. Earth has a limited supply of usable water. \_\_\_\_\_
2. If a region has no rainfall for one week, it is experiencing a drought. \_\_\_\_\_
3. Reclaimed water can be used for drinking. \_\_\_\_\_
4. Contaminated water can carry disease. \_\_\_\_\_
5. The biggest use of water is for agriculture. \_\_\_\_\_



Name \_\_\_\_\_

**Unit  
Review**

**Comprehension**

**Earth's Water Supply**



Fill in the bubble next to the correct answer.

1. The three elements of the water cycle are \_\_\_\_\_.  
Ⓐ conservation, desalination, reclamation  
Ⓑ evaporation, condensation, precipitation  
Ⓒ groundwater, rainwater, surface water  
Ⓓ water vapor, water table, watershed
2. People store water for future use in a(n) \_\_\_\_\_.  
Ⓐ reservoir                                      Ⓒ aquifer  
Ⓑ oasis                                              Ⓓ aqueduct
3. Which of these does *not* reduce our water supply?  
Ⓐ growing population                      Ⓒ drought  
Ⓑ contamination                              Ⓓ desalination
4. We measure the amount of water vapor in the air as \_\_\_\_\_.  
Ⓐ gas                                              Ⓒ clouds  
Ⓑ humidity                                      Ⓓ fog
5. Where is the most fresh water found on Earth?  
Ⓐ rivers                                              Ⓒ ice  
Ⓑ oceans                                              Ⓓ groundwater
6. Many deserts are formed by a(n) \_\_\_\_\_.  
Ⓐ aquifer                                              Ⓒ oasis  
Ⓑ watershed                                      Ⓓ rain shadow
7. Which of these is *not* an example of precipitation?  
Ⓐ rain                                              Ⓒ hail  
Ⓑ snow                                              Ⓓ fog

Name \_\_\_\_\_

**Unit  
Review**

**Vocabulary**

**Water Words**

Daily Science

**Big  
Idea 3**



**WEEK 5**

Write the vocabulary word that answers or completes each clue.

1. Evaporated water turns into this. \_\_\_\_\_
2. rain that has soaked into the ground \_\_\_\_\_
3. When prevailing winds change direction, they bring \_\_\_\_\_.
4. The side of a mountain that receives little rainfall is in the \_\_\_\_\_.
5. the measure of moisture in the air \_\_\_\_\_
6. a natural water source in the desert \_\_\_\_\_
7. a long period without rainfall \_\_\_\_\_
8. If a rock has many small holes, it is \_\_\_\_\_.
9. rivers, lakes, and streams \_\_\_\_\_
10. the recycling of used water \_\_\_\_\_
11. a way to water plants or crops \_\_\_\_\_
12. a region drained by river systems \_\_\_\_\_
13. a synonym for *pollute* \_\_\_\_\_
14. the act of saving something for later \_\_\_\_\_
15. When all the ground below you is saturated, you have reached the top of the \_\_\_\_\_.
16. People drill into the \_\_\_\_\_ to make a well.
17. Removing salt from seawater is called \_\_\_\_\_.
18. evaporation, condensation, and precipitation \_\_\_\_\_

aquifer  
conservation  
contaminate  
desalination  
drought  
groundwater  
humidity  
irrigation  
monsoons  
oasis  
porous  
rain shadow  
reclamation  
surface water  
water cycle  
watershed  
water table  
water vapor

Name \_\_\_\_\_

Daily Science

# Big Idea 3

WEEK 5

## Unit Review

### Visual Literacy

## From Ocean to Land

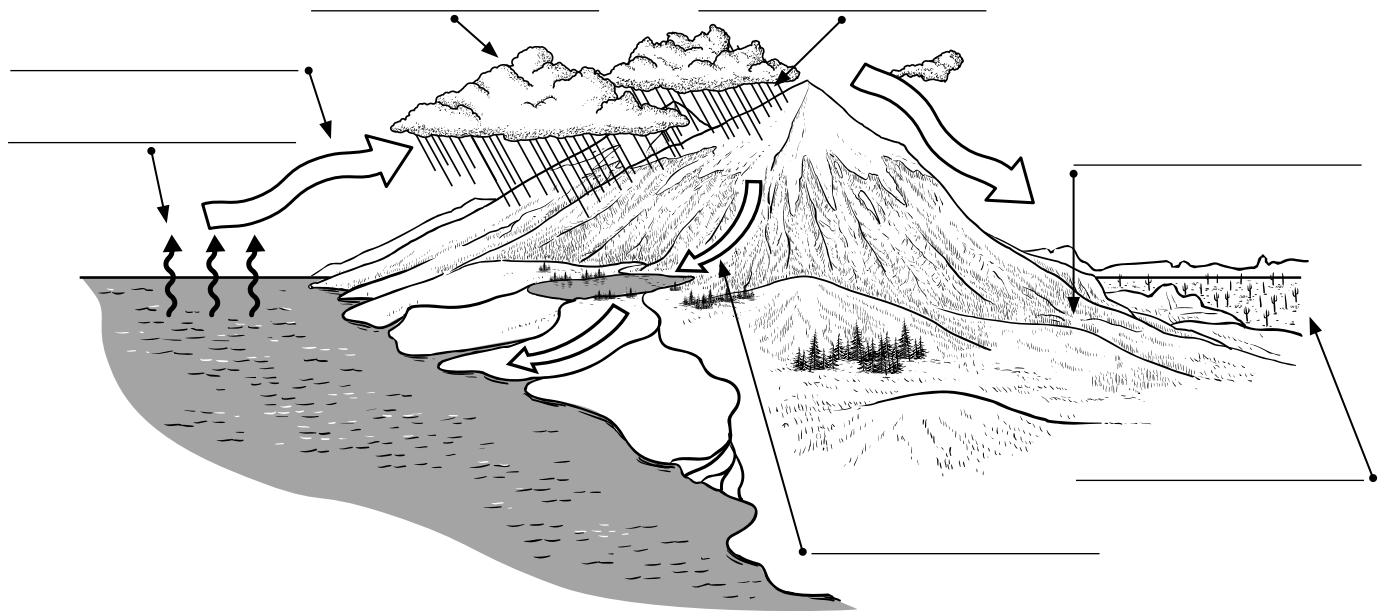
This diagram shows how water from the ocean affects the land nearby. Label each element, using the words in the box. Then write a caption describing what happens to the land on each side of the mountain.

condensation  
precipitation

evaporation  
rain shadow

watershed  
prevailing winds

desert



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Name \_\_\_\_\_

**Unit  
Review**

**Hands-on Activity**

**Create Your Own Water Cycle**

Daily Science

**Big  
Idea 3**



**WEEK 5**

See the water cycle at work in this simple experiment using water, soil, and the power of the sun.

**What You Need**

- 1 plastic container
- 1 plastic cup
- small rock
- plastic wrap
- wide tape
- 4 cups of soil or sand
- ½ cup water

1. Pour the soil into the plastic container and spread it around evenly. Then place the plastic cup in the middle of the container, partially in the soil for stability.
2. Pour the water evenly over the soil, but not in the cup.
3. Cover the container with plastic wrap and seal it around the edges with tape. Place the rock on top of the wrap, centered directly over the cup.
4. Place the container in a sunny location. Check on it the following day.

**What Did You Discover?**

1. What happened to the water?

\_\_\_\_\_

2. How much water did you end up with in the cup?

\_\_\_\_\_

3. Why do you think you put the rock over the cup?

\_\_\_\_\_

4. Do you think this experiment would work on a cloudy day? Explain your answer.

\_\_\_\_\_



Gravity is the force that keeps planets in orbit around the sun, and the moon in orbit around Earth.

### Key Concept

Gravity

### National Standard

Gravity is the force that keeps planets in orbit around the sun and governs the rest of the motion in the solar system. Gravity alone holds us to the Earth's surface and explains the phenomena of the tides.

Most fifth-grade students have some familiarity with the effect of gravity, whether it is rain falling from the sky or a vase knocked from a table. However, they may not understand gravity's greater role in our solar system. In this Big Idea, students learn that:

- gravity exerted by an object increases as its mass increases, and decreases with distance from the object;
- the gravitational attraction of the moon and sun combine to create ocean tides;
- planets are round because the gravity of massive objects pulls all matter toward a center; and
- planets move in elliptical orbits in which the forces of gravity and inertia balance exactly.

### Teacher Background

Gravity is a force of mutual attraction that guides the motion of all objects in the universe. This includes everything from the orbits of space stations and planets to the arcing trajectory of a baseball hit into the air. By understanding the relationship between mass and gravity, it is also possible to understand gravity's role in the formation and shape of our planets, moons, asteroids, and other objects in space.

Big or little, all objects that have mass have gravity, and as an object becomes more massive, it exerts more gravity. Objects that have mass also have inertia, the property of matter that keeps an object moving in a straight line and at a constant speed until it is pushed or pulled by a force. Planets are constrained to precise and predictable orbits around the sun because the forces of gravity and inertia are exactly balanced.

**For specific background information on each week's concepts, refer to the notes on pp. 98, 104, 110, and 116.**

## Unit Overview

### WEEK 1: Why do we weigh more on Earth than on the moon?

**Connection to the Big Idea:** Mass and distance are the two factors required for determining the gravitational force exerted by an object. Students learn that the amount of mass an object has determines how strong its gravity is and, in turn, how much you would weigh if you stood on that object in space.

**Content Vocabulary:** *gravitational force, mass, weight*

### WEEK 2: What causes ocean tides?

**Connection to the Big Idea:** Ocean tides are created by the gravitational pull of the moon and sun. Students learn that the location of the moon and sun relative to one another determines whether an area on Earth experiences spring tides or neap tides, and that the tides change with the phases of the moon.

**Content Vocabulary:** *navigate, neap tide, spring tide, tidal range, tide*

### WEEK 3: Why are planets round?

**Connection to the Big Idea:** Gravity acts from a center of mass. Students learn that when the planets first formed, they gathered mass through the process of accretion. Eventually, planets became spherical because they became sufficiently massive, and thus had sufficient gravity, for all their matter to be pulled toward their center.

**Content Vocabulary:** *accretion, centrifugal force, coalesce, spherical*

### WEEK 4: Why don't planets crash into each other?

**Connection to the Big Idea:** Gravity and inertia are the two forces that constrain the motion of the planets into precise, predictable orbits. Students learn that, absent of outside forces such as friction or air resistance, inertia would cause an object to move in a straight line forever. However, since gravitational force is present in space, gravity and inertia balance each other out. Because of this, the planets move in stable orbits and will not crash into each other.

**Content Vocabulary:** *comet, elliptical, free fall, inertia, trajectory*

### WEEK 5: Unit Review

You may choose to do these activities to review the concept of gravitational force.

**p. 122: Comprehension** Students answer multiple-choice questions about key concepts in the unit.

**p. 123: Vocabulary** Students write vocabulary words from the unit to match clues.

**p. 124: Visual Literacy** Students write whether gravity, inertia, or both are being demonstrated in various pictures.

**p. 125: Hands-on Activity** Students drop different objects off the side of a desk to see forces of gravity and air resistance at work. Instructions and materials needed for the activity are listed on the student page.



**Gravity is the force that keeps planets in orbit around the sun, and the moon in orbit around Earth.**

## Week 1

# Why do we weigh more on Earth than on the moon?

When Neil Armstrong first walked on the moon, he uttered the famous phrase, “That’s one small step for [a] man, one giant leap for mankind.” In fact, on the moon, Armstrong himself was able to move in giant leaps, nearly floating between footsteps. He could do this because on the moon, he weighed only a sixth of what he weighed on Earth.

This week students are introduced to the difference between weight and mass and discover that an object’s weight fluctuates depending on the amount of gravitational force that another object exerts. Gravitational force increases as an object’s mass increases and decreases with distance from the object. The moon has less mass—and thus less gravitational force—than Earth. If Armstrong had stood on Phobos, one of the tiny moons of Mars that exerts very little gravitational force, he’d have been able to take giant leaps indeed.

### Day One

**Vocabulary:** *gravitational force*

**Materials:** page 99

Introduce the vocabulary word and explain to students that the words *gravitational force* and *gravity* mean essentially the same thing. Have students read the passage and complete the activities. Review the answers together.

### Day Two

**Vocabulary:** *mass*

**Materials:** page 100; baseball, large inflated balloon

Before introducing the vocabulary word, make sure students have an understanding of the word *matter* (the substance that an object is made of). To demonstrate the concept of mass, pass around a baseball and a balloon and ask how the baseball could have more mass even though the balloon is larger. (A baseball is solid and has more matter, whereas a balloon is filled with air and has less matter.) Have students read the passage and complete the activities. Review the answers together.

### Day Three

**Vocabulary:** *weight*

**Materials:** page 101

Introduce the vocabulary word and have students read the passage. Then explain that in the United States, we generally measure weight in pounds, but scientists measure mass in grams or kilograms. Have students complete the activities and review the answers together.

### Day Four

**Materials:** page 102

Have students read the passage and complete the activities. If students have trouble with activity A, go over the chart together and remind students of the relationship between weight and gravitational force.

### Day Five

**Materials:** page 103

Have students complete the page independently. Then review the answers together.



Name \_\_\_\_\_

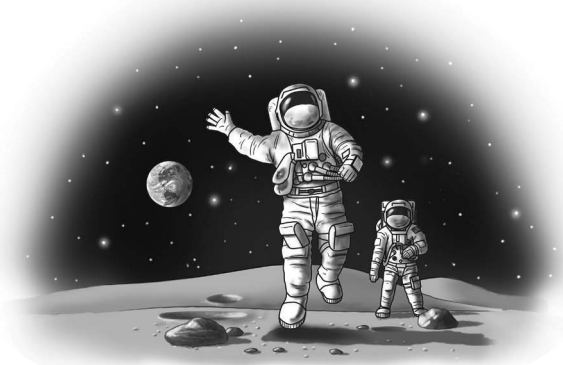
**Day  
1**

**Weekly Question**

**Why do we weigh more on Earth than on the moon?**

If you've ever seen videos of astronauts walking on the moon, then you've probably noticed the way they seemed to float from footstep to footstep. That's because everything weighs less on the moon than it does on Earth. The reason for this has to do with gravity. Gravity is the force of attraction that exists between all objects in the universe, including Earth and the moon. It's what makes all things that go up come down. And it's the reason we stay on Earth's surface instead of floating off into space.

Not all objects, however, have the same amount of gravity. Earth pulls us and all the things on the planet toward its center with a strong **gravitational force**. The gravitational force on the moon is not as strong as it is on Earth.



**Vocabulary**

**gravitational force**

grav-ih-TAY-shun-ul  
FORSS

*the force of  
attraction between  
any two bodies in  
the universe*

**A. Write true or false.**

1. Gravity pulls us toward Earth's center. \_\_\_\_\_
2. The moon's gravitational force is stronger than Earth's gravitational force. \_\_\_\_\_
3. Gravitational force is what keeps us from floating off the planet. \_\_\_\_\_
4. All bodies in the universe have gravity. \_\_\_\_\_

**B. Explain in your own words why astronauts appear to float when they walk on the moon. Use the term *gravitational force* in your answer.**

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Name \_\_\_\_\_

Daily Science

# Big Idea 4

WEEK 1

Day 2

## Weekly Question

# Why do we weigh more on Earth than on the moon?

What makes one object have a stronger gravitational force than another? There are two factors that determine gravitational force. The first is an object's **mass**. An object with a large amount of mass will exert more gravitational force than an object with a small amount of mass. Since Earth has more mass than the moon—about six times as much—it exerts more gravitational force.

Gravitational force also depends on the distance between objects. If we were standing on the moon, we'd be pulled by Earth's gravitational force. Even though Earth has a greater mass than the moon, the moon's gravity would be stronger than Earth's because we would be so much closer to the moon. Similarly, while standing on Earth, we are being pulled by the moon's gravity. However, it doesn't have much effect on us because the moon is so far away.



## Vocabulary

### mass

mass  
the amount of  
matter in an object

A. Check the box next to the object in each pair that has more mass.

- |                                          |                                     |                                       |                                  |
|------------------------------------------|-------------------------------------|---------------------------------------|----------------------------------|
| 1. <input type="checkbox"/> bowling ball | <input type="checkbox"/> basketball | 3. <input type="checkbox"/> toothpick | <input type="checkbox"/> nail    |
| 2. <input type="checkbox"/> paper towel  | <input type="checkbox"/> washcloth  | 4. <input type="checkbox"/> leaf      | <input type="checkbox"/> quarter |

B. All objects have gravitational force, including people. We pull on Earth just as it pulls on us. Why, then, doesn't Earth fall toward us when we jump? Use the word *mass* in your answer.

\_\_\_\_\_

C. The sun has 300,000 times more mass than Earth, yet we don't get pulled off Earth and into the sun by its gravitational force. Explain why.

\_\_\_\_\_

Name \_\_\_\_\_

**Day  
3**

**Weekly Question**

**Why do we weigh more on Earth than on the moon?**

Mass and **weight** are not the same thing. Mass measures how much matter something has. It doesn't make a difference whether you are on the moon or on Earth—your mass doesn't change. Your weight, on the other hand, is measured by the pull of gravity on your mass. With less gravity on the moon, you weigh less. With more gravity on Earth, you weigh more.

We don't generally notice the difference between mass and weight when we weigh ourselves on Earth, however. That's because the gravitational force is nearly the same no matter where you go on Earth, so your weight doesn't vary.

**Vocabulary**

**weight**

wayt  
measurement  
of the effect of  
gravity on a given  
mass

**A. Use the chart to answer the questions.**

|       | Weight<br>on Earth | Weight on<br>the Moon |
|-------|--------------------|-----------------------|
| Child | 65 lbs             | 10.8 lbs              |
| Adult | 150 lbs            | 25 lbs                |

1. How many fewer pounds does the child weigh on the moon than on Earth? \_\_\_\_\_
2. Which is greater, the adult's weight on the moon, or the child's weight on Earth? What is the difference between them in pounds?  
\_\_\_\_\_
3. Who has more mass on the moon, the child or the adult? Explain.  
\_\_\_\_\_

**B. If you go on a diet, do you change your weight or your mass? Explain.**

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Name \_\_\_\_\_



**Day  
4**

**Weekly Question**

## Why do we weigh more on Earth than on the moon?

Remember that all objects in the universe have gravity. Every object's gravitational force is different, depending on its mass. That means that your weight would be different on any planet or star.

If a person who weighed 150 pounds on Earth stepped onto a neutron star, he would weigh 21 trillion pounds! A neutron star is a star that has about the same mass as our sun, but is much smaller. All of its mass is concentrated into an area the size of San Francisco. If the 150-pound person were to set foot on Phobos, a tiny moon of Mars, his weight would barely register. That's because Phobos has very little mass, although it, too, is about the size of San Francisco.

- A.** The chart below shows approximately how much a 150-pound person on Earth would weigh on each planet in our solar system. Use the chart to answer the questions.

|                |         |                |         |
|----------------|---------|----------------|---------|
| <b>Mercury</b> | 57 lbs  | <b>Jupiter</b> | 381 lbs |
| <b>Venus</b>   | 137 lbs | <b>Saturn</b>  | 140 lbs |
| <b>Earth</b>   | 150 lbs | <b>Uranus</b>  | 120 lbs |
| <b>Mars</b>    | 57 lbs  | <b>Neptune</b> | 180 lbs |

1. On which planet would you weigh the closest to what you weigh on Earth? \_\_\_\_\_
2. Which planet exerts the strongest gravitational force? \_\_\_\_\_
3. On which two planets is gravity the weakest? \_\_\_\_\_

- B.** Which of the following statements are true? Check all that apply.

- ☐ The size of an object determines how much mass it has.
- ☐ An object's mass determines its gravitational force.
- ☐ The farther a planet is from the sun, the less gravity the planet has.
- ☐ The gravitational force of Phobos is weaker than the gravitational force of a neutron star.

Name \_\_\_\_\_

Daily Science

**Big  
Idea 4**



**WEEK 1**

**Day  
5**

**Weekly Question**

## **Why do we weigh more on Earth than on the moon?**

**A.** Use the words in the box to complete the sentences.

gravitational force   mass   weight

1. The \_\_\_\_\_ exerted by Earth keeps the moon in orbit around us.
2. An object's \_\_\_\_\_ would be different on Mars than it would be on Jupiter.
3. A feather is bigger than a marble but has less \_\_\_\_\_.

**B.** Answer the questions.

1. What is the difference between mass and weight?

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2. Why don't we notice a difference between mass and weight on Earth?

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**C.** What are two factors that determine an object's gravitational force on another object?

1. \_\_\_\_\_
2. \_\_\_\_\_



**Gravity is the force that keeps planets in orbit around the sun, and the moon in orbit around Earth.**

## Week 2

# What causes ocean tides?

The daily ebb and flow of ocean tides has been observed by humans for millennia, but not until Sir Isaac Newton proposed his theory of gravity in 1687 did we understand what caused the cyclic rise and fall of sea level. This week students learn that the moon exerts gravitational force on the world's oceans, resulting in a high tide, or "bulge" in the sea's surface that follows the moon as Earth rotates. The sun also contributes to the tidal bulge in the ocean, but because the sun is so far away, its contribution is only half that of the moon's. When the sun and moon are aligned, as happens twice each month, they produce higher high tides and lower low tides than when they are not aligned.

Over the course of a month, the relative positions of the moon and sun change as the moon completes its orbit around Earth. This means that the tides are also correlated with phases of the moon, a relationship that ancient people observed and students can now understand.

### Day One

**Vocabulary:** *tidal range, tide*

**Materials:** page 105

Introduce the vocabulary and explain to students that *tidal range* is a change in sea level height, as might be measured along a pier piling. It is not the distance that the edge of the water advances or retreats along a beach. After students have read the passage, have them complete the activities. For activity A, you may want to review how to add positive and negative integers.

### Day Two

**Materials:** page 106

After students read the passage, point out that the "bulge" in sea level always faces the moon, even as Earth rotates. Explain to students that, although a tide can be thought of as a gigantic wave, this is not the same as a "tidal wave," or tsunami, which is caused by earthquakes. Have students complete the activities and review the answers together.

### Day Three

**Vocabulary:** *neap tide, spring tide*

**Materials:** page 107; beach ball, globe, tennis ball

Introduce the vocabulary and inform students that it takes the moon  $29\frac{1}{2}$  days to complete one orbit around Earth. After students read the passage, have volunteers demonstrate the positions of the sun (beach ball), moon (tennis ball), and Earth (globe) during the course of the month to reinforce the concept that spring tides don't occur only in the spring. Have students complete the activity and review the answers together.

### Day Four

**Vocabulary:** *navigate*

**Materials:** page 108; diagram of complete moon phases (optional)

Have students read the passage and look at the diagram. You may want to review additional phases of the moon, including waning crescent (between last quarter and new moon), waxing crescent (between new moon and first quarter), waxing gibbous (between first quarter and full moon), and waning gibbous (between full moon and third quarter). Then have students complete the activities. For the oral activity, have students talk in pairs or small groups.

### Day Five

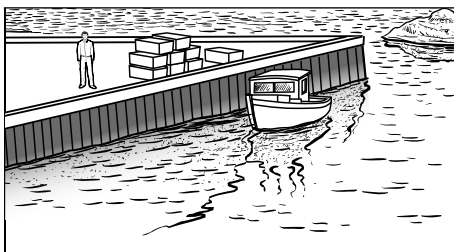
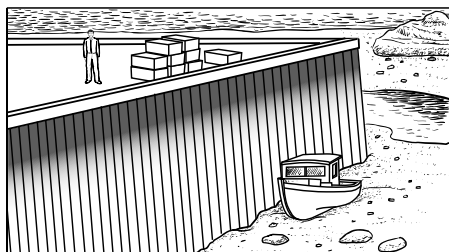
**Materials:** page 109

Have students complete the page independently. Then review the answers together.

**Day  
1****Weekly Question****What causes ocean tides?**

The daily rise and fall of the sea can be seen at beaches around the world. These changes in sea level are called **tides**. A high tide occurs when the sea level is at its highest point of the day. At low tide, the water level is at its lowest. These regular cycles of changing sea levels are caused by the gravitational pull of the moon and sun.

The difference between high and low tide is called the **tidal range**. The tidal range varies between locations, depending on the shape of the coastline. The most extreme tidal range in the world is in the Bay of Fundy in eastern Canada. Here, water is funneled from a wide bay into a narrowing river, causing dramatic sea level changes. In fact, the difference between high and low tide can exceed 55 feet!

**high tide****low tide****Vocabulary****tide**

tyde  
the rise and fall of  
sea level

**tidal range**

TY-dul raynj  
the difference in  
height between  
high and low tide

**A.** The average height of the ocean's surface at a particular location is measured as 0 feet. Use this information to answer the questions.

1. If the water measures  $-5$  feet at low tide and 3 feet at high tide, what is the tidal range? \_\_\_\_\_

2. What is the tidal range if the water measures 2 feet at high tide and  $-1$  foot at low tide? \_\_\_\_\_

**B.** It usually takes about 6 hours to go from high tide to low tide. If you were in a boat out in the middle of the ocean, do you think you would notice the change in sea level? Explain your answer.

\_\_\_\_\_

Name \_\_\_\_\_

**Day  
2**

**Weekly Question**

## **What causes ocean tides?**

To understand the effect of gravity on ocean tides, the first thing to remember is that every object with mass exerts gravitational force. Simply put, the moon has mass, so its gravity pulls on Earth. Earth's oceans respond to the tug of the moon by bulging up toward it. This bulge is what we experience as high tide. The bulge actually forms on both sides of Earth—one directly under the moon, and one on the opposite side. In between the bulges, the ocean dips. These dips are the low tides.

As Earth rotates, the giant bulges in the ocean move so that one bulge always stays directly under the moon, while the other stays on the opposite side. You might think of the tide as a giant wave that follows the moon across the ocean. In one 24-hour period, two high tides and two low tides sweep across the planet.

- A. Write an "H" next to the city experiencing high tide and an "L" next to the city experiencing low tide.**



- B. Answer the questions.**

1. How many high tides does the planet experience each day? \_\_\_\_\_
2. If the moon had more mass, what effect do you think this would have on Earth's tides? Explain what would happen to the bulges and dips in the ocean.

\_\_\_\_\_  
\_\_\_\_\_

**Daily Science**

**Big  
Idea 4**

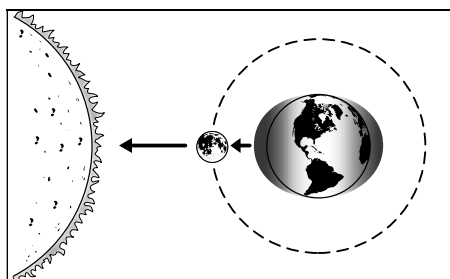
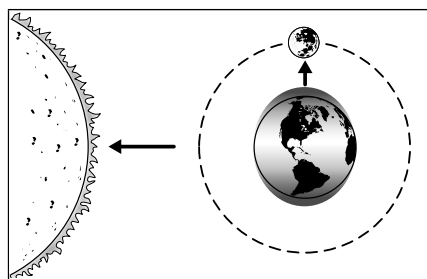
**WEEK 2**



**Day  
3****Weekly Question****What causes ocean tides?**

The moon is not the only thing that affects Earth's tides. The sun's gravity also has an effect, but it is less than the moon's. This is because, although the sun is much more massive than the moon, it is much farther away. The sun is so distant that its gravitational effect on our tides is only half that of the moon's.

The fact that the moon orbits Earth means that sometimes the sun, moon, and Earth are aligned. When the sun and moon are aligned, their gravitational effects combine to produce the highest high tides and the lowest low tides. These tides are called **spring tides**, and they occur twice a month, every month of the year. When the sun and moon are at right angles to each other, however, their gravitational effects work against each other. High tides are not very high and low tides are not very low. These tides are called **neap tides**. Like spring tides, neap tides also happen twice a month.

**spring tide****neap tide**

Answer the questions.

1. About how many spring tides occur each year? \_\_\_\_\_
2. Why does the moon have a stronger pull on the tides than the sun does?  
\_\_\_\_\_
3. When is there a greater tidal range, during spring tides or neap tides?  
Explain your answer.  
\_\_\_\_\_  
\_\_\_\_\_

**Vocabulary****neap tide**

NEAP tide  
a tide that occurs twice a month and results in the smallest change in sea level

**spring tide**

SPRING tide  
a tide that occurs twice a month and results in the greatest change in sea level

Name \_\_\_\_\_

Daily Science

## Big Idea 4

WEEK 2

Day 4

### Weekly Question

## What causes ocean tides?

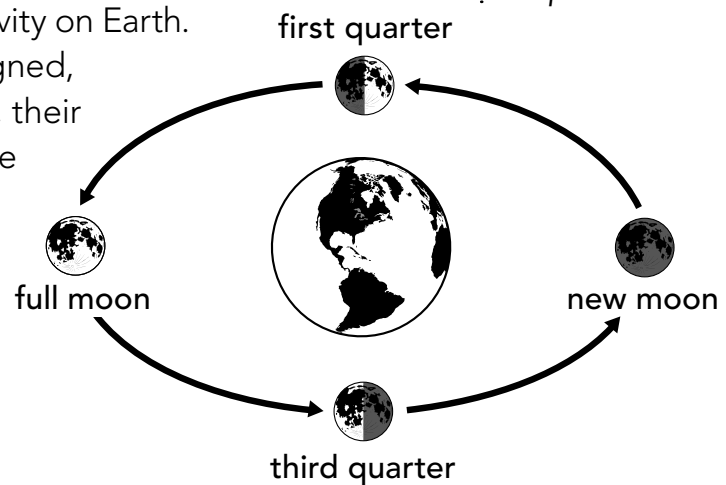
Predicting tides is important for many reasons, especially because low tides sometimes expose dangerous rocks or shallow areas that are difficult for ships to **navigate** around. In the past, sailors used the phases of the moon to predict tides. Sailors discovered that spring tides happened at the same time as the full or new moon. And the neap tides occurred during the first or third quarters of the moon.

It wasn't until Sir Isaac Newton produced his theory of gravity in 1687 that people understood why there was a relationship between the height of a tide and the phase of the moon. Newton knew that the sun and moon exerted gravity on Earth. He theorized that when these bodies aligned, as happened during a full or new moon, their gravitational forces combined to make the tides more extreme.

### Vocabulary

#### navigate

NAV-ih-gayt  
to steer or follow  
a planned course



- A. Explain how Isaac Newton's theory of gravity accounted for the occurrence of spring tides when the moon was full or new.

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- B. Even though the tides are the same during a full moon and a new moon, one of these moon phases helps sailors navigate better at night. Which one? Explain your answer.

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What other reasons might there be for predicting the tides? When and where would it be important to know how high or low the tide will be?

Name \_\_\_\_\_

**Day  
5**

**Weekly Question**

# What causes ocean tides?

A. Use the words in the box to complete the paragraph.

tidal range      neap tides  
spring tides      navigate

Tides are caused by the gravitational pull of the moon and the sun. When the moon and sun are aligned, they produce \_\_\_\_\_, or tides with the biggest \_\_\_\_\_. When the sun and the moon are at right angles to each other, they produce \_\_\_\_\_. Sailors predicted these tides so they could better \_\_\_\_\_ through dangerous waters.

B. The chart below shows the early morning low tides and evening high tides for Monterey Bay, California, in June of 2009. Use it to answer the questions.

|         | Low Tide |           | High Tide |          | Phase                                                                                               |
|---------|----------|-----------|-----------|----------|-----------------------------------------------------------------------------------------------------|
| June 16 | 12:08 AM | 2.0 feet  | 6:08 PM   | 4.8 feet | third quarter  |
| June 17 | 1:11 AM  | 1.3 feet  | 6:42 PM   | 5.2 feet |                                                                                                     |
| June 18 | 2:04 AM  | 0.6 feet  | 7:20 PM   | 5.6 feet |                                                                                                     |
| June 19 | 2:52 AM  | -0.2 feet | 8:01 PM   | 6.0 feet | crescent       |
| June 20 | 3:38 AM  | -0.9 feet | 8:46 PM   | 6.4 feet |                                                                                                     |
| June 21 | 4:24 AM  | -1.4 feet | 9:33 PM   | 6.7 feet |                                                                                                     |
| June 22 | 5:10 AM  | -1.9 feet | 10:22 PM  | 6.8 feet | new moon       |
| June 23 | 5:57 AM  | -1.7 feet | 11:13 PM  | 6.7 feet |                                                                                                     |

- The lowest tides occurred during which phase of the moon? \_\_\_\_\_
- On which date did the spring tides occur? \_\_\_\_\_
- On which date was the tidal range the least? \_\_\_\_\_

Daily Science

**Big  
Idea 4**

**WEEK 2**



*Gravity is the force that keeps planets in orbit around the sun, and the moon in orbit around Earth.*

## Week 3

# Why are planets round?

This week students learn that planets are round due to the amount of mass, and thus gravity, they have. Gravity acts from a center of mass, pulling all matter in toward it. When an object becomes big enough, the only way for all its matter to be as close to the center of mass as possible is to form a sphere.

While all planets must be round, not all round objects are planets. For example, Pluto is round but is no longer considered a planet because scientists discovered that it does not exert enough gravitational force to control all the objects around it in space. Students also learn that while all planets look round, not all of them have a perfectly spherical shape. In fact, Earth itself bulges slightly at the equator due to the centrifugal force of its rotation.

### Day One

Vocabulary: *spherical*

Materials: page 111

Introduce the vocabulary word and point out its relationship to the word *sphere*. Before students read the passage, discuss the names and descriptions of the planets of the solar system and the order of their distance from the sun. After students have finished reading, have them complete the activities. For the oral activity, point out to students that a planet's gravity can control both man-made objects, such as satellites, and natural objects, such as moons or rings.

### Day Two

Vocabulary: *accretion, coalesce*

Materials: page 112

Introduce the vocabulary. Then ask students to give examples of things that get bigger because they "stick together," or accrete. (e.g., dust balls under the bed, wads of sticky tape, rain droplets in a cloud, etc.) After students read the passage, have them complete the activities. Review the answers together.

### Day Three

Materials: page 113

After students read the passage, invite them to try to balance their pencils across the end of one finger. Explain that if you want to balance an object, you have to find its center of mass. Have students complete the activities. Review the answers together.

### Day Four

Vocabulary: *centrifugal force*

Materials: page 114

Introduce the vocabulary word and, to confirm students' understanding, draw a circle and an arrow pointing away from its center to show the direction of centrifugal force. After students read the passage, have them complete the activity. For question 3, you may want to review with students the effects of gravity on weight (Week 1), and how distance from an object's center of mass decreases gravitational force.

### Day Five

Materials: page 115

Have students complete the page independently. Then review the answers together.

Name \_\_\_\_\_

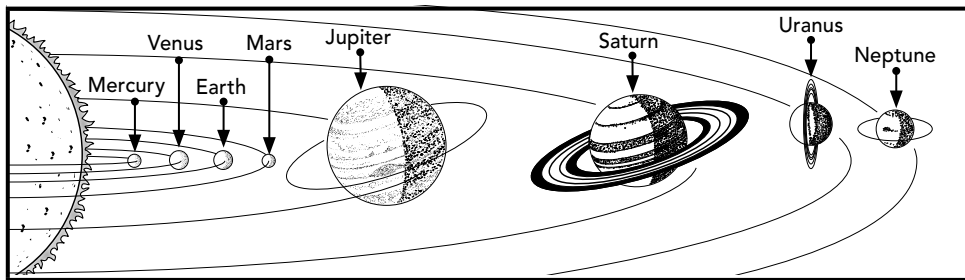
**Day  
1**

**Weekly Question**

## Why are planets round?

There are eight planets in our solar system: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune. Some planets are much larger than others, and some are surrounded by rings or moons. But all planets have three things in common. They orbit the sun, they are massive enough that their gravity controls all the objects in the area around them, and they are **spherical**.

Although you might not think of "roundness" as a particularly special or unusual quality, most objects in the solar system are not round. Millions of asteroids between the orbits of Mars and Jupiter are irregularly shaped chunks of rock. Planets are round because of their large mass and gravitational force.



**A.** Check the box next to the object that is *spherical*.

- ☐ paper tube    ☐ egg    ☐ football    ☐ basketball

**B.** What are three things that all planets have in common?

1. \_\_\_\_\_ 3. \_\_\_\_\_  
2. \_\_\_\_\_



Pluto would be classified as the ninth planet if it were not for the fact that there are millions of other space rocks within its orbit that its gravity doesn't control. What are two examples of objects that are controlled by a planet's gravity?

**Daily Science**

**Big  
Idea 4**

**WEEK 3**

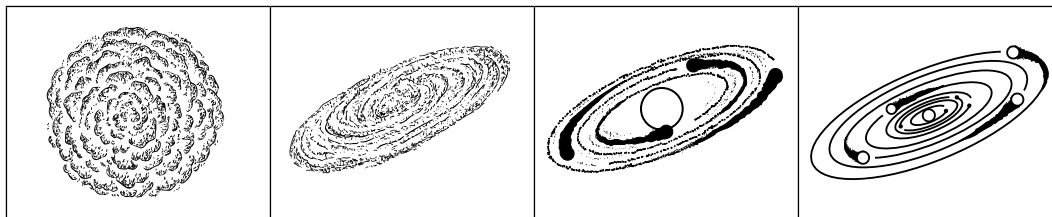
### Vocabulary

#### **spherical**

SFEER-ih-kul  
round, ball-shaped;  
having a surface  
equally distant  
from the center  
at all points

**Day  
2****Weekly Question****Why are planets round?**

Most scientists today believe that the solar system formed when a giant cloud of gas and dust contracted into a rotating disk of matter. Most of this material **coalesced** in the center of the disk and became our sun. The rest formed small, rocky bodies or balls of gas. Over time, gravitational force allowed these objects to attract and collect other chunks of rock or molecules of gas in their regions of space. As these objects grew in size, their gravity increased. This allowed them to attract and gather even more material. This process, called **accretion**, is believed to have formed the planets, asteroids, comets, and other bodies in our solar system.

**Formation of the Solar System****Vocabulary****accretion**

uh-CREE-shun  
the process of becoming larger by adding more material

**coalesce**

koh-uh-LESS  
to unite; to grow together

**A. Write true or false.**

1. Our solar system began as a rotating disk of gas and dust. \_\_\_\_\_
2. As the gravity of objects in the solar system increased, the objects became bigger. \_\_\_\_\_
3. Most of the gas and dust in the early solar system became the planets. \_\_\_\_\_

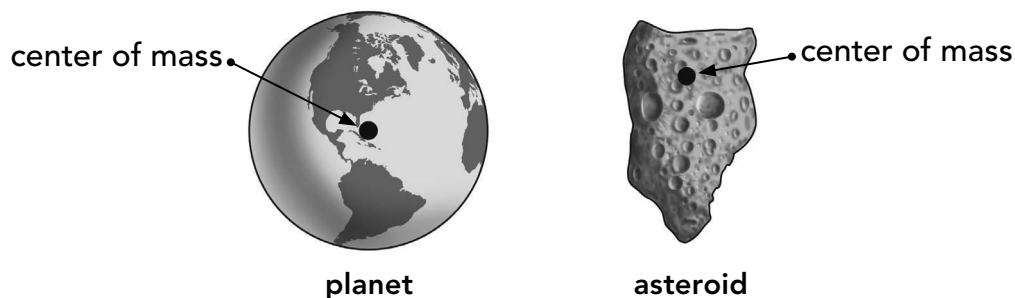
**B. Use the vocabulary words to complete the sentences.**

1. Dust and other particles of matter can \_\_\_\_\_ to form the beginning of a planet.
2. Through the process of \_\_\_\_\_, an object grows in size and increases its gravitational force.

**Day  
3****Weekly Question****Why are planets round?**

Gravity acts to pull everything toward an object's *center of mass*. The center of mass is a single imaginary point inside an object from which gravity seems to act. As an object acquires more mass, its gravity increases and more matter is pulled toward the object's center. When an object is massive enough, gravity forces it into a round shape. This is because the only way to get all of the object's matter as close to its center of mass as possible is to form a sphere. Every point on the surface of a sphere is equally distant from its center.

Objects such as asteroids or small moons are irregularly shaped because they have much less mass than planets. Therefore their gravitational force is not strong enough to form a sphere. Unlike planets, whose center of mass is also the center of the sphere, asteroids have a center of mass that may actually be located off-center, depending on where the most mass has accumulated.



**A.** Check the box next to the analogy that is *not* correct.

- ☐ **Center** is to **sphere** as **center of mass** is to **planet**.
- ☐ **Asteroid** is to **irregular-shaped** as **planet** is to **spherical**.
- ☐ **Center of mass** is to **planet** as **axis** is to **Earth**.
- ☐ **Planet** is to **asteroid** as **round** is to **irregular**.

**B.** Explain in your own words why an object with a lot of mass takes the shape of a sphere.

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Name \_\_\_\_\_

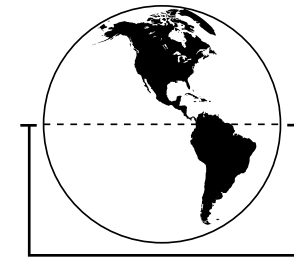
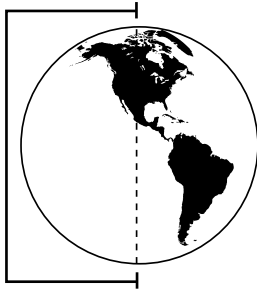
**Day  
4**

**Weekly Question**

## Why are planets round?

Even though Earth's gravity is strong enough to pull all of the planet's matter evenly toward its center, Earth is not a perfect sphere. This is because Earth's rotation creates **centrifugal force**. Centrifugal force is the same force that causes you to slide to one side when you go around a curve on a roller coaster. On Earth, centrifugal force pushes out the planet's surface at the equator, causing it to bulge slightly around the middle. In fact, Earth's diameter is 26 miles wider when measured at the equator than when measured from the North Pole to the South Pole. Believe it or not, this means that you weigh slightly less at the equator than you do at the poles! This is because at the equator, you are a little farther away from Earth's center of mass than you are at the poles.

diameter: 7,900 miles



diameter: 7,926 miles

Answer the questions.

1. Why does Earth's surface bulge at the equator? Use the vocabulary word in your answer.

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2. What would have to happen in order for Earth to become a perfect sphere?

---

3. Why does being farther from Earth's center of mass cause you to weigh less?

---

Daily Science

**Big  
Idea 4**



**WEEK 3**

### Vocabulary

#### **centrifugal force**

sen-TRIF-uh-gul  
forss

*the force that tends  
to push an object  
outward when it  
rotates around a  
center*



Name \_\_\_\_\_

**Day  
5**

**Weekly Question**

## **Why are planets round?**

**A.** Use the words in the box to complete the sentences.

center of mass

accretion

spherical

centrifugal force

coalesced

1. Earth is not a perfect sphere because \_\_\_\_\_ causes the equator to bulge out slightly.
2. Planets are \_\_\_\_\_ so that all of their matter can be as close to the \_\_\_\_\_ as possible.
3. Our solar system formed when gas and dust \_\_\_\_\_ into bodies that grew larger and larger over time through the process of \_\_\_\_\_.

**B.** Explain how mass and gravity cause planets to be round.

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**C.** What two qualities, besides roundness, must an object have in order to be considered a planet?

1. \_\_\_\_\_
2. \_\_\_\_\_

Daily Science

**Big  
Idea 4**



**WEEK 3**



*Gravity is the force that keeps planets in orbit around the sun, and the moon in orbit around Earth.*

## Week 4

# Why don't planets crash into each other?

Except in the plots of science fiction thrillers, we don't expect planets to collide or otherwise smash into each other as they travel through the vast expanses of outer space. Instead, planets move in well-defined and separate paths, orbiting the sun in obedience with the laws of motion and force.

This week students learn that the motions of planets are governed by the opposing influences of gravity and inertia. Planets follow elliptical orbits and, unlike objects in Earth's atmosphere, do not encounter air resistance, friction, or large objects that can impede their path. Early in the history of the solar system, however, small planetary bodies did crash into each other during the process of accretion.

### Day One

Vocabulary: *inertia*

Materials: page 117

Remind students that gravity is the force of mutual attraction that exists between any two bodies that have mass. Introduce the vocabulary word and have students read the passage. Then have them complete the activities independently. Review the answers as a group.

### Day Two

Vocabulary: *elliptical*

Materials: page 118

Introduce the vocabulary word and point out its relationship to the word *ellipse*. Draw an ellipse and a circle on the board to make sure students understand the difference. Then have students read the passage and complete the activities. Review the answers together.

### Day Three

Vocabulary: *free fall, trajectory*

Materials: page 119

Ask students to describe what sensation they imagine astronauts experience when orbiting Earth in a spacecraft. (floating, weightlessness, etc.) Tell students that these astronauts are actually falling in space. Introduce the vocabulary. Then have students read the passage and complete the activity. Review the answers together.

### Day Four

Vocabulary: *comet*

Materials: page 120

Review the theory of planetary accretion described in Week 3. Then have students read the passage and complete the activities. For the oral activity, you may want to prompt students by explaining that scientists believe an asteroid collision led to the extinction of the dinosaurs (because dust from the impact blocked out the sun), and this in turn allowed mammals to evolve.

### Day Five

Materials: page 121

Have students complete the page independently. Then review the answers together.

Name \_\_\_\_\_

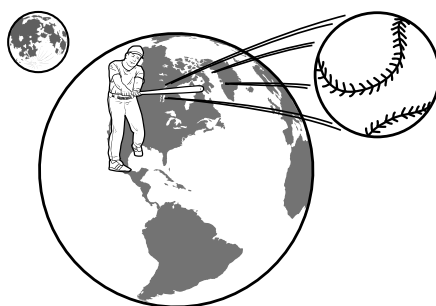
**Day  
1**

**Weekly Question**

**Why don't planets crash  
into each other?**

Just as we know that the sun will rise every morning, we expect the planets and the moon to stay in their orbits. And rightly so. For 400 years, people have understood that the movements of Earth, the moon, the planets, and all the other bodies in the universe are determined by precise and predictable laws of force and motion. These laws tell us that the path of an object is controlled by two forces: gravity and **inertia**.

Inertia keeps an object moving in a straight line and at a constant speed until it is pushed or pulled on by a force. Everything with mass has inertia, and the more massive something is, the more inertia it has. In the absence of all other forces, such as air resistance or gravity, inertia would allow a baseball that was hit out of the park to travel in a straight line all the way to the edge of the universe!



**Vocabulary**

**inertia**

ih-NUR-shuh  
*a property of matter that keeps an object moving in a straight line and at a constant speed*

**A.** What two forces govern the movement of the planets and all other bodies in the universe?

1. \_\_\_\_\_ 2. \_\_\_\_\_

**B.** Cross out the incorrect word in each sentence below and write the correct word above it to make the statement true.

1. Gravity keeps an object moving in a straight line at a constant speed.
2. The path of a baseball is unaffected by the laws of motion.
3. The more mass an object has, the less inertia it has.

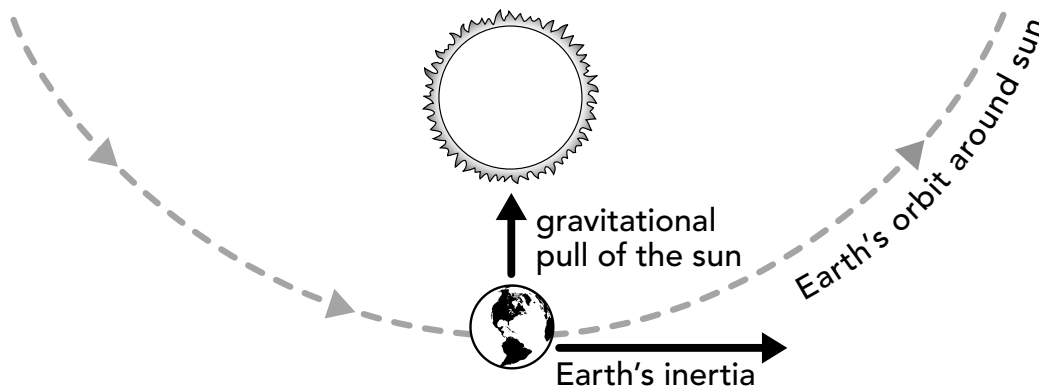
**Day  
2****Weekly Question****Why don't planets crash into each other?**

Planets move in well-defined and separate paths, obeying the laws of force and motion as they orbit the sun. What keeps planets in their orbit is the balance between the opposing forces of gravity and inertia. The sun's gravity pulls planets toward it, and inertia keeps planets moving in a straight line. The combined result is an **elliptical** orbit, meaning that the planets revolve around the sun in oval-shaped paths. The sun is almost, but not quite, at the center of this oval. Similarly, the orbit of the moon around Earth is elliptical.

Unlike a baseball hit through the air, objects in space don't encounter air resistance or other types of friction that could slow their motion. So the planets just keep circling the sun. And in the absence of all other forces, they will continue to do this forever.

**Vocabulary****elliptical**

ee-LIP-tih-kul

*having the shape of an oval or flattened circle***A. Complete the sentences, using words from the passage.**

1. The balance between gravity and \_\_\_\_\_ keeps planets in their orbits.
2. Air resistance is a kind of \_\_\_\_\_ that slows down an object's motion.
3. Gravity and inertia maintain the moon's \_\_\_\_\_ around Earth.

**B. Complete the analogy.**

**Circle** is to **round** as **oval** is to \_\_\_\_\_.

**Day  
3****Weekly Question****Why don't planets crash  
into each other?**

Astronauts orbiting Earth in a spacecraft are subject to the same laws of gravity and inertia that control the motions of the moon and planets. When you see astronauts floating inside their spacecraft, they may appear to be weightless, but they are actually still in the grip of Earth's gravity. Astronauts float because they are in **free fall**. During free fall, the gravitational force that causes a spacecraft and its contents to "fall" toward Earth is exactly matched by the forces of inertia that keep the spacecraft traveling in a straight line. The result is a curved **trajectory**—an elliptical orbit around Earth. Because downward fall is balanced by sideways motion, the spacecraft doesn't ever actually hit Earth.

You, too, may have experienced free fall momentarily on an amusement park ride. During a sudden drop, there is a brief sensation of weightlessness as your seat takes the plunge and inertia attempts to keep you in place. But hold on to your belongings, because coins and sunglasses will seem to "float" out of your pockets!

**Vocabulary****free fall**

FREE fall  
the unchecked fall  
of an object

**trajectory**

trah-JEK-tuh-ree  
the path of an  
object moving  
through space

Use the vocabulary words and information from the passage to complete the paragraph below.

Every object that moves through space follows a \_\_\_\_\_.

Even astronauts who appear to be floating are actually in \_\_\_\_\_.

This means that the downward force of \_\_\_\_\_ is exactly  
balanced by \_\_\_\_\_.

Name \_\_\_\_\_

Daily Science

# Big Idea 4



WEEK 4

Day 4

## Weekly Question

# Why don't planets crash into each other?

Although the balance between inertia and gravity keeps the planets in stable, predictable trajectories around the sun, this was not the case when the solar system first formed. At that time, small, solid bodies that coalesced early in the solar system's history did not have stable orbits. These bodies crashed into each other, and through the process of accretion, became the large planets orbiting the sun today. Objects such as **comets** and asteroids may be the leftovers.

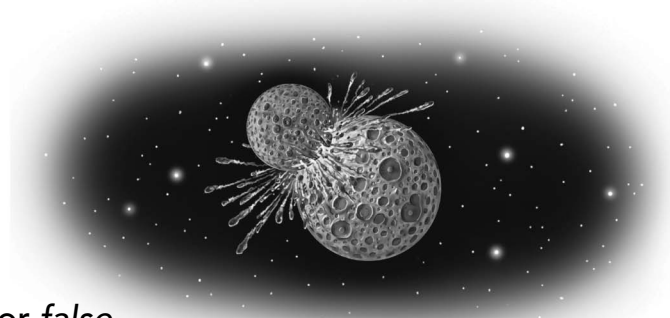
One of the most spectacular collisions between large bodies in our solar system may have happened right in our own "neighborhood." Scientists hypothesize that very early in Earth's history, an object the size of Mars collided with Earth and punched out a huge mass of material that became our moon. Luckily for us, a similar collision is probably impossible today.

## Vocabulary

### comet

KAH-mit

*an icy chunk of rock from a region of space beyond the orbit of Neptune*



Write *true* or *false*.

1. When the solar system first formed, objects in space moved in predictable trajectories. \_\_\_\_\_
2. Comets may be remains from the formation of the solar system. \_\_\_\_\_
3. The moon was formed when Earth and Mars crashed into each other. \_\_\_\_\_



## Talk

In the past, Earth was a planet where collisions with asteroids, meteorites, and comets happened regularly. How do you think these collisions helped shape life on Earth today?

Name \_\_\_\_\_



**Day  
5**

**Weekly Question**

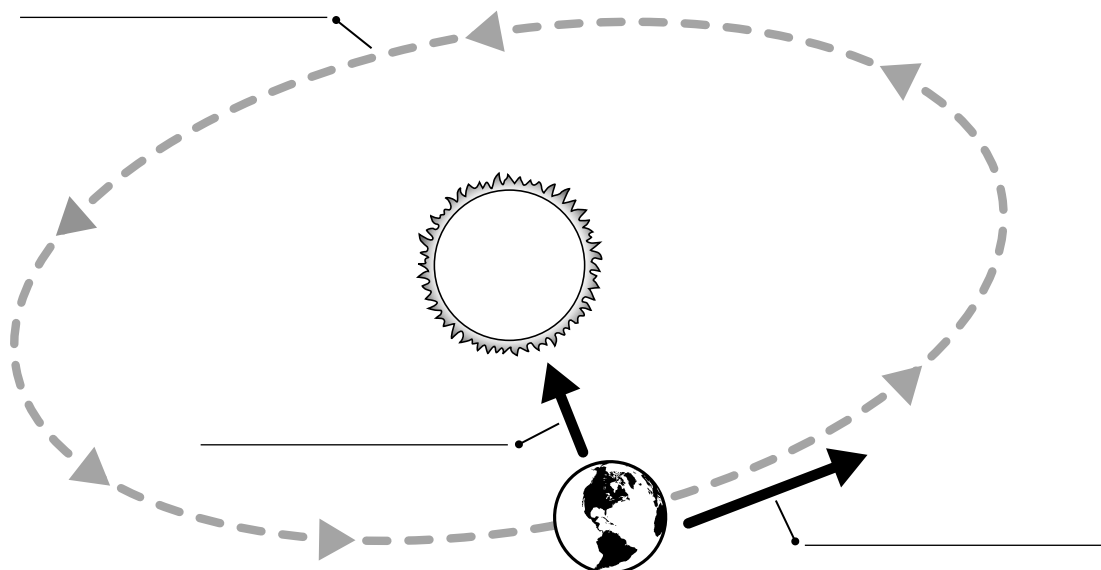
**Why don't planets crash  
into each other?**

A. Write the word from the box that completes each sentence.

elliptical    comets    trajectory  
free fall    inertia

1. When astronauts float in space, they are really in \_\_\_\_\_.
2. The orbit of Earth around the sun is \_\_\_\_\_, instead of completely circular.
3. An object's \_\_\_\_\_ is the path it takes through space.
4. \_\_\_\_\_ is the property of matter that keeps it moving in a straight line.
5. Scientists believe that \_\_\_\_\_ may be leftovers from the solar system's formation.

B. Label *gravity*, *inertia*, and *orbit* in the diagram below.



Name \_\_\_\_\_

**Unit  
Review**

**Comprehension**

**Matter of Fact**



Fill in the bubble next to the correct answer.

1. Which statement is true about gravity?
  - (A) Gravity doesn't exist on small planets or moons.
  - (B) Gravity has nothing to do with an object's mass.
  - (C) Gravity decreases as distance from the center of mass increases.
  - (D) Gravity only works if you are touching something.
  
2. Which statement is true about tides?
  - (A) Spring tides only happen in the spring.
  - (B) The lowest tides happen during a full or a new moon.
  - (C) Tides are caused by Earth's orbit around the sun.
  - (D) Tides are caused by tsunamis.
  
3. In order to be a planet, an object must be round, orbit the sun, and \_\_\_\_\_.
  - (A) control other objects in its region
  - (B) shine at night
  - (C) rotate around its axis
  - (D) have inertia
  
4. Why don't the planets in our solar system crash into each other?
  - (A) Gravity forces them apart.
  - (B) Laws of motion don't apply in space.
  - (C) They move too fast.
  - (D) Gravity and inertia are balanced.
  
5. Weight is determined by \_\_\_\_\_.
  - (A) mass alone
  - (B) mass and gravitational force
  - (C) gravitational force alone
  - (D) gravitational force and inertia
  
6. The bulge at Earth's equator is due to \_\_\_\_\_.
  - (A) gravitational force
  - (B) an elliptical orbit
  - (C) centrifugal force
  - (D) a buildup of dust and gas



Name \_\_\_\_\_

**Unit  
Review**

**Vocabulary**

**Word Accretion**

Daily Science

**Big  
Idea 4**



**WEEK 5**

Write the word from the box that matches or completes each clue.

1. Earth has an \_\_\_\_\_ orbit around the sun.
2. a force of attraction between two bodies \_\_\_\_\_
3. shaped like a ball \_\_\_\_\_
4. to come together or unite \_\_\_\_\_
5. Planets became larger through the process of \_\_\_\_\_.
6. measured in pounds \_\_\_\_\_
7. A feeling of weightlessness happens in a state of \_\_\_\_\_.
8. When the sun and moon are aligned, they produce \_\_\_\_\_.
9. This property keeps objects moving in a straight line. \_\_\_\_\_
10. The difference between high and low tide is called the \_\_\_\_\_.
11. a force created by Earth's rotation \_\_\_\_\_
12. the amount of matter in an object \_\_\_\_\_
13. When the sun and moon are at right angles, they produce \_\_\_\_\_.
14. the path of an object in space \_\_\_\_\_
15. Low tides may make it difficult for ships to \_\_\_\_\_.

accretion  
centrifugal force  
coalesce  
elliptical  
free fall  
gravitational force  
inertia  
mass  
navigate  
neap tides  
spherical  
spring tides  
tidal range  
trajectory  
weight

Name \_\_\_\_\_

## Unit Review

### Visual Literacy

# It All Falls Together

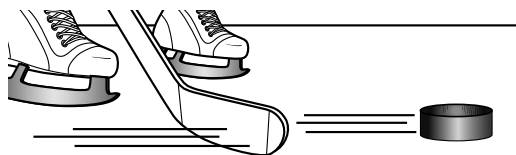
Look at the pictures below. Write whether the force of *gravity*, *inertia*, or *both* is being demonstrated. Explain your answer.

Daily Science

## Big Idea 4

WEEK 5

1.

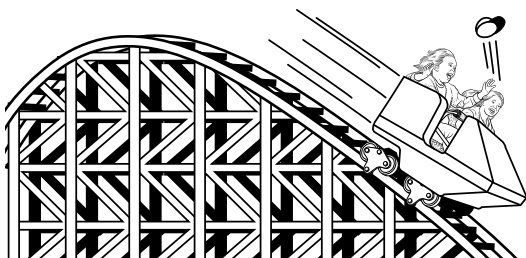


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2.

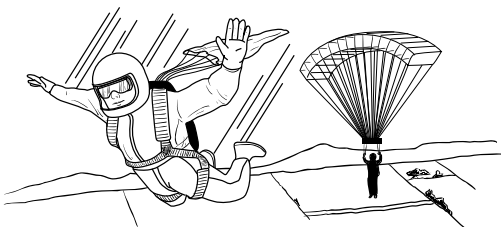


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3.



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4.

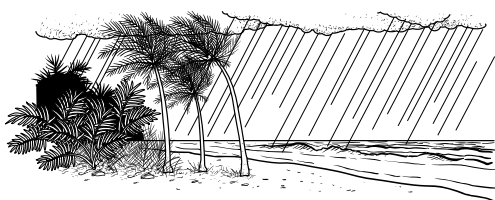


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5.



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Name \_\_\_\_\_

**Unit  
Review**

**Hands-on Activity**

**Gravity's Pull**

Daily Science

**Big  
Idea 4**



**WEEK 5**

The famous thinker Galileo argued that, in the absence of air resistance, two objects of different mass that are dropped at the same moment from the same height should strike the ground at the same time. Legend says he dropped items from the Leaning Tower of Pisa to prove the point. Now you can discover whether Galileo's hypothesis was right.

**What You Need**

- ball
- small rock
- feather
- wad of cotton

1. Line up the items along the edge of a desk or table.
2. Push all the objects off the table at the same time.
3. Record the order in which the objects hit the floor.
4. Repeat the experiment as often as needed to be sure of your results.

**What Did You Discover?**

1. Which object(s) hit the floor first?

\_\_\_\_\_

2. Which object(s) hit the floor last?

\_\_\_\_\_

3. Which objects do you think encountered air resistance? Why?

\_\_\_\_\_

4. What do you think would happen if you dropped the items in a vacuum, where there is no air?

\_\_\_\_\_



Heat flows from warmer objects to cooler ones until both reach the same temperature.

### **Key Concepts**

Conduction, Convection, and Radiation

### **National Standard**

Heat moves in predictable ways, flowing from warmer objects to cooler ones until both reach the same temperature.

While students may intuitively understand the concept of heat flowing from warmer objects to cooler ones, they are not likely to be familiar with the specific ways in which heat is transferred between objects of different temperatures. In this Big Idea, students learn:

- the difference between heat and temperature;
- how microwaves heat food by means of radiation and how hot food heats containers by conduction;
- that hurricanes move heat from the tropics to the poles by means of convection; and
- that a thermos bottle slows heat transfer by blocking conduction, convection, and radiation.

### **Teacher Background**

Anyone who has ever warmed his or her hands by the fire has experienced the effects of heat transfer: heat from the fire flows to the cold hands and warms them up. Yet the same is true of an ice cube in a bowl of hot soup. Coldness from the ice cube doesn't flow to the soup. It is heat from the soup that flows to the ice cube.

Heat moves between objects of different temperatures in a variety of ways. If you warm your hands on a hot cup of cocoa, heat flows from the cup to your hands by means of conduction, which is the transfer of heat through physical contact. When you warm your hands by a fire, waves of energy from the flames transfer heat to your hands by means of radiation, or movement of energy through matter or empty space. And blowing hot air on your hands warms them by convection, which is the transfer of heat through the movement of a liquid or gas. Understanding these three different processes makes it possible to comprehend everything from how thermoses and microwave ovens work to what causes weather disturbances such as hurricanes.

**For specific background information on each week's concepts, refer to the notes on pp. 128, 134, 140, and 146.**

## Unit Overview

### WEEK 1: How does a thermometer work?

**Connection to the Big Idea:** A thermometer measures temperature, which is not the same thing as heat. Temperature is the measure of the kinetic energy of a substance's molecules. Heat is the transfer of thermal energy between substances. Students learn that outdoor thermometers measure temperature with the help of liquid that expands or contracts in response to gaining or losing kinetic energy.

**Content Vocabulary:** *heat, kinetic energy, phase change, room temperature, temperature, thermal energy*

### WEEK 2: How does a microwave oven cook food?

**Connection to the Big Idea:** Microwaves transfer thermal energy by means of radiation to cook food, and hot food transfers heat to its container by means of conduction. Students learn that radiation is the movement of energy through empty space and matter, and conduction is heat transfer through physical contact.

**Content Vocabulary:** *conduction, conventional, electromagnetic, microwaves, radiation, wavelength*

### WEEK 3: What causes hurricanes?

**Connection to the Big Idea:** Hurricanes provide an example of convection, or the transfer of heat through the movement of a liquid or a gas. Students learn that hurricanes are a powerful mechanism for transferring heat from tropical oceans to higher latitudes. Heat mixes into the

atmosphere through convection of warm air. As the air cools, more heat is released into the atmosphere when water vapor condenses into raindrops.

**Content Vocabulary:** *circulating, convection, heat of condensation, hurricane, satellite*

### WEEK 4: How does a thermos work?

**Connection to the Big Idea:** A thermos bottle is designed to slow the flow of heat by conduction, convection, and radiation. Students learn that through its use of insulating materials, mirrored surfaces, and a vacuum, this simple device can keep both hot things hot and cold things cold.

**Content Vocabulary:** *insulator, vacuum*

### WEEK 5: Unit Review

You may choose to do these activities to review concepts about heat transfer.

**p. 152: Comprehension** Students answer multiple-choice questions about key concepts in the unit.

**p. 153: Vocabulary** Students write vocabulary words from the unit to match clues.

**p. 154: Visual Literacy** Students label a picture of a hot grill to show where conduction, convection, and radiation are taking place.

**p. 155: Hands-on Activity** Students use food coloring to watch how heat moves by means of convection through water of different temperatures. Instructions and materials needed for the activity are listed on the student page.



*Heat flows from warmer objects to cooler ones until both reach the same temperature.*

## Week 1

# How does a thermometer work?

While it might be common knowledge that thermometers are used to measure temperature, few people realize that temperature is *not* the same thing as heat. Temperature is a measurement of the average kinetic energy, or energy of motion, of a substance's molecules. Heat, on the other hand, refers to the flow of thermal energy between objects of different temperatures.

This week students learn how the jostling and bouncing of molecules results in the exchange of thermal energy between the air and an outdoor thermometer, causing its liquid to expand or contract. When thermal energy stops flowing, the molecules inside the thermometer have reached the same temperature as the air, and the level of the liquid indicates the temperature. Students also discover that the properties of water make it unsuitable for use in a thermometer because water becomes ice at temperatures below 0°C and a gas at temperatures above 100°C.

### Day One

**Vocabulary:** *heat, kinetic energy, temperature*

**Materials:** page 129

Invite students to imagine themselves stepping outside on a really hot day and to describe what it feels like. Explain that while heat may make them feel slow or sluggish, heat makes the molecules in the air move faster and more energetically. Introduce the vocabulary and direct students to read the passage. Then have them complete the activities.

### Day Two

**Vocabulary:** *thermal energy*

**Materials:** page 130

Introduce the vocabulary word and have students read the passage. Then explain to students that when they feel heat, they are actually experiencing the transfer of thermal energy. Have students complete the activities and review the answers together.

### Day Three

**Vocabulary:** *phase change*

**Materials:** page 131

Introduce the vocabulary word and review the three phases of water. (solid, liquid, gas) Then instruct students to read the passage. Have students complete the activities and review the answers together.

### Day Four

**Vocabulary:** *room temperature*

**Materials:** page 132; different thermometers (optional)

Before students read the passage, you may want to show them different kinds of thermometers, such as a bulb thermometer, spring thermometer, and digital thermometer. Introduce the vocabulary word and have students read the passage. Then have them complete the activities.

### Day Five

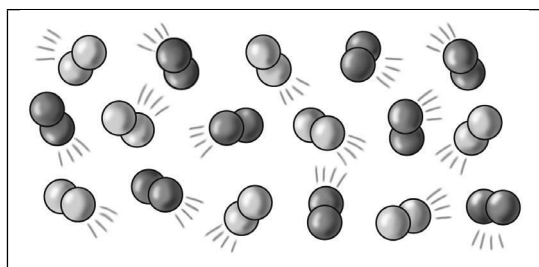
**Materials:** page 133

Have students complete the page independently. Then review the answers together.

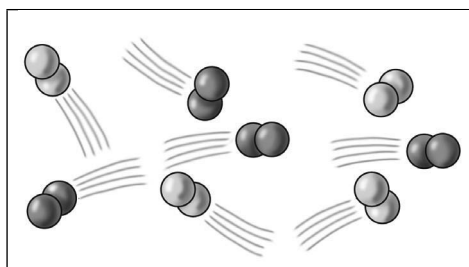
**Day  
1****Weekly Question****How does a thermometer work?**

Check the thermometer on a hot day, and it will tell you that the **temperature** is high. But even though you may “feel the heat” when you step outside, **heat** and temperature are not the same thing.

The best way to understand the difference between heat and temperature is to think about molecules. Molecules are the individual particles that make up a substance. Molecules have both mass and speed, and the hotter a substance is, the faster its molecules move. Temperature is the measure of the energy that this motion generates, which is called **kinetic energy**. Heat, on the other hand, is the *flow* of energy from warm objects to cool ones as the result of their being at different temperatures.



Air molecules on a cool day



Air molecules on a hot day

**Vocabulary****heat**

heet

*energy that flows between objects of different temperatures*

**kinetic energy**

kih-NET-ik

EN-ur-jee

*energy of motion*

**temperature**

TEM-per-uh-CHUR

*the average kinetic energy of the molecules of a substance*

**A.** Cross out the incorrect word in each sentence and write the correct one above it to make the statement true.

1. The hotter a substance is, the slower its molecules move.
2. Heat measures the average kinetic energy of molecules.
3. Energy generated by the movement of molecules is called heat energy.
4. Molecules have both color and speed.

**B.** Explain in your own words the difference between temperature and heat.

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**Day  
2****Weekly Question****How does a thermometer work?**

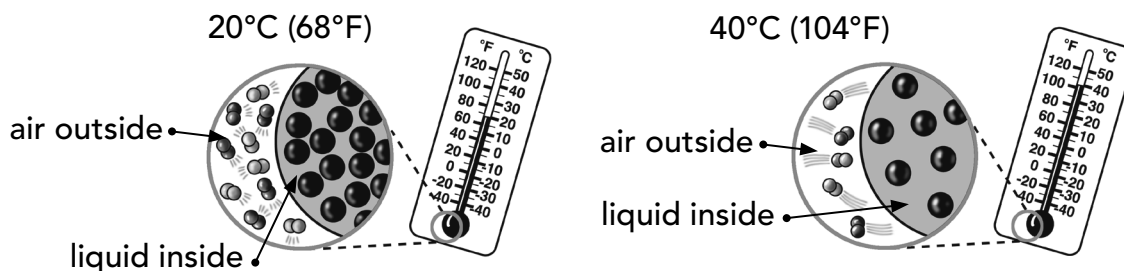
A typical outdoor thermometer consists of a thin glass tube filled with a colored liquid. Like most substances, the liquid inside a thermometer expands when it is heated and contracts when it is cooled. The height of the column of liquid, which “tells” you the temperature, is read from a scale along the side of the thermometer.

Knowing that temperature is actually a measure of the kinetic energy of molecules makes it easier to understand how a thermometer works. As molecules of air move, they hit the walls of a thermometer with kinetic energy. Each collision between an air molecule and the wall of the thermometer results in a transfer of **thermal energy** from the air to molecules in the thermometer. This causes the molecules in the liquid to gain kinetic energy and move farther apart, expanding the liquid. When the liquid inside the thermometer reaches the same temperature as the air, thermal energy stops flowing and the liquid stops expanding. Now you can read the temperature.

**Vocabulary****thermal energy**

THER-mul

EN-ur-jee

*energy of a  
substance  
expressed as  
heat*

- A.** If the temperature is 80°F outside, does the air transfer *more* or *less* thermal energy to a thermometer than if it is 60°F? Explain your answer.

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- B.** Explain why, when you have a fever, you have to keep a thermometer in your mouth for a certain length of time in order to read your correct temperature.

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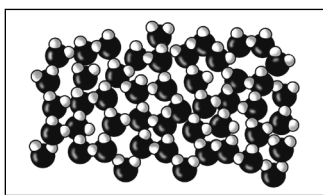
**Day  
3****Weekly Question****How does a thermometer work?**

Water is the most common liquid on Earth, but it is not used in thermometers. Why not? Water is a liquid only between  $0^{\circ}\text{C}$  ( $32^{\circ}\text{F}$ ) and  $100^{\circ}\text{C}$  ( $212^{\circ}\text{F}$ ), which means that when the outside temperature dips below  $0^{\circ}\text{C}$ , the water in the thermometer freezes. And when the temperature is above  $100^{\circ}\text{C}$ , the water turns to gas.

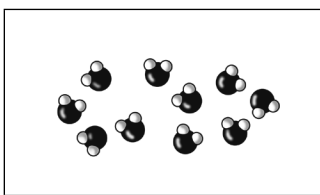
These changes in water's form show that heating or cooling a substance doesn't just affect its temperature. It can also result in a **phase change**. Imagine heating ice cubes in a sauce pan on a stove. First, the ice cubes melt. Then, the water boils. What is happening? The molecules of ice do not have a lot of kinetic energy, so they stay in a fixed place. Heat increases the kinetic energy of the molecules to the point that they leave the solid and begin to flow as liquid water. With enough heat, the molecules move fast enough to leave the liquid and enter the air as a gas.

**Vocabulary****phase change**

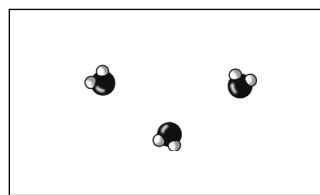
FAZE chaynj  
a change from one  
state of matter into  
another

**Molecules of Water**

solid



liquid



gas

**A. Number the steps in the correct order to show how ice changes into gas.**

- \_\_\_\_\_ The molecules gain enough kinetic energy to leave their solid form.
- \_\_\_\_\_ The water becomes liquid and gets hotter.
- \_\_\_\_\_ Ice is heated and the molecules speed up.
- \_\_\_\_\_ The molecules leave their liquid form and enter the air as a gas.
- \_\_\_\_\_ Ice molecules vibrate in a fixed place.

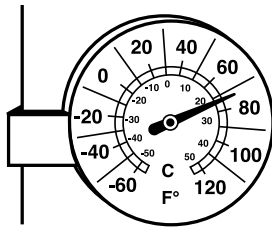
**B. Which of these is *not* a phase change? Check the correct box.**

- |                                                       |                                                            |
|-------------------------------------------------------|------------------------------------------------------------|
| <input type="checkbox"/> steam coming out of a kettle | <input type="checkbox"/> snow being formed into a snowball |
| <input type="checkbox"/> ice cream melting            | <input type="checkbox"/> clouds forming                    |

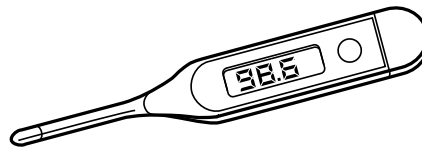
**Day  
4****Weekly Question****How does a thermometer work?**

The liquid that once filled most thermometers was mercury, a heavy metal that has the unusual property of being a liquid at **room temperature**. Unfortunately, mercury was discovered to be toxic and is no longer commonly used. Instead, most thermometers today are filled with red-colored alcohol.

Some thermometers, however, don't use any liquid. For example, a spring thermometer contains a coiled piece of metal that expands when heated. And a digital thermometer detects temperature by using an electronic sensor. But however they are designed, all thermometers have two things in common. They all measure temperature, and they all work because of one basic law of nature—the properties of substances change when the temperature changes.



spring thermometer



digital thermometer

**Vocabulary****room  
temperature**

room  
TEM-per-uh-CHUR  
an average  
temperature of  
20–25°C (68–77°F)

**A.** Since the liquid substance used in most thermometers is alcohol, what does this tell you about the properties of alcohol? Fill in the bubble next to the correct answer.

- ☐ Ⓐ It is toxic.
- ☐ Ⓑ It is a liquid at room temperature.
- ☐ Ⓒ It is a solid at room temperature.
- ☐ Ⓓ It becomes a gas at 100°C and a solid at 0°C.

**B.** Complete the sentences to name two things that all thermometers have in common.

1. They measure \_\_\_\_\_.
2. They work based on the fact that \_\_\_\_\_.

Name \_\_\_\_\_



**Day  
5**

**Weekly Question**

**How does a thermometer work?**

A. Use the words in the box to complete the sentences.

phase change    thermal energy    heat  
temperature    kinetic energy

1. All molecules move, and the energy of their motion is called \_\_\_\_\_.
2. The measurement of the average amount of kinetic energy in the molecules of a substance is \_\_\_\_\_.
3. \_\_\_\_\_ is energy expressed as heat.
4. Heating or cooling a substance can result in a \_\_\_\_\_.
5. \_\_\_\_\_ is the transfer of thermal energy.

B. Summarize the process of how water changes from ice into a gas.  
Use the words *kinetic energy*, *heat*, and *phase change* in your answer.

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C. Check the box next to the phrase that completes the analogy.

Thermal energy is to heat as \_\_\_\_\_.

☐ temperature is to phase change

☐ thermometer is to temperature

☐ ice is to gas

☐ kinetic energy is to motion



*Heat flows from warmer objects to cooler ones until both reach the same temperature.*

## Week 2

# How does a microwave oven cook food?

One of the most familiar and ubiquitous appliances in kitchens today is the microwave oven. Students may be surprised to learn that the technology behind this popular household device originated in a secret weapons program operated by Allied forces during World War II!

This week students discover that microwave ovens cook food by means of radiation—waves of energy that can pass through matter or empty space. Microwave radiation is absorbed by the water molecules in food or beverages; the molecules “flip” back and forth in response to the oscillating electromagnetic fields of the microwaves. It is this molecular motion that then translates into heat, which cooks the food. Since microwave radiation is only absorbed by water molecules, and not by plastic or glass, the containers generally stay cooler than the food. However, a container can heat up in a microwave oven due to physical contact with the hot food itself, which transfers heat to the plate, cup, or bowl by means of conduction.

### Day One

**Vocabulary:** microwaves, radiation, wavelength

**Materials:** page 135

Before students read the passage, draw a wavy line on the board and point out its troughs and peaks. Introduce the vocabulary and, to demonstrate how scientists measure a wavelength, draw a horizontal line between the two peaks you drew on the board. Then have students read the passage and complete the activity. Review the answers together.

### Day Two

**Materials:** page 136

Explain to students that one of the first uses of microwaves was by the British, who used them to detect enemy planes during World War II. This “secret weapon” was known as *radar* (Radio Detection And Ranging). After students have read the passage, have them complete the activities.

### Day Three

**Vocabulary:** conventional, electromagnetic

**Materials:** page 137

After introducing the vocabulary, write *electromagnetic* on the board. Underline *electro* and *magnetic* separately, and explain to students that each underlined phrase stands for the type of energy produced. (electric and magnetic) Then have students read the passage and complete the activities. Review the answers together.

### Day Four

**Vocabulary:** conduction

**Materials:** page 138

Introduce the vocabulary word and have students read the passage and complete the activities. For the oral activity, have students discuss the questions in pairs and then share their answers with the class. If students have trouble coming up with ideas, suggest that they think about things that can be conducted. (an orchestra, a train, an experiment, a meeting, etc.)

### Day Five

**Materials:** page 139

Have students complete the page independently. Then review the answers together.

Name \_\_\_\_\_

**Day  
1**

**Weekly Question**

**How does a microwave oven cook food?**

When you hear the word **radiation**, you might think of x-ray machines or even nuclear weapons. But radiation is also what cooks your food in a microwave oven. Does that mean the food becomes radioactive? Of course not! Radiation is simply the transfer of energy by waves. These waves can move through matter as well as empty space. In fact, radiation from the sun travels 93 million miles through mostly empty space before it reaches Earth.

The sun's energy, or solar radiation, radiates in waves of different **wavelengths**. Waves with the longest wavelengths have the least energy. Waves with the shortest wavelengths have the most energy. **Microwaves** are longer than visible light and have wavelengths measured in centimeters (cm). Microwaves that are about 12 cm in length are the ones used to heat food in microwave ovens.

Use information from the passage and the diagram at the bottom of the page to fix each of the following statements. Cross out the incorrect words and write the correct ones above them.

1. Microwaves are shorter than visible light waves.
2. X-ray radiation is used to heat food.
3. The longest wavelengths have the most energy.
4. Radiation is the transfer of matter by waves.

**Vocabulary**

**microwaves**

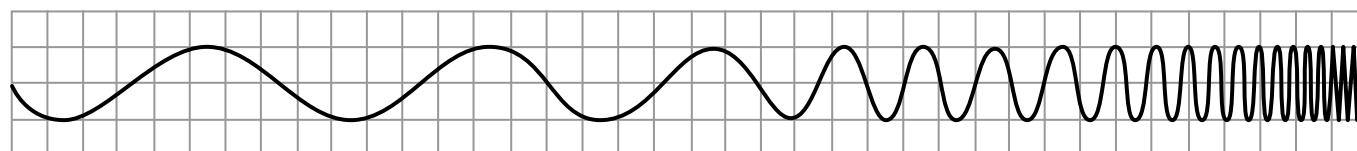
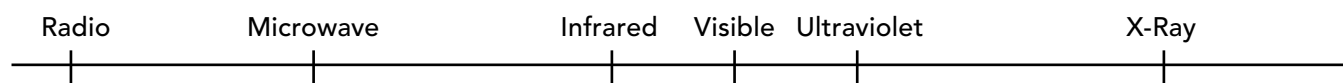
MY-krow-wayvz  
energy waves  
between 1 meter  
and 1 millimeter  
in length

**radiation**

RAY-dee-AY-shun  
transfer of energy  
by waves that  
move through  
matter and space

**wavelength**

WAYV-lenkth  
the distance  
between one  
peak and the  
next in a wave



**Solar Radiation**

Name \_\_\_\_\_

Daily Science

**Big  
Idea 5**

**WEEK 2**

**Day  
2**

**Weekly Question**

**How does a microwave oven cook food?**

Before microwave ovens were invented, microwave radiation was used by the military to detect enemy aircraft. This system was called *radar*. Then, in 1945, a man named Percy Spencer was experimenting with a device that produced microwaves and discovered that the waves had accidentally melted a candy bar in his pocket! Spencer's discovery helped scientists realize that microwaves could also be used to cook food.

Microwaves have two properties that make them ideal for cooking food. First of all, they are easily absorbed by water molecules, as well as by some fats and sugars—substances commonly found in the food we eat. When these molecules absorb microwaves, the energy is converted directly into thermal energy. The second useful property of microwaves is that they are *not* absorbed by most plastics, glass, paper, or ceramics. This means that food and beverages can be cooked in cups, bowls, and plates without the containers getting too hot. Metal, however, reflects microwaves. Microwaves can generate electric currents in metals and create sparks, which is why you can't put anything metal in microwave ovens.



**A. After each word, write whether the material *absorbs*, *reflects*, or *neither* absorbs nor reflects microwaves.**

1. coffee \_\_\_\_\_

5. empty glass \_\_\_\_\_

2. metal spoon \_\_\_\_\_

6. paper cup \_\_\_\_\_

3. plastic spoon \_\_\_\_\_

7. silver tray \_\_\_\_\_

4. potato \_\_\_\_\_

8. pizza \_\_\_\_\_

**B. What are the two properties of microwaves that make them ideal for cooking food?**

1. \_\_\_\_\_

2. \_\_\_\_\_

**Day  
3****Weekly Question****How does a microwave oven cook food?**

The invention of microwave ovens has changed the way people cook. Cooking with microwaves is much, much faster and uses less electricity compared to cooking with **conventional** electric ovens. Electric ovens create heat by passing an electric current through metal wires called *filaments*. The filaments get hot and heat the air inside the oven, which in turn gradually heats the food. In contrast, a microwave oven sends out waves that directly excite the water molecules in food, causing them to heat up almost immediately.

This heating effect is the result of **electromagnetic** fields that microwaves produce. The fields change direction billions of times each second, and water molecules move in tune with these fields. As the water molecules try to align with the constantly changing direction of the electromagnetic fields, the water molecules flip back and forth at a very fast pace. This movement translates into heat.

**Vocabulary****conventional**

kun-VEN-shun-ul  
*ordinary, typical*

**electromagnetic**

ee-LEK-troh-mag-  
NET-ik  
*having both electric  
and magnetic energy*

**A. Write *conventional oven*, *microwave oven*, or *both* to answer each question.**

1. Which kind of oven has metal filaments that get hot when electricity flows through them? \_\_\_\_\_

2. Which kind of oven uses less electricity than the other? \_\_\_\_\_

3. Which kind of oven uses heat to cook food? \_\_\_\_\_

4. Which kind of oven excites the water molecules in food? \_\_\_\_\_

**B. Complete the paragraph.**

Microwaves produce \_\_\_\_\_ that are constantly changing directions. Water \_\_\_\_\_ try to move in tune with these fields.

Name \_\_\_\_\_

Daily Science

# Big Idea 5

WEEK 2

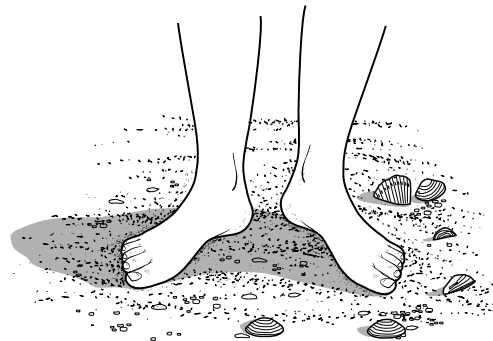
Day 4

## Weekly Question

# How does a microwave oven cook food?

Although microwaves are not absorbed by the materials in many food containers, you must still be careful when you remove a dish from a microwave oven because it could be hot. But this is not because of microwave radiation. It is from the dish being in contact with hot food. Remember that heat flows from warmer objects to cooler ones until both objects reach the same temperature. In the case of microwaved food, heat is transferred from the food to the dish through the process of **conduction**. In other words, when hot food comes into contact with a cool container, heat flows from the food to the container.

Radiation and conduction work together in other ways to transfer heat. If you have ever walked barefoot in the summer, you know that pavement or sand can feel hot under your feet. The sun's radiation has caused the ground to heat up, and conduction transfers this thermal energy to your feet as soon as they touch the ground.



## Vocabulary

### conduction

kun-DUK-shun

transfer of energy  
by physical contact

Draw an arrow between the words in each pair to show the direction in which heat is being conducted between the objects.

- |                      |           |              |            |
|----------------------|-----------|--------------|------------|
| 1. cold floor        | bare feet | 3. egg       | frying pan |
| 2. microwaved dinner | plate     | 4. ice cream | bowl       |



## Talk

The word *conduction* contains the root word *conduct*. What other meanings of *conduct* can you think of? In what ways, if any, are they related to the meaning of *conduction*? Brainstorm with a partner.



Name \_\_\_\_\_



**Day  
5**

**Weekly Question**

**How does a microwave oven cook food?**

A. Use the words in the box to complete the paragraph.

microwave      wavelength      conventional  
radiation      conduction      electromagnetic

The first \_\_\_\_\_ oven was called a Radarange® because it cooked food with a kind of \_\_\_\_\_ that was used in military radar technology. Microwaves used in cooking have a \_\_\_\_\_ of about 12 cm. The microwaves are readily absorbed by water molecules in food, and they cook the food much faster than a \_\_\_\_\_ oven does. The water molecules flip back and forth with the \_\_\_\_\_ fields. This motion is converted to heat, which flows to cooler parts of the food and container through the process of \_\_\_\_\_.

B. Write whether each of the following is an example of *radiation*, *conduction*, or *reflection*.

1. sun heating the sand \_\_\_\_\_
2. bottle of soda chilling on ice \_\_\_\_\_
3. an image being seen in a mirror \_\_\_\_\_
4. a pan heating on a stove top \_\_\_\_\_
5. microwaves bouncing off metal \_\_\_\_\_



*Heat flows from warmer objects to cooler ones until both reach the same temperature.*

## Week 3

# What causes hurricanes?

This week students learn that hurricanes are tropical phenomena that are the result of uneven heating of Earth. These massive storm systems transport heat from the equator to higher latitudes, and they accomplish this in two ways: through convection, which relies on the mixing and movement of air molecules to convey heat, and through the heat released when water vapor condenses, delivering thermal energy to the atmosphere.

Although hurricanes can be extremely violent, modern technology allows us to know when they are coming and to prepare for them. Conditions that spawn potentially destructive storms are well understood, and weather satellites constantly monitor the warm ocean waters that are the breeding grounds for tropical storms and hurricanes.

### Day One

**Vocabulary:** hurricane, satellite

**Materials:** page 141; globe, flashlight

After introducing the vocabulary, use the flashlight and globe to demonstrate how the sun heats Earth unevenly. Shine the flashlight first on the equator and then at the poles. Explain that because Earth is a sphere, sunlight hits the equator directly but strikes the poles at an angle, which means that the light reaching the poles is not as strong as the light reaching the equator. Have students read the passage and complete the activities. Review the answers together.

### Day Two

**Vocabulary:** convection

**Materials:** page 142

Invite students to guess why hurricanes and tornadoes spin. Then explain that the movement of water and air on Earth is changed by Earth's rotation. Scientists call this effect the *Coriolis force*. Introduce the vocabulary word and have students read the passage and complete the activities.

### Day Three

**Vocabulary:** heat of condensation

**Materials:** page 143

Before students read the passage, remind them that water molecules must absorb thermal energy in order to evaporate and become a gas. Then, after students have finished reading, reiterate that thermal energy isn't actually "lost" when the vapor condenses. It stays in the atmosphere when water vapor condenses back into a liquid. Have students complete the activities and review the answers together.

### Day Four

**Vocabulary:** circulating

**Materials:** page 144

Point out to students that hurricanes are just one of many convection systems on Earth. Then have them read the passage. If students have trouble understanding how convection happens in the mantle, explain that this process applies to any material that flows. So, even though magma is technically a solid, it flows like taffy in the mantle, and thus transfers heat by convection. Have students complete the activities.

### Day Five

**Materials:** page 145

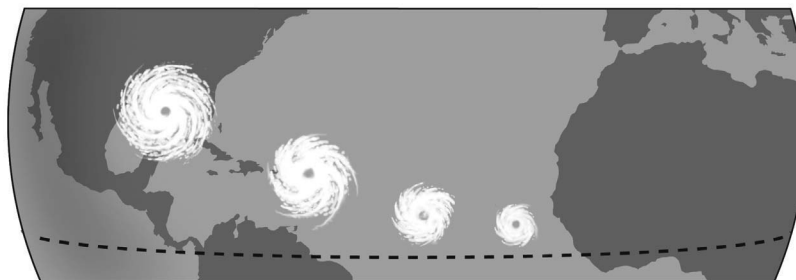
Have students complete the page independently. Then review the answers together.

**Day  
1****Weekly Question****What causes hurricanes?**

A **hurricane**, even one viewed from a weather **satellite** hundreds of miles above Earth, is an awesome sight. Its tightly wound spiral of white clouds can be up to 600 miles wide, forming a massive, rotating storm that can travel thousands of miles and bring strong winds, heavy rains, and high seas along with it.

Hurricanes occur as a result of the sun heating Earth unevenly. The equator gets more direct sunlight, and therefore more thermal energy, than regions at the poles. Because heat flows from warmer places to cooler ones, thermal energy from the equator must eventually end up at the poles. Hurricanes are a very dramatic, sometimes violent way that heat is conveyed from the tropics to higher and cooler latitudes.

**Path of a  
Developing  
Hurricane**

**Vocabulary****hurricane**

HER-ih-kayn  
*a large, rotating  
storm system with  
high winds and  
heavy rains*

**satellite**

SAT-uh-lite  
*an unmanned  
spacecraft that  
orbits Earth or  
the moon*

**A. List four characteristics of hurricanes.**

- |          |          |
|----------|----------|
| 1. _____ | 3. _____ |
| 2. _____ | 4. _____ |

**B. Use the vocabulary words to complete the sentence.**

Meteorologists can look at images from a \_\_\_\_\_  
to predict whether a \_\_\_\_\_ will hit the United States.

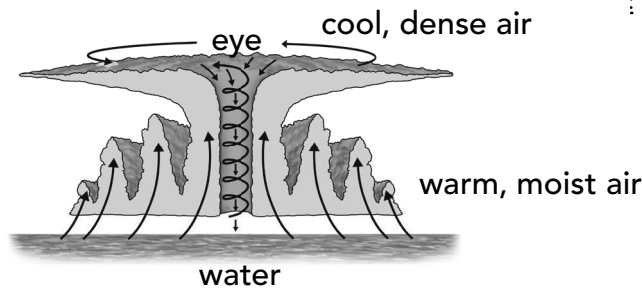
**C. Explain why hurricanes move from the tropics to the poles, and not the other way around.**

\_\_\_\_\_

**Day  
2****Weekly Question****What causes hurricanes?**

Hurricanes form over tropical oceans in late summer and early fall, when water temperatures are at their warmest. Heating by the sun causes the moisture-filled air to rise high into the atmosphere. The warm air is replaced by cooler, denser air that sinks back down toward the water's surface. This cooler air is then heated by the sun, picks up moisture, and rises, and the cycle continues. In this way, heat is transferred from warm waters to the atmosphere.

Heat transferred by the flow of air or water is called **convection**. Convection is one way heat is transported by hurricanes to higher latitudes. But there's a twist—literally! Earth's rotation puts a spin on the rising and sinking air. Hurricanes spin clockwise in the Southern Hemisphere and counterclockwise in the Northern Hemisphere.

**Vocabulary****convection**

kun-VEK-shun

*the transfer of heat energy through the movement of a gas or a liquid*

**A. Write true or false.**

1. Earth's rotation is what causes hurricanes to spin. \_\_\_\_\_
2. Hurricanes form over landmasses in August and September. \_\_\_\_\_
3. Air heated by the sun sinks toward the water's surface. \_\_\_\_\_
4. Convection transfers heat from the tropics to higher latitudes. \_\_\_\_\_

**B. There are many examples of convection besides hurricanes. Which of the following is *not* an example of convection? Fill in the correct bubble.**

- Ⓐ Cold milk poured into coffee cools the hot drink.
- Ⓑ An ice cube melts when it touches a warm glass.
- Ⓒ Air blowing from an air conditioner cools a room.
- Ⓓ A pot of soup heats evenly as it is stirred.

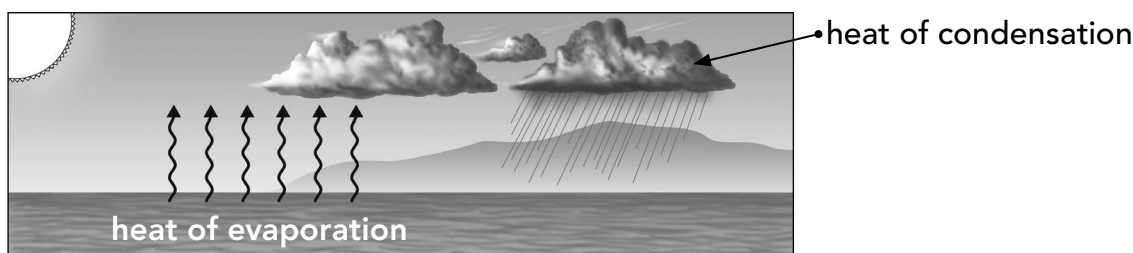
**Day  
3****Weekly Question****What causes hurricanes?****Big  
Idea 5****WEEK 3**

Hurricanes transfer thermal energy not only through the process of convection, but also through the transport of water vapor to higher elevations and new locations. The heat that water molecules absorb during evaporation travels with the gas until the molecules condense back into a liquid. As raindrops form, this heat is released into the atmosphere as **heat of condensation**. The heat released into the atmosphere equals the amount of heat that was absorbed when the water evaporated.

The condensation of water vapor can occur thousands of miles away from where the water first evaporated. Through the heat of condensation, the spinning mass of wet air associated with a hurricane transports thermal energy, and higher temperatures, to places far from the tropical oceans where hurricanes form.

**Vocabulary****heat of condensation**

HEET uhv  
KON-den-SAY-shun  
the heat released  
when water vapor  
condenses



**A.** Next to each of the following examples of heat transfer, write whether it is occurring through *convection* or *heat of condensation*.

1. clouds forming in the sky \_\_\_\_\_
2. steam condensing on a window \_\_\_\_\_
3. hurricane winds blowing \_\_\_\_\_

**B.** Use the term *heat of condensation* to explain how water heated by the sun off the coast of Africa could end up putting heat back into the atmosphere in Texas.

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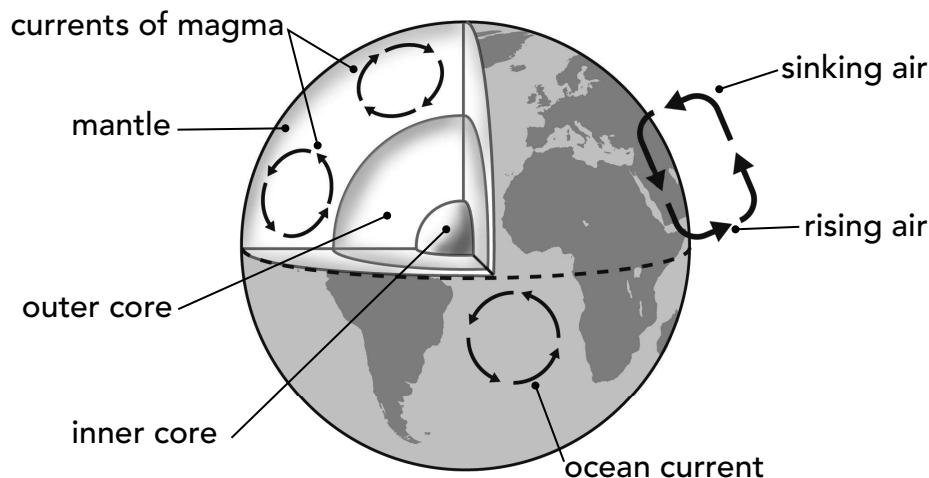
**Day  
4****Weekly Question****What causes hurricanes?**

Earth has many natural systems in which convection plays a role in the transfer of thermal energy. Like hurricanes, tornadoes and thunderstorms move thermal energy through wind and **circulating** air.

But convection isn't limited to the air. In the ocean, water circulates in currents partly in response to the differences in water temperature that are caused by the sun. These great currents move warm water and heat around the world. And even inside Earth, heat from Earth's core results in huge convection currents of magma. These currents move heat and matter from deep within the mantle to Earth's surface.

**Vocabulary****circulating**

SER-kyoo-layt-ing  
moving about or  
flowing freely



**A.** Name the substance in which convection occurs to complete each sentence.

1. \_\_\_\_\_ transfers thermal energy in the ocean.
2. Movement of \_\_\_\_\_ conveys heat within the mantle.
3. \_\_\_\_\_ transports thermal energy in thunderstorms.

**B.** Write the source of heat that drives convection in each of these systems.

The ocean: \_\_\_\_\_ The mantle: \_\_\_\_\_

Name \_\_\_\_\_

**Day  
5**

**Weekly Question**

## **What causes hurricanes?**

**A.** Use the words in the box to complete the sentences.

convection

hurricane

condensation

circulating

satellite

1. The swirling winds of a \_\_\_\_\_ result from the uneven heating of Earth.
2. Heat travels by \_\_\_\_\_ in any material that can flow.
3. A \_\_\_\_\_ can view weather patterns from above Earth.
4. When water vapor forms raindrops, it releases thermal energy back into the air in the form of heat of \_\_\_\_\_.
5. \_\_\_\_\_ currents of magma move heat from Earth's core to the surface.

**B.** Cross out the incorrect word in each sentence and write the correct word above it to make the statement true.

1. The amount of heat released when water vapor freezes is equal to the amount of heat absorbed when water evaporates.
2. Convection transports heat from the tropics to the equator.
3. Hurricanes are characterized by rotating winds, high seas, and heavy snow.

**C.** Name the two ways that hurricanes transfer heat.

1. \_\_\_\_\_
2. \_\_\_\_\_

Daily Science

**Big  
Idea 5**

**WEEK 3**



*Heat flows from warmer objects to cooler ones until both reach the same temperature.*

## Week 4

# How does a thermos work?

If you have ever tried to eat an ice-cream cone before it melts all over your hand, or you've taken a sip of hot tea only to discover it has turned to iced tea, then you've been frustrated by one of the most fundamental principles of the universe: heat flows from warmer objects to cooler ones. For centuries, people have sought creative ways to circumvent this law of nature, and one of the most well-known solutions is the thermos.

This week students learn that the simple thermos bottle is designed to inhibit heat transfer by conduction, convection, and radiation. A thermos has insulators that interfere with conduction; between the walls of the thermos, there is a vacuum, which limits the flow of heat by convection; and inside the thermos, a mirror-like reflective surface blocks heat transfer through radiation. Yet this only works for a little while. The law of heat transfer dictates that eventually, even a hot or a cold beverage stored in a thermos will reach room temperature.

### Day One

Materials: page 147;  
thermos bottle

Before students read the passage, review the three processes by which heat is transferred: *conduction*, *convection*, and *radiation*. Then allow students to examine the thermos bottle and to guess how its design might slow the transfer of heat. Have students read the passage and complete the activities. Review the answers together.

### Day Two

Vocabulary: *insulator*  
Materials: page 148

Introduce the vocabulary word and ask students if they have ever heard of the walls of a building being lined with insulation, and what it might be used for. (to keep heat from escaping in winter and from entering in summer) Have students read the passage and complete the activities. For activity B, you may want to point out that metal is a good conductor.

### Day Three

Vocabulary: *vacuum*  
Materials: page 149

Introduce the vocabulary word and have students read the passage. Then explain the diagram by pointing out that the arrows represent heat, which cannot escape the thermos due to the vacuum. Instruct students to complete the activities. Review the answers together.

### Day Four

Materials: page 150

Before students read the passage, have them recall why metal objects are not used inside microwave ovens. (Metal reflects microwaves, which are a kind of radiation.) After students finish reading, have them complete the activities. If students have trouble with activity B, prompt them with examples of words containing the root *therm*. (*thermostat*, *thermometer*, *thermal energy*, *hypothermia*, etc.)

### Day Five

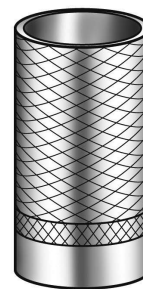
Materials: page 151

Have students complete the page independently. Then review the answers together.



**Day  
1****Weekly Question****How does a thermos work?**

In 1892, a scientist named James Dewar needed a way to store extremely cold liquid oxygen without the heat from his laboratory warming up his samples. So Dewar designed a container that was able to hold liquid oxygen at  $-300^{\circ}\text{F}$ . This container, which became known as the Dewar flask, is the ancestor of the modern thermos bottle. The thermos is an amazing container that can not only keep cold things cold but can keep hot things hot. It maintains temperature by slowing the transfer of heat due to conduction, convection, and radiation.

**Dewar flask****modern thermos**

- A.** Fill in the blanks to explain the direction in which heat is flowing between the hand and the container in each picture.

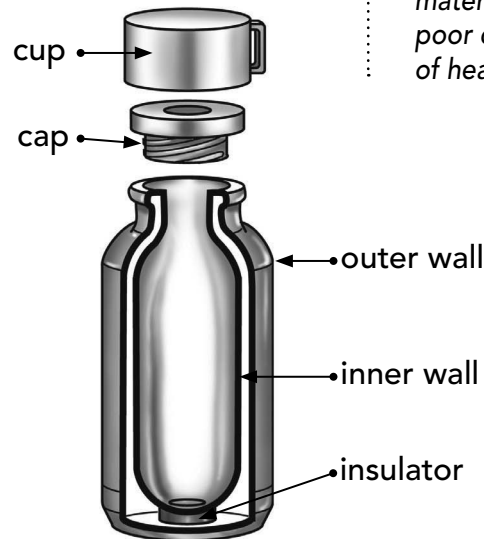
**picture 1****picture 2**

1. In picture 1, heat is flowing from the \_\_\_\_\_ to the \_\_\_\_\_.
  2. In picture 2, heat is flowing from the \_\_\_\_\_ to the \_\_\_\_\_.
- B.** Cross out the incorrect word in each sentence and write the correct word above it to make the statement true.
1. Heat flows from objects at room temperature to objects that are warmer.
  2. James Dewar invented a special flask to keep liquid oxygen warm.
  3. A thermos maintains temperature by slowing condensation, convection, and radiation.

**Day  
2****Weekly Question****How does a thermos work?**

One way to slow down the transfer of heat between objects is to keep them separated. This stops heat transfer by conduction, which requires that objects physically touch each other for heat to flow from one to the other. A second way to slow conduction is by the use of **insulators**. Materials such as plastic, wood, and fabric are poor conductors of heat and therefore make good insulators. Air can work as an insulator as well. For example, Styrofoam® cups have tiny air pockets in the foam that keep heat from moving out or in.

A thermos is basically a bottle inside a bottle that limits heat conduction in both ways—through the use of insulators and physical separation. The inner bottle, which is where you put your hot or cold drink, has little contact with the outside. The only places where heat can travel are through the thermos cap and at points where the inner and outer walls of the bottles meet. And to further reduce heat conduction, these parts of the thermos are made from insulators.

**Vocabulary****insulator**

IN-suh-lay-ter  
*material that is a  
poor conductor  
of heat*

**A.** List the two ways a thermos bottle slows heat transfer by conduction.

1. \_\_\_\_\_
2. \_\_\_\_\_

**B.** If you were designing a pot to cook spaghetti in, which parts would you make from good conductors of heat? Which parts would you make from insulators? Explain your answer.

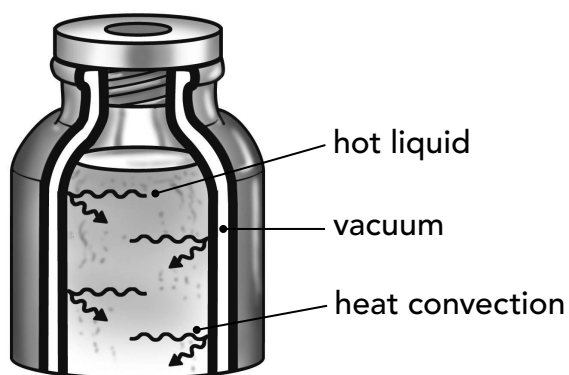
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**Day  
3****Weekly Question****How does a thermos work?**

While air is a good insulator, a **vacuum** is even better. That is because in a vacuum, heat cannot be transferred by convection. Remember that convection is the transfer of heat by movement of a gas or a liquid. Since there is no air in the space between the walls of a thermos bottle, convection of heat does not occur. In fact, another name for a thermos is *vacuum bottle*.

Many devices utilize a vacuum. For example, foods that are vacuum-packed are sealed within a vacuum in order to keep air from touching the food and spoiling it. On the other hand, despite its name, a vacuum cleaner doesn't actually contain a vacuum. But it does create one by pulling air through it when it is turned on.

**Vocabulary****vacuum**

VAK-yoom

*a space empty  
of air or other  
material***A. Write true or false.**

1. Convection cannot take place in a vacuum. \_\_\_\_\_
2. A vacuum cleaner creates conduction when it is turned on. \_\_\_\_\_
3. The space between the thermos walls contains a vacuum. \_\_\_\_\_
4. A vacuum is a good conductor. \_\_\_\_\_

**B. Use words from the passage to complete the sentences.**

1. Some foods are packed within a \_\_\_\_\_ to keep air out.
2. \_\_\_\_\_ requires the movement of a gas or a liquid.

Name \_\_\_\_\_

Daily Science

# Big Idea 5

WEEK 4

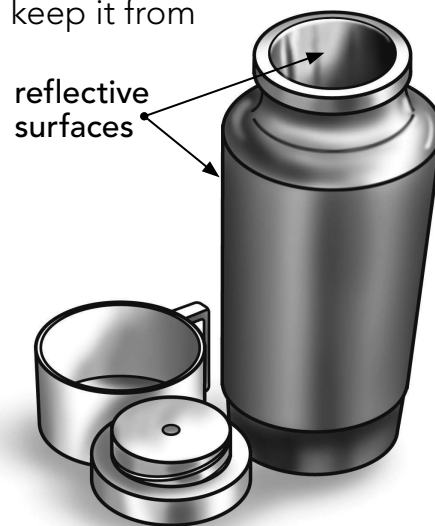
## Day 4

### Weekly Question

## How does a thermos work?

The inside surface of the inner bottle of a thermos is shiny, like a mirror. This reflective surface is not just for looks. Shiny surfaces block the loss of heat energy through radiation, which is the movement of energy through matter and space. The shiny surface inside a thermos prevents heat from a hot drink from radiating out of the vessel. Some thermoses even have shiny outer surfaces. These surfaces reflect heat from outside the bottle and keep it from warming up cold drinks.

A thermos bottle is designed to slow the transfer of thermal energy by radiation, convection, and conduction, and it relies on reflective surfaces, a vacuum, and the use of insulators to do this. However, no container can completely stop all types of heat transfer. Even a thermos can only slow the flow of heat. Eventually, a hot or cold liquid in a thermos will reach room temperature.



- A.** Explain in your own words how the shiny surfaces of a thermos help keep hot drinks hot and cold drinks cold.

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- B.** The word *thermos* contains the Greek root *therm*, meaning "heat." List three other words that contain *therm* and write their definitions.

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

Name \_\_\_\_\_

**Day  
5**

**Weekly Question**

## How does a thermos work?

A. Use the words in the box to complete the sentences.

insulator

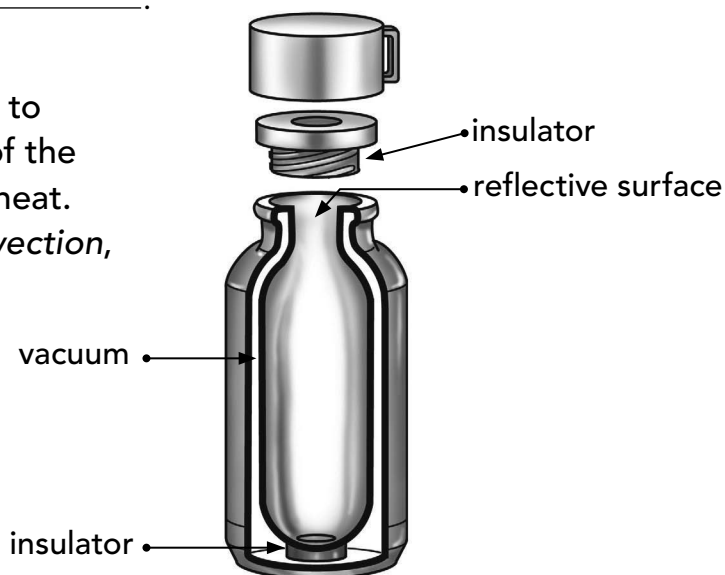
room temperature

conductors

vacuum

1. To keep from burning his hand on the hot pan, the chef wore an oven mitt as an \_\_\_\_\_.
2. A \_\_\_\_\_ limits the flow of heat by convection.
3. Metals are excellent \_\_\_\_\_ of heat.
4. Although a thermos limits heat transfer, eventually its contents will reach \_\_\_\_\_.

B. Write a caption for this diagram to explain how each labeled part of the thermos helps slow the flow of heat. Use the words *conduction*, *convection*, and *radiation* in your answer.



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Daily Science

**Big  
Idea 5**



**WEEK 4**

Name \_\_\_\_\_

**Unit  
Review**

**Comprehension**

**Take the Heat**



Fill in the bubble next to the correct answer.

1. What are three ways heat can move between objects?  
☐ (A) energy, wavelengths, evaporation  
☐ (B) radiation, conduction, convection  
☐ (C) insulators, conductors, condensers  
☐ (D) absorption, microwaves, condensation
2. \_\_\_\_\_ is the measure of the kinetic energy of a substance's molecules.  
☐ (A) condensation  
☐ (B) radiation  
☐ (C) temperature  
☐ (D) latitude
3. Hurricanes transfer thermal energy by means of \_\_\_\_\_.  
☐ (A) convection and heat of condensation  
☐ (B) conduction and convection  
☐ (C) radiation and conduction  
☐ (D) heat of condensation and radiation
4. Why were the first microwave ovens sometimes referred to as "radar ranges"?  
☐ (A) They could detect radio signals.  
☐ (B) They were invented by James Radar.  
☐ (C) They used radar to cook food.  
☐ (D) Microwave ovens and radar systems both use microwaves.
5. Which feature of a thermos does *not* limit heat flow?  
☐ (A) its insulators  
☐ (B) the vacuum inside it  
☐ (C) its shiny surface  
☐ (D) its cup
6. The state of matter in which water molecules move the fastest is \_\_\_\_\_.  
☐ (A) solid  
☐ (B) ice  
☐ (C) gas  
☐ (D) liquid

Name \_\_\_\_\_

**Unit  
Review**

**Vocabulary**

**You're Getting Warmer**

Daily Science

**Big  
Idea 5**



**WEEK 5**

Write the vocabulary word that matches or completes each clue.

1. the energy of motion \_\_\_\_\_
2. liquid changing into gas \_\_\_\_\_
3. the flow of thermal energy \_\_\_\_\_
4. Microwave ovens use \_\_\_\_\_  
to cook food.
5. the distance between two peaks \_\_\_\_\_
6. moving about or flowing \_\_\_\_\_
7. something that slows the flow of heat  
\_\_\_\_\_
8. For heat transfer to occur by \_\_\_\_\_,  
objects must be in physical contact.
9. the measure of the kinetic energy of a substance's  
molecules \_\_\_\_\_
10. an artificial object orbiting Earth \_\_\_\_\_
11. typical or ordinary \_\_\_\_\_
12. a type of radiation that is absorbed by water  
\_\_\_\_\_
13. This is the heat that is released when raindrops form.  
\_\_\_\_\_
14. Hurricanes transfer heat by \_\_\_\_\_.
15. the absence of air \_\_\_\_\_

circulating  
conduction  
convection  
conventional  
heat  
heat of  
condensation  
insulator  
kinetic energy  
microwave  
phase change  
radiation  
satellite  
temperature  
vacuum  
wavelength

Name \_\_\_\_\_

**Unit  
Review**

**Visual Literacy**

**Conduction, Convection,  
and Radiation**

Daily Science

**Big  
Idea 5**



**WEEK 5**

The picture below shows examples of heat being transferred through *conduction*, *convection*, and *radiation*. Label where each of these is taking place. Then write a caption to explain how conduction, convection, and radiation are warming the objects in the picture.



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Name \_\_\_\_\_

**Unit  
Review****Hands-on Activity****Purple Swirl**

To see the effects of heat transfer in action, all you need is food coloring and water. You don't even need your hands to make the water swirl—thermal energy does all the work!

**What You Need**

- clear glass or plastic tray, or other rectangular container
  - large Styrofoam® cup containing very hot water
  - large Styrofoam® cup containing ice water
  - red and blue liquid food coloring
1. Fill the tray with lukewarm water.
  2. Set the tray on top of the two cups, with the hot cup under one end and the cold cup under the other.
  3. Add several drops of red food coloring to the water above the hot cup, and several drops of blue food coloring to the water above the cold cup.

**What Did You Discover?**

1. Describe the direction(s) the water moves. Why does it move that way?

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2. Which forms of heat transfer are you observing?

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3. What is the advantage to using foam cups for the hot and cold water?

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4. What eventually happened to the color of the water in the tray?

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When a new substance is made through a chemical reaction, it has properties that are different from the original substances.

### **Key Concepts**

Chemical Reactions and Chemical Reactivity

### **National Standard**

Substances react chemically in characteristic ways with other substances to form new substances (compounds) with different characteristic properties.

While students may understand that a substance has observable traits, they might not comprehend that substances have chemical properties that determine how they will react with other substances. In this Big Idea, students learn that:

- soda is a mixture containing different substances with different physical properties;
- in the chemical reaction that causes corrosion, iron reacts with oxygen to form rust;
- a battery produces electricity through a chemical reaction that is reversible; and
- reactants brought together on a match head combine in a combustion reaction that is not reversible.

### **Teacher Background**

Chemical reactions happen all around us, all the time. When we light a match, a chemical reaction occurs. When a battery provides electricity or metal rusts, chemical reactions are taking place. In this unit, students gain an understanding of the basic principles governing these reactions, and learn that the reactions result in new substances with different characteristic properties.

Before students are introduced to chemical reactions, they learn that all substances have physical properties. When substances undergo a physical change, their chemical makeup does not alter. This is in contrast to a chemical change, in which a substance's chemical makeup is altered. Understanding the concepts of physical and chemical changes helps students understand the various types of chemical reactions, including oxidation, reduction, electrochemical reactions, and combustion, that students observe around them every day.

**For specific background information on each week's concepts, refer to the notes on pp. 158, 164, 170, and 176.**

## Unit Overview

### WEEK 1: What puts the fizz in soda?

**Connection to the Big Idea:** Soda is a mixture of different substances that have different physical properties. By studying the components of a soft drink solution, students learn about physical properties such as boiling point, freezing point, and solubility.

**Content Vocabulary:** *boiling point, carbonated, freezing point, mixture, soluble, solution*

### WEEK 2: Why does metal rust?

**Connection to the Big Idea:** Corrosion is the result of a chemical reaction that creates rust. Students learn that when iron and oxygen react with one another, the new compound iron oxide is formed. Iron oxide has properties that are different from the original metal.

**Content Vocabulary:** *chemical reaction, compound, corrosion, oxidized, product, reactant, reduced*

### WEEK 3: Why do batteries die?

**Connection to the Big Idea:** Substances have chemical properties that determine how they will react with other substances to form compounds. Students learn that the reactants in an electrochemical reaction combine to generate electrons. A battery “dies” when the chemical reactants are used up. When the battery is connected to a source of electricity, the electrochemical reaction is reversed and the battery is recharged.

**Content Vocabulary:** *acid, chemical properties, current, electrode*

### WEEK 4: Why can't you light a match more than once?

**Connection to the Big Idea:** Combustion is a type of chemical reaction that creates heat and light. While learning about the invention of the match, students learn about the concepts of chemical stability, reactivity, and irreversible reactions.

**Content Vocabulary:** *combustion, friction, ignite, irreversible, reactive, stable*

### WEEK 5: Unit Review

You may choose to do these activities to review the concept of chemical reactions.

**p. 182: Comprehension** Students answer multiple-choice questions about key concepts in the unit.

**p. 183: Vocabulary** Students write vocabulary words from the unit to match clues.

**p. 184: Visual Literacy** Students study diagrams of a match being lit and answer questions about the physical and chemical changes taking place.

**p. 185: Hands-on Activity** Students reverse the oxidation process by cleaning dirty pennies in an acid solution. Instructions and materials needed for the activity are listed on the student page.



*When a new substance is made through a chemical reaction, it has properties that are different from the original substances.*

## Week 1

# What puts the fizz in soda?

This week students are introduced to mixtures and solutions in the context of a familiar drink. Mixtures, students learn, can have physical properties that are different from those of the pure substances they are made up of. A carbonated soft drink is a mixture of sweet, flavored water and carbon dioxide gas. This gas, which is put under pressure during the bottling process, escapes into the air in the form of bubbles and fizz as soon as the soda is opened.

The example of soda provides an opportunity to learn about three physical properties of substances: boiling point, freezing point, and solubility. The fizz in soda is actually carbon dioxide gas that is boiling out of the liquid because carbon dioxide's boiling point is much lower than room temperature. However, the sugar-water solution of soda freezes at a lower temperature than pure water does because the solution has a lower freezing point. And the fact that soda contains dissolved carbon dioxide and sugar demonstrates the solubility of these substances.

### Day One

**Vocabulary:** carbonated, mixture

**Materials:** page 159

Introduce the vocabulary and have students read the passage. Then point out that mixtures can be solids, liquids, or gases. Invite students to name solids, liquids, and gases that they think are mixtures. (e.g., sand, cake batter, iced tea, air) Have students complete the activities and review the answers together.

### Day Two

**Vocabulary:** boiling point, freezing point

**Materials:** page 160

Introduce the vocabulary and point out that *boiling point* and *freezing point* indicate changing states of matter, from liquid to gas and from liquid to solid, respectively. After students have read the passage, explain that water is the only substance on Earth that can exist in all three states of matter under normal atmospheric conditions. Carbon dioxide, on the other hand, is a gas under normal conditions. It can only liquefy under intense pressure or turn to dry ice in extreme cold. Have students complete the activity. Review the answers as a group.

### Day Three

**Vocabulary:** soluble, solution

**Materials:** page 161

Introduce the vocabulary. Then explain that a substance's ability to be dissolved in a liquid is called its *solubility*. Point out that the words *solution*, *soluble*, *solubility*, and *dissolve* are derived from the word root *solv*, which means "to loosen." Have students read the passage and complete the activities. Review the answers together.

### Day Four

**Materials:** page 162

Have students read the passage and complete the activities. If students need help with activity C, remind them that the ocean contains salt water, while a pond contains fresh water.

### Day Five

**Materials:** page 163

Have students complete the page independently. Then review the answers together.

**Day  
1****Weekly Question****What puts the fizz in soda?**

Have you ever popped open a can or bottle of soda, only to be sprayed with a wet burst of bubbles? That rush of liquid and fizz is propelled by carbon dioxide ( $\text{CO}_2$ ) gas in your drink. In fact, this presence of carbon dioxide is why soft drinks are called **carbonated** beverages. Carbonation occurs during the manufacturing and bottling process, when large amounts of carbon dioxide gas are added to flavored water. The **mixture** of liquid and gas is put under pressure before the can or bottle is sealed.

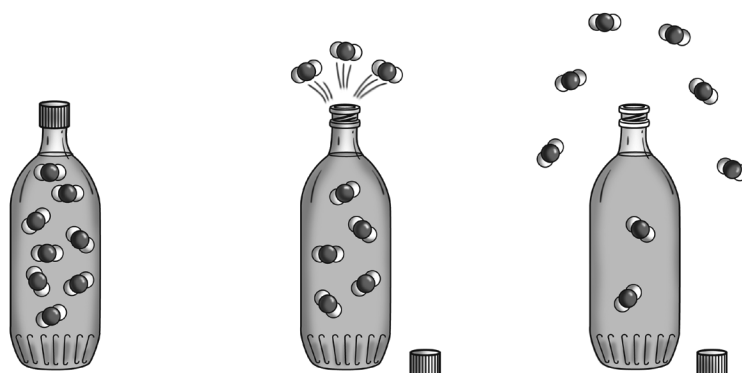
As soon as you open your soda, the pressure is released and  $\text{CO}_2$  escapes into the air. The gas will continue to leave your soda until the amount of  $\text{CO}_2$  in the liquid is equal to the amount of  $\text{CO}_2$  in the air. That's why, if you don't finish your soft drink right away, your drink goes "flat."

**Vocabulary****carbonated**

KAR-buh-nay-tid  
containing carbon  
dioxide gas

**mixture**

MIKS-chur  
a combination  
of two or more  
different substances

**A. Use the vocabulary words to complete the sentences.**

1. Club soda is a \_\_\_\_\_ beverage.
2. Chocolate milk is a \_\_\_\_\_ of chocolate syrup and milk.

**B. Mixtures can usually be separated into their individual substances.**

Explain how, in a carbonated liquid, the gas separates from the liquid.

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**Day  
2****Weekly Question****What puts the fizz in soda?**

When you think of a boiling mixture, you probably don't picture an ice-cold soda. But, in fact, that's just what is happening when you see bubbles in your soft drink. Carbon dioxide gas is, in effect, "boiling" out of your cold soda. Unlike water, which has a **boiling point** of 100°C (212°F), carbon dioxide changes from liquid to gas at -57°C (-70°F). So even at the temperature of a chilled soda, CO<sub>2</sub> is still a gas, and it bubbles out of the liquid.

Boiling point and **freezing point** are physical properties of a substance. Physical properties may include color, hardness, texture, or many other characteristics of matter that can be measured or seen. The freezing point of carbon dioxide gas is -78°C (-109°F). At this temperature, CO<sub>2</sub> becomes a solid, taking the form of dry ice. But in the same way that the boiling point of a substance doesn't have to be terribly hot, the freezing point doesn't have to be very cold, either. Liquid gold, for example, "freezes" at 1,064°C (1,947°F).

Room temperature is approximately 20°C (68°F). Use the information in the table below to answer the questions.

|          | <b>Freezing Point</b> | <b>Boiling Point</b> |
|----------|-----------------------|----------------------|
| Water    | 0°C                   | 100°C                |
| Nitrogen | -210°C                | -196°C               |
| Mercury  | -39°C                 | 357°C                |
| Gold     | 1,064°C               | 2,856°C              |

- Which substance has the highest boiling point? \_\_\_\_\_
- Which substance has the lowest freezing point? \_\_\_\_\_
- Which substance is a solid at room temperature? \_\_\_\_\_
- Which two substances are liquids at room temperature? \_\_\_\_\_

**Vocabulary****boiling point**

BOY-ling POYNT  
the temperature  
at which a liquid  
changes into a gas

**freezing point**

FREE-zing POYNT  
the temperature  
at which a liquid  
changes into a solid

**Day  
3****Weekly Question****What puts the fizz in soda?**

Soda is more than just a mixture of liquid and gas. It is also a **solution**, meaning it is a liquid that contains substances that have been dissolved. Soda is made mostly of water, which can dissolve many substances. Carbon dioxide gas, for instance, is **soluble** in water. Soft drinks also contain dissolved solids, such as sugar.

Not all substances are soluble in water. For example, oil does not dissolve well in water. So when you shake a bottle of salad dressing that contains oil, water, and vinegar, the liquids mix together only temporarily. After a while, the oil separates from the vinegar and water and floats to the top of the liquid mixture.

- A. Solubility** is a physical property. The table below shows the solubility of various substances in water. The higher the number, the more soluble the substance is. Use this information to answer the questions.

|                | <b>Solubility<br/>(per gram of water)</b> |
|----------------|-------------------------------------------|
| Oxygen         | 0.0000434 gram                            |
| Carbon dioxide | 0.00145 gram                              |
| Sugar          | 2.0 grams                                 |
| Salt           | 0.36 gram                                 |

- Which substance dissolves best in water? \_\_\_\_\_
- Which gas dissolves more easily in water—oxygen or carbon dioxide? \_\_\_\_\_
- Which substance is the least soluble in water? \_\_\_\_\_

- B.** If you mixed peanut butter with water, do you think it would make a solution? Explain why or why not.
- \_\_\_\_\_

**Vocabulary****soluble**

SOL-yoo-bul  
able to be dissolved

**solution**

suh-LOO-shun  
a mixture, usually liquid, in which all the components are mixed evenly

Name \_\_\_\_\_

**Day  
4**

**Weekly Question**

## **What puts the fizz in soda?**

If you've ever tried to make a Popsicle® out of soda, you've probably noticed that soda doesn't freeze very well. That's because, although soft drinks are mostly water, the physical properties of water change when other ingredients are dissolved into it. In fact, most mixtures and solutions have physical properties that are different from the pure substances they are made of. Adding carbon dioxide and sugar to water lowers the freezing point of the solution as compared to that of pure water. So it takes colder temperatures to freeze soda than it does to freeze pure water.

The same thing is true when you add salt to water. Pure water freezes at 0°C, but a solution that is 20% salt freezes at -16°C. This is why salt is spread on snowy highways in winter. The salt dissolves into the ice and snow and causes it to melt. Until temperatures dip below -16°C, salt can help keep roads from icing up.

### **A. Answer the questions.**

1. Which freezes at a warmer temperature, pure water or soda? \_\_\_\_\_
2. Which has a higher freezing point, a 20% salt solution or pure water? \_\_\_\_\_

**B. A liquid called "antifreeze" is sometimes added to water to keep it from freezing. How do you think antifreeze works? Fill in the bubble next to the correct answer.**

- |                                          |                            |
|------------------------------------------|----------------------------|
| Ⓐ It lowers the boiling point of water.  | Ⓒ It dissolves water.      |
| Ⓑ It lowers the freezing point of water. | Ⓓ It carbonates the water. |

**C. Which do you think would freeze first, a pond or the ocean? Use the word *freezing point* in your answer.**

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Name \_\_\_\_\_

**Day  
5**

**Weekly Question**

## What puts the fizz in soda?

A. Use the words in the box to complete the sentences.

boiling point      solution      carbonated  
freezing point      mixture

1. A soft drink is a \_\_\_\_\_ of gas, sugar, and water, but it is also a \_\_\_\_\_ because the gas and sugar are dissolved in the water.
2. Carbon dioxide's \_\_\_\_\_ is very low, which is why it is a gas at room temperature.
3. Carbon dioxide gas is what makes a soft drink \_\_\_\_\_.
4. The \_\_\_\_\_ of soda is lower than that of pure water.

B. Cross out the incorrect word in each sentence and write the correct word or words above it to make the statement true.

1. Water is a solid at room temperature.
2. Carbonation involves mixing oxygen gas into a beverage.
3. The freezing point of water increases when salt is added.
4. Oil forms a solution with the water and vinegar in salad dressing.

C. Fill in the bubble next to the words that complete the analogy.

**Boiling point** is to **gas** as \_\_\_\_\_.

Ⓐ **freezing point** is to **liquid**

Ⓑ **freezing point** is to **solid**

Ⓒ **liquid** is to **solid**

Ⓓ **solid** is to **liquid**

Daily Science

**Big  
Idea 6**

**WEEK 1**



*When a new substance is made through a chemical reaction, it has properties that are different from the original substances.*

## Week 2

# Why does metal rust?

This week students learn about chemical reactions by studying one of the most commonly observed reactions occurring in nature: the rusting of metal. Unlike physical changes, which do not alter the chemical makeup of substances, a chemical reaction produces a change that transforms the substances into a brand-new material. Rust, for example, is created when iron reacts with oxygen and forms a new compound called iron oxide.

The chemical reaction that produces rust happens when electrons move from iron atoms to oxygen atoms. A substance's loss of electrons is known as *oxidation*, while a gaining of electrons is called *reduction*. In the formation of rust, iron is oxidized and oxygen is reduced. For every oxidation that occurs in a chemical reaction, a reduction must also take place.

### Day One

**Vocabulary:** chemical reaction, corrosion

**Materials:** page 165

Invite students to recall times they have seen rust on something, such as a car, a metal fence, or a pipe, and to describe what the rust looked like. Then introduce the vocabulary and point out that *corrosion* is the result of the chemical reaction that creates rust. Have students read the passage and complete the activities. Review the answers together.

### Day Two

**Vocabulary:** compound, product, reactant

**Materials:** page 166

Introduce the vocabulary and have students read the passage. Then explain that iron and oxygen are elements, which are pure chemical substances that cannot be separated into simpler substances. However, rust (iron oxide) is a compound consisting of the elements iron and oxygen. Instruct students to complete the activities. Then review the answers as a group.

### Day Three

**Vocabulary:** oxidized, reduced

**Materials:** page 167; apple or avocado, plastic knife

Cut the avocado or apple into pieces and ask students to predict what will happen to them within a few minutes. (The cut surfaces will turn brown.) Then introduce the vocabulary and have students read the passage. After they have completed the activities, have students look at the cut-up fruit and note any changes. Explain that substances in the fruit react with oxygen in the air and that, like metal, fruit also oxidizes.

### Day Four

**Materials:** page 168

Have students read the passage. Then point out that the Golden Gate Bridge in San Francisco is painted orange not only to protect it from corrosion, but to provide visibility to passing ships and airplanes as well. Have students complete the activities and review the answers together.

### Day Five

**Materials:** page 169

Have students complete the page independently. Then review the answers together.

Name \_\_\_\_\_

**Day  
1**

**Weekly Question**

## **Why does metal rust?**

You know what rusty metal looks like, but have you ever wondered why you've never seen rust on a piece of wood or plastic? Rust is a sign of **corrosion**, which occurs when metal is exposed to air and moisture. Metal that is rusted may be crumbly, have holes in it, or have rough, reddish-brown patches on it.

Corrosion in metals arises from a **chemical reaction**, which is a process in which substances react to form new substances. A chemical reaction is different from a physical change. When you scratch metal, the chemical makeup of metal stays the same, even if its appearance changes. But when metal rusts, a chemical reaction takes place between water, oxygen, and iron that changes the metal into a whole new substance.



### **A. Use the vocabulary words to complete the sentences.**

1. One way to protect a car from \_\_\_\_\_ is to keep it inside a garage.
2. A \_\_\_\_\_ can occur when substances are exposed to air and moisture.

### **B. Explain in your own words how a chemical reaction is different from a physical change.**

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**Daily Science**

**Big  
Idea 6**



**WEEK 2**

### **Vocabulary**

#### **chemical reaction**

KEM-ih-kul

ree-AK-shun

*a change in which one or more new substances are formed*

#### **corrosion**

kuh-ROH-zhun

*a chemical wearing away of a material*

**Day  
2****Weekly Question****Why does metal rust?**

During a chemical reaction, substances called **reactants** recombine to form new substances called **products**. In the chemical reaction that forms rust, the reactants are iron and oxygen. The product they form when they recombine is a **compound** called iron oxide. Adding water speeds up the corrosion process.

Iron oxide, like all products of a chemical reaction, has properties that are different from its original substances. One difference between pure iron and iron oxide is that iron oxide takes up more space. That means that if a metal structure starts to rust, the rusted area may push apart the areas that are not rusted. This can result in cracks in the structure. The compounds that form rust are also weaker than iron, which means they crumble more easily. So you can see why a lot of rust can be bad for structures and machinery made of metal, such as bridges and cars!

**Vocabulary****compound**

KOM-pownd  
a substance made  
of two or more  
elements that are  
chemically combined

**product**

PRAH-dukt  
a new substance  
that is formed during  
a chemical reaction

**reactant**

ree-AK-tent  
a substance that  
changes during a  
chemical reaction

**A.** What are two properties of iron oxide that are different from iron?

1. \_\_\_\_\_
2. \_\_\_\_\_

**B.** Cross out the incorrect word or phrase in each sentence and write the correct one above it to make the statement true.

1. Rust is the product of the chemical reaction between iron and oxide.
2. A compound is made from a single element.
3. The properties of reactants are the same as the properties of products.

**C.** Check the box next to the word that completes the analogy.

Iron is to **iron oxide** as **reactant** is to \_\_\_\_\_.

- ☐ product    ☐ rust    ☐ oxygen    ☐ substance

**Day  
3****Weekly Question****Why does metal rust?**

As with any chemical reaction, the formation of rust involves the transfer of electrons. When iron reacts with oxygen and forms the new compound iron oxide, the reaction occurs because electrons move from the metal atoms to the oxygen atoms. In other words, the iron that loses electrons is **oxidized**. In the same reaction, oxygen gains electrons from the iron and is **reduced**. For every electron that is lost by a substance in a chemical reaction, an electron is gained by another substance.

The oxidation and reduction process happens all around us, all the time. In fact, many cleaning products contain substances that oxidize. Household bleach, for example, removes stains by oxidizing them.

In other situations, oxidation isn't such a positive thing. For instance, air can oxidize food, causing it to spoil or go stale. This is why some foods include substances called *antioxidants*. Antioxidants give up their electrons very easily, so they satisfy the appetite of "electron-hungry" oxygen atoms and protect the food.

**Vocabulary****oxidized**

OX-ih-dyzd  
to have lost  
electrons

**reduced**

ree-DOOST  
to have gained  
electrons

**A.** In each reaction described below, underline the substance that gets oxidized.

1. An apple turns brown after reacting with air.
2. Bleach removes a stain.
3. Oxygen picks up electrons found in food.
4. An iron key rusts in the rain.

**B.** Fill in the bubble next to the activity that slows down oxidation.

- |                                         |                              |
|-----------------------------------------|------------------------------|
| (A) removing the lid from a jar of food | (C) peeling an apple         |
| (B) keeping a car in a dry garage       | (D) adding bleach to a stain |

Name \_\_\_\_\_

Daily Science

# Big Idea 6

WEEK 2

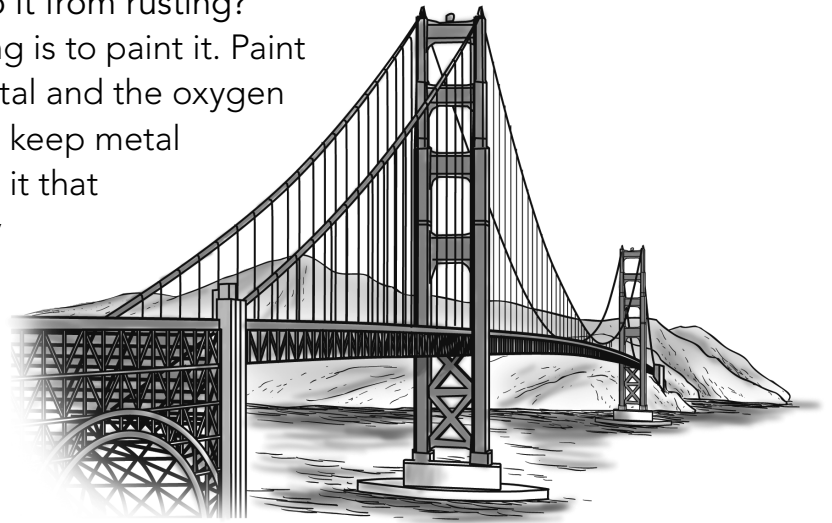
## Day 4

### Weekly Question

## Why does metal rust?

Metal is used to build many types of structures, appliances, and other everyday items because it is strong, easy to shape, and relatively cheap and plentiful. But most metals react with water and oxygen, which is present in almost every environment on Earth. So how do people use metal and keep it from rusting?

One way to keep metal from rusting is to paint it. Paint forms a protective barrier between metal and the oxygen and moisture in the air. Another way to keep metal from oxidizing is to add a substance to it that makes the metal less able to give away its electrons. For example, stainless steel is made from iron that has carbon and chromium added to it. Stainless steel doesn't oxidize or corrode as quickly as ordinary iron. That is why knives are often made of stainless steel. Their blades stay sharp longer.



The Golden Gate Bridge in San Francisco is actually painted orange, not gold.

### A. What are two ways to keep metal from rusting?

1. \_\_\_\_\_
2. \_\_\_\_\_

### B. Name two ways stainless steel is different from ordinary iron.

1. \_\_\_\_\_
2. \_\_\_\_\_

### C. Check the object that is the *least* likely to be made of stainless steel.

- ☐ sauce pan    ☐ plate    ☐ scissors    ☐ refrigerator door

Name \_\_\_\_\_

**Day  
5**

**Weekly Question**

## **Why does metal rust?**

**A.** Use the words in the box to complete the paragraph.

oxidized    reactants    compound    reduced  
product    corrosion    chemical reaction

New substances created through a \_\_\_\_\_ have properties that are different from the starting materials, and one example of this is rust. In the reaction that creates rust, iron and oxygen are the \_\_\_\_\_, and a \_\_\_\_\_ called iron oxide is the \_\_\_\_\_. During the reaction, electrons move from the metal atoms to the oxygen atoms. When the metal atoms lose electrons, they are \_\_\_\_\_. When the oxygen atoms gain electrons, they are \_\_\_\_\_. The result of this process is the \_\_\_\_\_ of metal.

**B.** Write *true* or *false*.

1. One way to keep metal from rusting is to paint it. \_\_\_\_\_
2. Exposure to air and water can cause iron to break down. \_\_\_\_\_
3. Electrons can't be shared or moved between atoms. \_\_\_\_\_
4. Rust is created by the oxidation of iron. \_\_\_\_\_
5. Antioxidants cause food to spoil faster. \_\_\_\_\_

Daily Science

**Big  
Idea 6**

**WEEK 2**



*When a new substance is made through a chemical reaction, it has properties that are different from the original substances.*

## Week 3

# Why do batteries die?

This week, by studying the chemical reactions that take place inside a battery, students learn that a substance's chemical properties determine how it reacts with other substances. When the substances in a battery undergo a reaction, they form new substances and, in the process, produce electrons. This chemical reaction, called an electrochemical reaction, converts the chemical energy available in a battery into the electrical energy needed to power our electronic devices.

A battery's "life" refers to the length of time it is able to supply electricity. When all the reactants in a battery have been used up, the battery stops producing electricity and "dies." For many batteries, however, the electrochemical reaction is reversible and batteries can be recharged.

### Day One

**Vocabulary:** *current*

**Materials:** page 171;  
different types of  
batteries

Show students the different types of batteries you brought in. Allow students to examine the batteries and observe how they are distinguished according to voltage and type. Then have students read the passage. You may want to point out that many electricity-related words are derived from Count Volta's name, including *volts*, *voltage*, and *voltmeter*. Finally, have students complete the activities and review the answers together.

### Day Two

**Vocabulary:** *acid*,  
*chemical properties*

**Materials:** page 172

After introducing the vocabulary, tell students that many acidic substances, such as lemon juice, have a sour taste, and that taste is an example of a *physical property*. An acid's ability to produce hydrogen when dissolved in water is an example of a *chemical property*. Have students read the passage and complete the activities. Review the answers together.

### Day Three

**Vocabulary:** *electrode*

**Materials:** page 173

Point out to students that electrons are negatively charged particles. Then introduce the vocabulary word and have students read the passage and complete the activities. Review the answers together.

### Day Four

**Materials:** page 174

Have students read the passage. Then invite them to list any devices they use that have chargers. (cell phones, MP3 players, laptops, etc.) Have students discuss the benefits of using batteries that can be recharged. (better for the environment, costs less than buying new batteries, etc.) Then instruct students to complete the activities. Go over the answers as a group.

### Day Five

**Materials:** page 175

Have students complete the activities independently. Then review the answers together.



**Day  
1****Weekly Question****Why do batteries die?**

Many materials—from potatoes and lemons to stacks of metal coins—can be used to make a battery. All you need is a material that has the ability to produce a flow of electrons. The first battery, demonstrated by Count Alessandro Volta in 1800, was a stack of discs made of alternating kinds of metal separated by paper soaked with salt water. It was that simple.

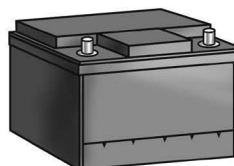
Today, batteries come in a variety of materials with different properties. Batteries can be disposable or rechargeable, and they can be made of various compounds such as lithium ion, nickel cadmium, or metal hydride. The different materials used to construct batteries result in differences in the amount of electric **current** produced, the size and cost of the battery, and the lifetime of the battery. But no matter what material is used, eventually every battery “dies” and stops producing electricity.

**Vocabulary****current**

KUR-int  
the flow of  
electricity through  
a conductor

voltaic  
pilealkaline  
batteries

car battery

lemon  
battery**Different Kinds of Batteries****A. Write true or false.**

1. Only metals can be used to make a battery. \_\_\_\_\_
2. Eventually, a battery stops producing electricity. \_\_\_\_\_
3. Batteries have the ability to generate a flow of electrons. \_\_\_\_\_

**B. Name four ways that batteries can differ from one another, depending on the different materials used to construct them.**

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_

**Day  
2****Weekly Question****Why do batteries die?**

Batteries generate electricity through a type of chemical reaction called an *electrochemical* reaction. During this particular kind of reaction, the reactants combine to create new substances and, in the process, produce electrons.

Whether or not a reaction produces electrons depends on the **chemical properties** of the reactants. Chemical properties are determined by the chemical composition of a substance and, in turn, control a substance's ability to undergo a particular chemical change. For example, a substance might have the tendency to rust, to catch on fire, to form an **acid**, or to explode. Unlike a physical property, which can be observed without changing a substance's composition or structure, a chemical property can be observed or measured only when a substance undergoes a chemical change.

**A.** Next to each example of a substance's property, write whether the property is *physical* or *chemical*.

1. Hydrogen explodes when ignited. \_\_\_\_\_
2. Copper is a reddish-orange, shiny metal. \_\_\_\_\_
3. Silver reacts with moisture to form tarnish. \_\_\_\_\_
4. Metal corrodes when exposed to air. \_\_\_\_\_
5. Water freezes at 32°F. \_\_\_\_\_

**B.** Explain in your own words the difference between physical and chemical properties.

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**Vocabulary****acid**

AS-sid  
a chemical compound that, when dissolved in water, produces hydrogen that is missing its electron

**chemical properties**

KEM-ih-kul  
PRAH-per-teez  
characteristics that determine the chemical changes that a substance can undergo

**Day  
3****Weekly Question****Why do batteries die?**

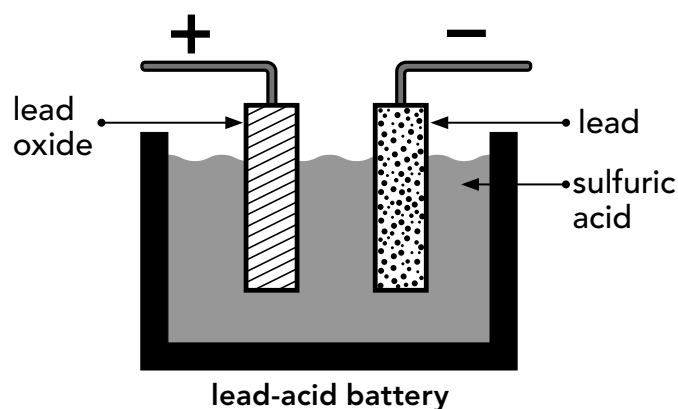
Think of a battery as a reaction chamber filled with chemicals. For example, a typical car battery consists of a series of compartments, each containing a pair of **electrodes** immersed in a kind of acid called sulfuric acid. One electrode is made of lead, and the other electrode is made of lead oxide. Electrodes are where a battery's electrochemical reactions take place, and different reactions take place on different electrodes.

On the lead electrode of a car battery, the lead reacts with sulfuric acid to form a new compound called lead sulfate. This reaction produces electrons, and negative charges build up on the lead electrode.

On the lead oxide electrode, the material also reacts with sulfuric acid to produce lead sulfate. However, this reaction removes electrons from the electrode. As a result, positive charges collect on the lead oxide electrode. When the two electrodes are connected in an electrical circuit, electrons flow from the negatively charged electrode to the positively charged electrode, and electricity is produced.

**Vocabulary****electrode**

ee-LEK-troh-d  
a metal rod or plate that can conduct electricity into or out of a battery

**A. Complete the analogy.**

**Sulfuric acid** is to **reactant** as **lead sulfate** is to \_\_\_\_\_.

**B. Use words from the passage to complete the paragraph.**

The lead electrode in a car battery reacts with the acid solution to form \_\_\_\_\_, and this reaction \_\_\_\_\_ electrons.

The lead oxide electrode reacts with the solution to form the same compound, but this reaction \_\_\_\_\_ electrons.

Name \_\_\_\_\_

**Day  
4**

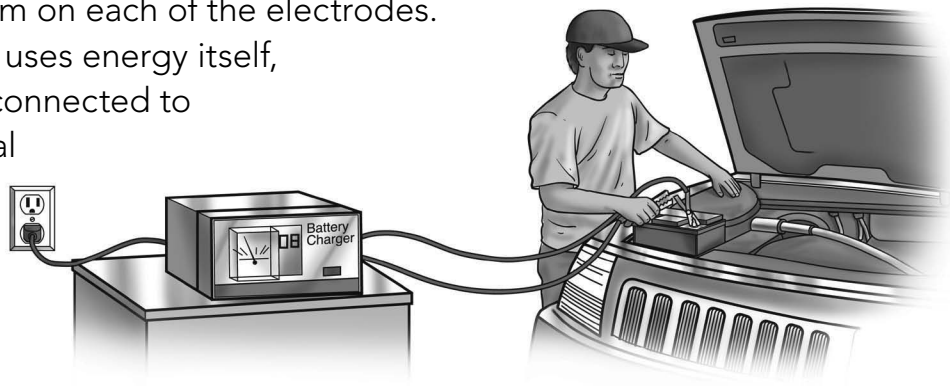
**Weekly Question**

## **Why do batteries die?**

A battery contains only a fixed amount of reactants, so as soon as these reactants have been used up, the reaction stops and the battery goes dead. A dead battery produces no more electrons and no more electricity.

However, some batteries can be recharged by connecting them to a source of electricity such as a wall outlet. This is possible because the electrochemical reactions that create electricity are reversible. When a battery is recharging, electricity flows in the opposite direction. In a car battery, this allows the lead sulfate that coats both of the electrodes to dissolve back into the acid solution. Lead and lead oxide re-form on each of the electrodes.

This process of recharging uses energy itself, but when the battery is reconnected to the car, the electrochemical reaction that produces electricity can start all over again.



**Daily Science**

**Big  
Idea 6**

**WEEK 3**

**A. Number the steps in the correct order to show how a battery is recharged.**

- \_\_\_\_ Lead sulfate dissolves into the acid solution.
- \_\_\_\_ The battery is connected to a source of electricity.
- \_\_\_\_ Lead and lead oxide re-form on the electrodes.
- \_\_\_\_ The battery produces electrons.

**B. Name two devices you have used or seen that have rechargeable batteries. Then name the source of the energy that you would use to recharge them.**

1. \_\_\_\_\_
2. \_\_\_\_\_

Name \_\_\_\_\_

**Day  
5**

**Weekly Question**

## **Why do batteries die?**

**A.** Use the words in the box to complete the sentences.

chemical properties    electrodes    acid  
electrochemical        current

1. Batteries generate electricity through \_\_\_\_\_ reactions that take place on \_\_\_\_\_.
2. An \_\_\_\_\_ is a substance that generates a form of hydrogen when it dissolves in water.
3. The way a substance reacts or combines with other substances to create new substances is determined by its \_\_\_\_\_.
4. Different kinds of materials used in batteries result in different amounts of electric \_\_\_\_\_ produced.

**B.** Write *true* or *false*.

1. The chemical properties of a substance are determined by its chemical composition. \_\_\_\_\_
2. The chemical reactions that power a car battery are irreversible. \_\_\_\_\_
3. All batteries have the ability to produce a flow of electrons. \_\_\_\_\_
4. When a battery's reactants are used up, it no longer produces electricity. \_\_\_\_\_
5. All electrochemical reactions produce light. \_\_\_\_\_

Daily Science

**Big  
Idea 6**

**WEEK 3**



*When a new substance is made through a chemical reaction, it has properties that are different from the original substances.*

## Week 4

# Why can't you light a match more than once?

This week students explore the chemistry of how a match burns. They learn that when a match is lit, it undergoes the chemical reaction of combustion and produces energy in the form of heat and light. Inventors of the first matches had to contend with chemical mixtures that tended to spontaneously combust or explode upon lighting. Finding the balance between the stability of substances and chemical reactivity proved to be challenging.

The modern match is a testimony to experimentation and persistence. Inventors finally discovered the proper reactants to produce the desired chemical reaction. Thus, the flash of light and heat that accompanies the strike of a match is a one-time event: the reactants that initiate combustion are limited, and the products of the reaction don't burn again. No matter how hard you rub a burned match against a striking surface, it will not relight.

### Day One

**Vocabulary:**  
*combustion, ignite*

**Materials:** page 177

Before students read the passage, explain that people once relied on fire as their only source of heat and light. Then ask: **Why do you think fire was so important? What happened if a person couldn't light a fire?** (He or she might freeze, couldn't see in the dark, couldn't cook food, etc.) Introduce the vocabulary and have students read the passage. Then have them complete the activities and review the answers together.

### Day Two

**Vocabulary:** *friction, stable*

**Materials:** page 178

Introduce the vocabulary and invite students to list situations in which friction occurs. (e.g., using an eraser or sandpaper, sliding down a slide, dragging a box across the floor) Then have students read the passage and complete the activities. If students need help with the oral activity, prompt them with examples of how friction can be helpful (walking without slipping) or harmful (skinning your knee).

### Day Three

**Vocabulary:** *reactive*

**Materials:** page 179

Introduce the vocabulary word and have students read the passage. Point out to students that a chemical reaction doesn't start until the reactants are physically brought together. Direct them to complete the activities. Then go over the answers as a group.

### Day Four

**Vocabulary:** *irreversible*

**Materials:** page 180

Before students read the passage, have them describe what a burned match looks like. (black, misshapen, crumbly, etc.) Then ask students why they think a match can be lit only once. Revisit their hypotheses after they have read the passage. Then instruct students to complete the activities.

### Day Five

**Materials:** page 181

Have students complete the page independently. Then review the answers together.

Name \_\_\_\_\_

**Day  
1**

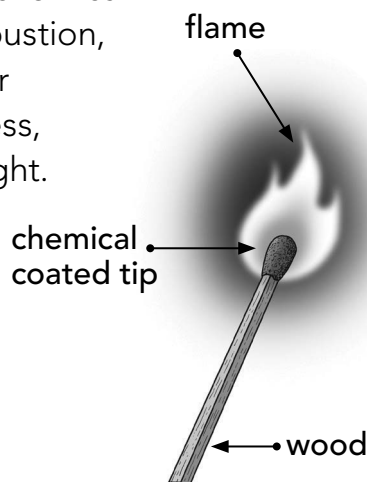
**Weekly Question**

**Why can't you light a match more than once?**

Imagine trying to start a campfire without a match—it's very hard to do! In fact, before matches were invented, it was often difficult to get a fire going or even light a candle. But by the 1800s, people knew that mixing certain substances together could produce a flame. They applied these chemicals to the ends of sticks to create some of the first matches.

A match produces a flame through a chemical reaction called **combustion**. During combustion, substances combine with oxygen in the air to make new substances and, in the process, produce energy in the form of heat and light.

The first matches that were made could produce a flame, but they had one problem. The chemicals that were put on the match tips sometimes reacted too easily! Early matches could unexpectedly **ignite**, bursting into flames or exploding.



**Vocabulary**

**combustion**

kum-BUSS-chun  
the oxidation  
or burning of  
a substance

**ignite**

ig-NYT  
to catch on fire

**A. Use the vocabulary words to complete the sentences.**

1. Chemical substances applied to the ends of sticks cause them to \_\_\_\_\_.
2. A kind of reaction called \_\_\_\_\_ results in the oxidation of a substance.

**B. The first matches were stored in airtight boxes to keep them from igniting suddenly on their own. Why do you think this worked?**

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Name \_\_\_\_\_

Daily Science

## Big Idea 6

WEEK 4

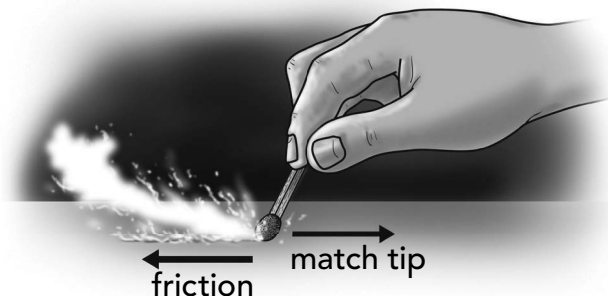
Day 2

### Weekly Question

## Why can't you light a match more than once?

In 1826, the English chemist John Walker developed a new kind of match. He realized that, in order for a match to work safely, its reactants had to react less easily. In other words, the match had to be a little hard to light. Walker came up with the idea of creating a match that would ignite only when it was rubbed against a surface. He put two substances—potassium chlorate and antimony sulfide—on a match tip. He knew that these substances were relatively **stable** and wouldn't accidentally ignite like some other chemicals. However, he also knew that heat would cause the two substances to react. And this heat could be generated by **friction**.

Friction is a force that resists movement between objects that touch. In the same way that rubbing your hands together causes them to get warm, heat is produced when a match tip is struck against a surface. The heat lasts only a second, but it provides enough energy to start the reaction between chemicals on the match.



### Vocabulary

#### friction

FRIK-shun

*a force between two surfaces that resists movement and produces heat*

#### stable

STAY-bul

*having the ability to resist a chemical change*

Check the boxes next to the statements that are true.

- ☐ John Walker did not think a chemical reaction was required to light a match.
- ☐ Potassium chlorate and antimony sulfide are relatively stable substances.
- ☐ Friction is a force that resists chemical change.
- ☐ Rubbing your hands together is an example of friction.



### Talk

In some situations friction is helpful, and in other situations it can hurt. Discuss with a partner two ways friction can be helpful and two ways it may not be.



**Day  
3****Weekly Question****Why can't you light a match more than once?**

The friction match invented by John Walker was a kind of "strike-anywhere" match. It was called this because the match would ignite after being struck on almost any surface. But the match had a bad smell, so a few years later a new type of match was developed by a chemist who put an odorless chemical called phosphorus into the reaction mix. These matches became popular, but they were dangerous because the phosphorus was very **reactive**.

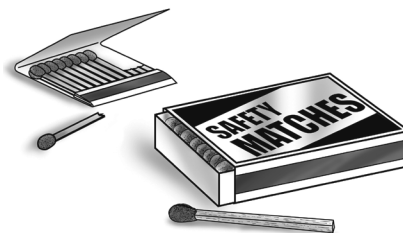
Finally, in 1844, the "safety match" was created by Swedish inventors. They put a chemical called potassium chlorate on the tip of the match and moved the phosphorus to a strip alongside the matchbox. In this way, the reactants didn't come together until the match was struck against the strip. And the match didn't smell as bad.

**Vocabulary****reactive**

ree-AK-tiv  
able to easily  
enter into a  
chemical reaction



Strike-anywhere matches have a white tip.



Safety matches can be made of either wood or cardboard.

- A. Explain the difference between a strike-anywhere match and a safety match.

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- B. Complete the analogy.

**Match tip** is to **potassium chlorate** as **matchbox strip** is to \_\_\_\_\_.

- C. Cross out the incorrect word and write the correct one above it to make the statement true.

Phosphorus matches were popular, but they were too stable.

Name \_\_\_\_\_

Daily Science

# Big Idea 6

WEEK 4

Day 4

## Weekly Question

# Why can't you light a match more than once?

A lit match looks very different from an unused match. Fire, smoke, and soot are the most obvious signs of combustion. There are, however, other substances produced from the reaction that are not visible to the eye. These include potassium chloride and compounds called phosphorus oxides. These new substances have properties that are different from the original substances. Most importantly, the new compounds are not very reactive. This is a good thing if you don't want a match to relight accidentally after you have blown it out!

Furthermore, a match contains only a limited amount of reactive material. So after all the reactants have been used up, no amount of friction will cause the match to relight. And unlike a battery that can be recharged, the chemical reaction that ignites a match is **irreversible**.

## Vocabulary

### irreversible

eer-ih-VERS-ih-bul  
unable to go in the opposite direction



unused match



lit match



burned match

A. Give three reasons why a match lights only once.

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

B. What are two obvious products of combustion? What are two products that are *not* obvious?

Obvious: \_\_\_\_\_

Not obvious: \_\_\_\_\_

Name \_\_\_\_\_

**Day  
5**

**Weekly Question**

**Why can't you light a match more than once?**

A. Use the words in the box to complete the paragraph.

combustion    friction    ignites  
irreversible    reactive    stable

A match \_\_\_\_\_ when substances on the match tip combine with oxygen in the air. Early matches used substances that were too \_\_\_\_\_, which resulted in sudden, unexpected \_\_\_\_\_ of the matches. In order to create a safe and effective match, inventors needed to find reactants that were more \_\_\_\_\_. But these reactants didn't light as easily, so one inventor had the idea of using \_\_\_\_\_ to momentarily heat the substances and start the reaction. To this day, however, no one has invented a match that can be used more than once. This is because the reaction is \_\_\_\_\_. Once all of the reactants on a match have been used up, it can't light again.

B. Name two ways that people tried to make matches safer.

1. \_\_\_\_\_
2. \_\_\_\_\_

Daily Science

**Big  
Idea 6**



**WEEK 4**

Name \_\_\_\_\_

**Unit  
Review**

**Comprehension**

**Ignite Your Curiosity**



Fill in the bubble next to the correct answer.

1. Which of these is a chemical property of metal?  
Ⓐ It reacts with oxygen to form rust.  
Ⓑ It is hard and shiny.  
Ⓒ It can conduct electricity.  
Ⓓ It has a very high boiling point.
2. Which of these is *not* a way to keep food from oxidizing?  
Ⓐ storing it in an airtight container  
Ⓑ adding antioxidants  
Ⓒ adding carbonation  
Ⓓ sealing it securely in plastic wrap
3. In a chemical reaction, \_\_\_\_\_.  
Ⓐ reactants form mixtures                      Ⓒ new substances are formed  
Ⓑ CO<sub>2</sub> gas dissolves                              Ⓓ the freezing point is lowered
4. Which of these is *not* a product of combustion?  
Ⓐ heat                                                      Ⓒ smoke  
Ⓑ light                                                      Ⓓ wood
5. The electrochemical reaction in a car battery \_\_\_\_\_.  
Ⓐ produces rust                                      Ⓒ stops electric current  
Ⓑ is reversible                                              Ⓓ is irreversible
6. Which of these is *not* true about soda?  
Ⓐ It is a compound.                                      Ⓒ It is a sugar-water solution.  
Ⓑ It has a lower freezing point than water.                                      Ⓓ It is carbonated.

Name \_\_\_\_\_

**Unit  
Review**

**Vocabulary**

**React to This!**

Daily Science

**Big  
Idea 6**

**WEEK 5**

Write the vocabulary word that matches or completes each clue.

1. When a material is \_\_\_\_\_,  
it enters easily into a chemical reaction.
2. able to be dissolved \_\_\_\_\_
3. cannot be reversed \_\_\_\_\_
4. to catch on fire \_\_\_\_\_
5. end material in a chemical reaction \_\_\_\_\_
6. qualities that determine how a substance reacts  
with other substances \_\_\_\_\_
7. This chemical reaction produces a flame.  
\_\_\_\_\_
8. This generates heat by rubbing. \_\_\_\_\_
9. a mixture that is a liquid \_\_\_\_\_
10. The temperature at which liquid changes into a gas  
is a substance's \_\_\_\_\_.
11. Substances in a \_\_\_\_\_ can be separated.
12. not very reactive \_\_\_\_\_
13. The temperature at which liquid changes into a solid  
is a substance's \_\_\_\_\_.
14. starting material in a chemical reaction \_\_\_\_\_
15. Rusting metal is a sign of this. \_\_\_\_\_

boiling point  
chemical  
properties  
combustion  
corrosion  
freezing point  
friction  
ignite  
irreversible  
mixture  
product  
reactant  
reactive  
soluble  
solution  
stable

Name \_\_\_\_\_

**Unit  
Review**

**Visual Literacy**

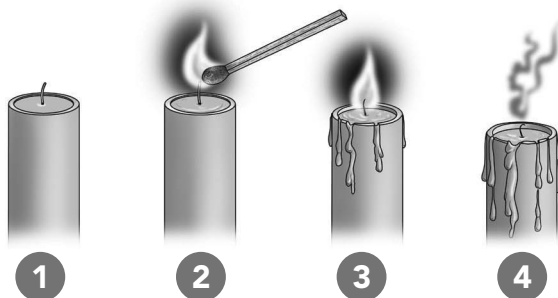
**Illuminating Discussion**

Daily Science

**Big  
Idea 6**

**WEEK 5**

- A. Look at the pictures showing a candle as it is lit and after it has been blown out. Then answers the questions below.



1. Name a physical property of the unlit candle in picture 1.  
\_\_\_\_\_
2. Name a physical property of the candle that has been blown out in picture 4.  
\_\_\_\_\_
3. What starts the chemical reaction of the wick burning in picture 2?  
\_\_\_\_\_
4. Which product of combustion is visible in picture 3?  
\_\_\_\_\_

- B. Write whether each statement below describes a *physical* or a *chemical* change.

1. The solid wax melts into liquid. \_\_\_\_\_
2. Chemicals on the match tip ignite. \_\_\_\_\_
3. Substances in the wax combine with oxygen in the air. \_\_\_\_\_

Name \_\_\_\_\_

**Unit  
Review**

**Hands-on Activity**

# Penny for Your Thoughts

Daily Science

## Big Idea 6



**WEEK 5**

When copper pennies are first made, they look shiny and new. But after a while, the copper becomes oxidized. Complete the experiment to see what happens when an oxidized penny is placed in an acidic solution. The results are priceless!

### What You Need

- ½ cup white vinegar
- 2 teaspoons salt
- 1 shallow clear glass or plastic bowl
- 1 spoon (not metal)
- 20 dull pennies
- 1 clean steel nail
- paper towels

1. Pour the salt and vinegar into the bowl and stir until the salt dissolves.
2. Dump 15 of the copper pennies into the bowl so that they are fully covered in solution.
3. After 10 minutes, remove five pennies from the solution. Rinse them in water and put them on the paper towels to dry.
4. While the rest of the pennies are reacting with the vinegar and salt solution, place the nail halfway into the solution.
5. After 30 minutes, remove the pennies and the nail from the solution. Rinse them and place them on the paper towels to dry.

### What Did You Discover?

1. What did you observe when you placed the pennies in the solution?

\_\_\_\_\_

2. What did the first batch of pennies look like when you removed them from the solution and dried them off? How did they compare to the untreated pennies?

\_\_\_\_\_

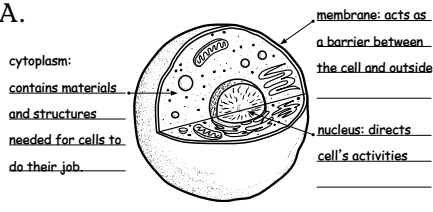
3. What did the nail look like when you removed it from the solution?

\_\_\_\_\_

# Answer Key

## Big Idea 1: Week 1 • Day 1

A.



B. Muscle cells help you move, and bone cells give your body its shape.

## Big Idea 1: Week 1 • Day 2

1. connective tissue
2. connective tissue
3. muscle tissue
4. connective tissue
5. muscle tissue
6. muscle tissue

## Big Idea 1: Week 1 • Day 3

- A. 1. The muscle tissue attached to your skeleton is made from long, thin cells.  
 2. Skeletal muscle cells have more than one nucleus and a cell membrane.  
 3. When you flex your arm, the muscle tissue becomes shorter and thicker.
- B. Answers will vary—e.g.,  
*Voluntary:* hand, neck, tongue  
*Involuntary:* heart, digestive muscles, lungs

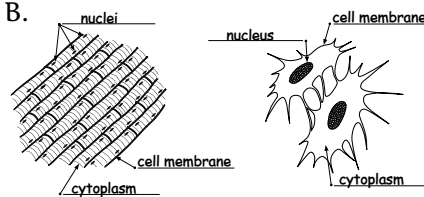
## Big Idea 1: Week 1 • Day 4

- A. *Alike:* Both have cytoplasm and both perform special functions.  
*Different:* Bone cells are star-shaped and surrounded by calcium, while muscle cells are long and thin and have more than one nucleus.
- B. Answers will vary—e.g., As your bones grow, calcium makes them hard, which also makes them stronger.

## Big Idea 1: Week 1 • Day 5

- A. cell, nucleus, membrane, cytoplasm, tissue, Connective tissue, Muscle tissue

B.

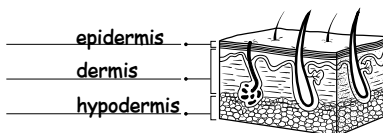


## Big Idea 1: Week 2 • Day 1

- A. 1. epithelial tissue  
 2. connective tissue
- B. It protects the body from the outside world, moves materials in and out of the body, and secretes sweat.
- C. cell is to tissue

## Big Idea 1: Week 2 • Day 2

A.



- B. 1. dermis  
 2. epidermis  
 3. hypodermis
- C. the dermis, because this is the layer where hair roots are located and where sensations of temperature are registered

## Big Idea 1: Week 2 • Day 3

1. callus      3. sebum  
 2. sebum      4. callus
- TALK: Answers will vary—e.g., Water and soap wash off sebum, which can clog your pores.

## Big Idea 1: Week 2 • Day 4

- A. 1. The fingers have the most callus cells.  
 2. because you aren't soaking in water for more than 20 minutes  
 3. because there aren't many callus cells on your stomach
- B. The substance is like sebum because it acts like a waterproof seal. It is different because it comes from a gland near the tail, and ducks have to spread it themselves.

## Big Idea 1: Week 2 • Day 5

- A. organ, epithelial, hypodermis, dermis, epidermis, sebum, callus
- B. 1. false      2. true      3. true

- C. First degree burns happen in the epidermis, second degree in the dermis, and third degree in the hypodermis. The more serious the burn, the deeper layer it affects.

## Big Idea 1: Week 3 • Day 1

1. esophagus
2. small intestine
3. break down food, absorb nutrients, expel waste

## Big Idea 1: Week 3 • Day 2

- A. When food is in your mouth, your salivary glands secrete saliva, which, along with chewing, helps break down nutrients for your body to absorb.
- B. 1. Both help break down food. Chewing breaks food into smaller pieces but enzymes break down food's nutrients.  
 2. Answers will vary—e.g., You might choke on food pieces that are too big; you might not break down food enough to get all its nutrients.

## Big Idea 1: Week 3 • Day 3

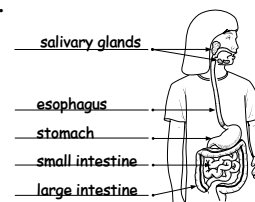
- A. 1. acids  
 2. villi  
 3. small intestine
- B. Strong muscles in the stomach contract to force out spoiled food.

## Big Idea 1: Week 3 • Day 4

- A. 1. absorb water from waste  
 2. compact the waste  
 3. expel waste from the body
- B. digestive, excretory

## Big Idea 1: Week 3 • Day 5

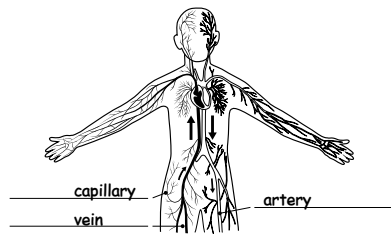
- A. digestive system, salivary glands, enzymes, esophagus, intestine, villi
- B.





**Big Idea 1: Week 4 • Day 1**

A.



- B. 1. Blood moves oxygen and nutrients throughout the body.  
2. Blood carries waste away so it can be eliminated.

**Big Idea 1: Week 4 • Day 2**

1. plasma
2. white blood cells
3. platelets
4. from red blood cells
5. If that person got a cut, the blood would not clot. He or she would not stop bleeding.

**Big Idea 1: Week 4 • Day 3**

- A. 1. false    2. false    3. true  
B. 4.2 billion  
C. marrow, stem, blood

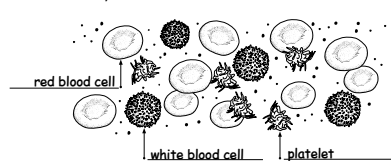
**Big Idea 1: Week 4 • Day 4**

1. red blood cells
2. accident
3. 40–95 units
4. 5 units

**Big Idea 1: Week 4 • Day 5**

- A. circulatory system, blood vessels, plasma, platelets, marrow, stem cells

B.



- C. Answers will vary—e.g., People should donate blood to help those who need it after an accident, during surgery, or when fighting a disease.

**Big Idea 1: Week 5 • Unit Review 1**

1. A    5. B
2. C    6. C
3. D    7. D
4. B

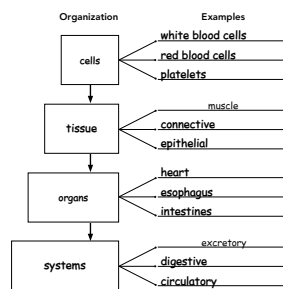
**Big Idea 1: Week 5 • Unit Review 2**

ACROSS

1. cytoplasm
5. tissue
7. marrow
9. esophagus
12. villi
14. enzymes

DOWN

2. plasma
3. dermis
4. hypodermis
6. organ
8. membrane
10. platelets
11. nucleus
13. cell

**Big Idea 1: Week 5 • Unit Review 3****Big Idea 1: Week 5 • Unit Review 4**

1. The bread broke down into a wet, mushy substance.
2. The gum remained as a wad.
3. The bread is digestible but the gum is not.

**Big Idea 2: Week 1 • Day 1**

- A. *habitat* is to *ecosystem*  
B. microorganisms, habitat, ecosystem, decomposers

**Big Idea 2: Week 1 • Day 2**

- A. 1. contains earthworms' food  
2. shields earthworms from exposure  
3. helps earthworms stay cool and hydrated  
B. Earthworms burrow into soil to avoid exposure to the sun and to remain hydrated.

**Big Idea 2: Week 1 • Day 3**

- A. 1. false    2. true    3. false  
B. 1. They add nutrients and minerals to the soil with their castings.  
2. They aerate soil when they burrow.  
3. They help water drain through the soil.

**Big Idea 2: Week 1 • Day 4**

A. 3, 2, 1, 5, 4

- B. Answers will vary—e.g., Soil wouldn't have as many nutrients, so plants might not grow and provide food for animals.

**Big Idea 2: Week 1 • Day 5**

- A. ecosystem, decomposers, castings, aerate, exposure, hydrated  
B. 1. As decomposers, earthworms break down kitchen waste and add nutrients to the soil.  
2. Not all trash is organic. Some of it is plastic, glass, or other things that don't decay.

**Big Idea 2: Week 2 • Day 1**

- A. *Pandas*: live in China, eat bamboo  
*Polar Bears*: live in the Arctic Circle, eat seals  
*Both*: members of the bear family, consumers, have special adaptations  
B. 1. allows a dolphin to breathe underwater  
2. keeps sand out of a camel's eyes  
3. allows a monkey to grab branches and balance itself

**Big Idea 2: Week 2 • Day 2**

- A. 1. Pandas have flat teeth to help them grind their food.  
2. Pandas have a bone that extends from their wrist to help them grasp bamboo.  
B. 1. Most bears are omnivores.  
2. Pandas cannot easily digest bamboo.  
3. A panda's habitat is mild.

**Big Idea 2: Week 2 • Day 3**

- A. 1. helps polar bear swim  
2. helps polar bear grip ice and catch prey  
3. helps polar bear walk on ice  
B. 1. because no plants grow where they live  
2. Fur and fat keep the polar bear warm in the cold climate.

**Big Idea 2: Week 2 • Day 4**

1. false                      3. true
2. false                      4. true

**TALK:** Answers will vary—e.g., fight climate change, set aside land for animals, breed them in captivity, stop hunting them, etc.

**Big Idea 2: Week 2 • Day 5**

- A. consumers, omnivores, herbivores, carnivores, adaptations, habitats
- B. A polar bear would not survive in a panda's habitat because the polar bear would not have the right food, and the climate would be too warm.
- C. Answers will vary—e.g., *Panda ecosystem:* bamboo, rain, cool weather, mountains  
*Polar bear ecosystem:* ice, seals, ocean, frigid temperatures

**Big Idea 2: Week 3 • Day 1**

- A. predator, prey
- B. 1. powerful legs  
2. sharp teeth  
3. strong jaw  
4. sharp claws
- C. 1. false    2. true    3. true

**Big Idea 2: Week 3 • Day 2**

- A. Answers will vary—e.g., In the savanna food chain, grasses are eaten by gazelles, which in turn are eaten by lions.
- B. 1. wide grasslands  
2. warm and usually dry  
3. scattered shrubs and trees

**Big Idea 2: Week 3 • Day 3**

- A. Answers will vary—e.g.,  
1. impala/giraffe  
2. acacia tree/grass, giraffe/zebra  
3. grass, aardvark, hyena
- B. Cheetahs are fast and can outrun prey and lions.

**Big Idea 2: Week 3 • Day 4**

- A. Answers will vary—e.g.,  
1. plankton/fish, salmon, grizzly bear/wolf  
2. plants, elk/rabbits, wolf/grizzly bear
- B. Answers will vary—e.g., The rabbits spread without being eaten. The rabbits hurt the vegetation by eating too much of it.

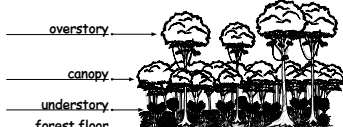
**Big Idea 2: Week 3 • Day 5**

- A. savanna, predators, prey, competition, food chain, food web
- B. A food chain is a sequence of organisms in which each member feeds on the one below it. A food web includes many overlapping food chains.
- C. 1. hyena is to gazelle  
2. Alaska is to grizzly bear

**Big Idea 2: Week 4 • Day 1**

- A. Answers will vary—e.g.,  
1. warm, humid  
2. rainy  
3. thousands of plants
- B. monkey

**Big Idea 2: Week 4 • Day 2**

- A. 
  - \_\_\_\_\_ overstory
  - \_\_\_\_\_ canopy
  - \_\_\_\_\_ understory
  - \_\_\_\_\_ forest floor
- B. the canopy, because it traps humidity and captures most of the sunlight, which makes it easy for plants to grow

**Big Idea 2: Week 4 • Day 3**

- A. 1. false    3. true  
2. false    4. true
- B. 1. from dead organic matter that falls from above  
2. from the soil

**Big Idea 2: Week 4 • Day 4**

- A. Answers will vary—e.g., The rainforest is home to a wide diversity of life, including insects, frogs, and many types of plants.
- B. 1. pollinate flowers  
2. help scatter seeds  
3. provide nutrients

**Big Idea 2: Week 4 • Day 5**

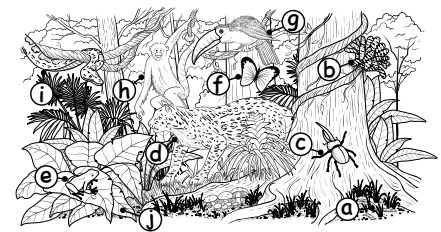
- A. rainforest, diversity, producers, overstory, understory, canopy, epiphytes
- B. 1. forest floor  
2. canopy  
3. overstory

**Big Idea 2: Week 5 • Unit Review 1**

- A. 1. C    3. A    5. B  
2. B    4. D    6. C
- B. 1. They aerate it.  
2. They provide nutrients with their castings.

**Big Idea 2: Week 5 • Unit Review 2**

1. diversity                      10. epiphyte
2. castings                      11. aerate
3. decomposer                  12. exposure
4. adaptation                  13. consumer
5. savanna                      14. food web
6. hydrated                      15. producer
7. canopy                      16. predator
8. omnivore                      17. competition
9. carnivore                      18. herbivore

**Big Idea 2: Week 5 • Unit Review 3****Big Idea 2: Week 5 • Unit Review 4**

1. Earthworms ate the lettuce and mixed it into the soil; the other lettuce rotted and didn't move.
2. Earthworms mixed the layers; the other layers stayed in place.
3. Earthworms burrow and bring nutrients deep into the soil, mixing the soil around.

**Big Idea 3: Week 1 • Day 1**

- A. 
- B. 1. true    3. true  
2. false    4. false
- C. 3 milliliters

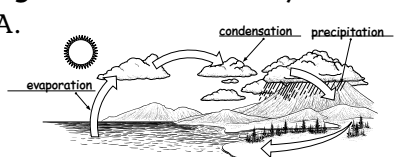
**Big Idea 3: Week 1 • Day 2**

- A. 4, 2, 1, 3
- B. 1. evaporate  
2. water vapor, humidity

**Big Idea 3: Week 1 • Day 3**

- A. Condensation is when water vapor condenses into a liquid, and precipitation is when that liquid falls to the ground as droplets or ice.
- B. boiling water

**Big Idea 3: Week 1 • Day 4**

- A. 

- B. Answers will vary—e.g.,  
Because fresh water returns to the ocean through precipitation or by rivers and balances out the salt.

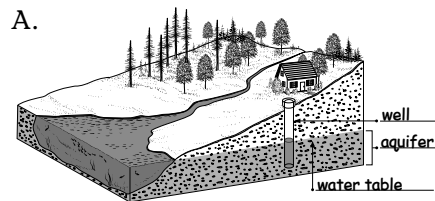
### Big Idea 3: Week 1 • Day 5

- A. water cycle, evaporate, water vapor, humidity, condensation, precipitation  
B. Answers will vary—e.g.,  
Yes, because water can be blown to a different location on Earth by the wind. It has also been constantly recycled over millions of years in the water cycle.

### Big Idea 3: Week 2 • Day 1

- A. 1. 30%  
2. It is frozen in glaciers and polar ice caps.  
B. 1. irrigation  
2. groundwater

### Big Idea 3: Week 2 • Day 2



- B. Answers will vary—e.g.,  
1. sponge 2. skin  
C. The water table gets so low that it drops below the reach of the well.

### Big Idea 3: Week 2 • Day 3

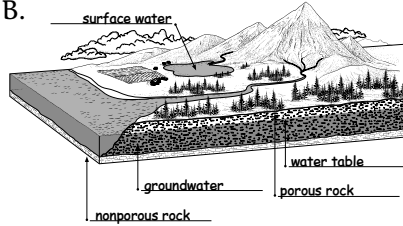
- A. *Diagram 1:* The rain is soaking into porous rock, which gets saturated, so the water starts collecting on the surface.  
*Diagram 2:* The rain is falling on nonporous rock, so all the water collects on the surface.  
B. Surface water is water you can see above the ground, and groundwater is water that has soaked into the ground.

### Big Idea 3: Week 2 • Day 4

- A. 1. pollution 2. overuse  
B. 1. The water table can drop below the reach of wells.  
2. Saltwater intrusion makes groundwater too salty to use.

### Big Idea 3: Week 2 • Day 5

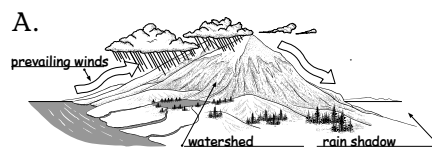
- A. 1. e 3. f 5. d  
2. a 4. b 6. c  
B.



### Big Idea 3: Week 3 • Day 1

- A. 1. seven  
2. Australia  
B. All boxes should be checked.

### Big Idea 3: Week 3 • Day 2



- B. 1. c 2. a

### Big Idea 3: Week 3 • Day 3

- A. When the winds blow from the Indian Ocean, they bring water vapor with them.  
B. 1. The air is too warm for water to condense.  
2. Dry prevailing winds blow over land instead of water.

### Big Idea 3: Week 3 • Day 4

- A. The first two boxes should be checked.  
B. Answers will vary—e.g.,  
1. reserve: to keep for future use  
2. serve: to assist or help

### Big Idea 3: Week 3 • Day 5

- A. rain shadow, Prevailing winds, watershed, monsoons, oasis, reservoir  
B. Answers should include two of the following: The area is in a rain shadow; Prevailing winds come from over dry land instead of water; The air is too warm for water to condense.  
C. Prevailing winds change direction and blow from the ocean, bringing heavy rain.

### Big Idea 3: Week 4 • Day 1

- A. 1. 9.5 billion 3. 3.5 billion  
2. 3 billion  
B. 4,380 gallons

### Big Idea 3: Week 4 • Day 2

- A. 1. A drought is caused by less rainfall than usual.  
2. In some places, water is too contaminated to drink.  
B. Answers will vary—e.g.,  
*Agriculture:* The crops might not grow.  
*Drinking water:* There might not be enough water to drink.  
*Economy:* Businesses such as restaurants might not be able to operate.

### Big Idea 3: Week 4 • Day 3

- A. 2, 4, 1, 5, 3  
B. 1. It is an expensive process.  
2. It can provide water easily only to people who live near the ocean.

### Big Idea 3: Week 4 • Day 4

1. bathroom  
2. Answers will vary—e.g.,  
dishwasher, sprinkler system  
TALK: Answers will vary—e.g.,  
only water the lawn once a week, don't take long showers, don't leave the faucet running, etc.

### Big Idea 3: Week 4 • Day 5

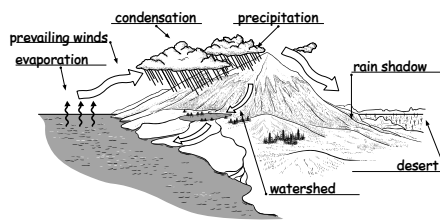
- A. 1. conservation  
2. reclamation  
3. contaminate  
4. desalination  
5. drought  
B. 1. true 3. false 5. true  
2. false 4. true

### Big Idea 3: Week 5 • Unit Review 1

1. B 3. D 5. C 7. D  
2. A 4. B 6. D

### Big Idea 3: Week 5 • Unit Review 2

- |                  |                  |
|------------------|------------------|
| 1. water vapor   | 10. reclamation  |
| 2. groundwater   | 11. irrigation   |
| 3. monsoons      | 12. watershed    |
| 4. rain shadow   | 13. contaminate  |
| 5. humidity      | 14. conservation |
| 6. oasis         | 15. water table  |
| 7. drought       | 16. aquifer      |
| 8. porous        | 17. desalination |
| 9. surface water | 18. water cycle  |

**Big Idea 3: Week 5 • Unit Review 3**

Answers will vary—e.g., On one side of the mountain, where there is precipitation and a watershed, the land is fertile and has more trees. On the other side, or the rain shadow, the land is dry and becomes a desert.

**Big Idea 3: Week 5 • Unit Review 4**

1. It evaporated, condensed on the plastic, and then ended up in the cup.
2.  $\frac{1}{2}$  cup—about the same amount we started with
3. This made the condensed water gather over the cup so it could fall there, instead of back into the soil.
4. It could work, but it would be slower. There would need to be some sunlight in order for the water to evaporate.

**Big Idea 4: Week 1 • Day 1**

- A. 1. true      3. true  
2. false      4. true
- B. The gravitational force on the moon is not as strong as the gravitational force on Earth, so the astronaut weighs less.

**Big Idea 4: Week 1 • Day 2**

- A. 1. bowling ball      3. nail  
2. washcloth      4. quarter
- B. Earth has much more mass than we do.
- C. Because the sun is so much farther away, its gravity doesn't have as much of an effect.

**Big Idea 4: Week 1 • Day 3**

- A. 1. 54.2  
2. child's weight on Earth; 40 lbs  
3. the adult, because he or she has more mass in general, and mass doesn't change between Earth and the moon

- B. Both, because when you change the size of your body, you are losing mass. With less mass, the pull of gravity is less, and so you weigh less as well.

**Big Idea 4: Week 1 • Day 4**

- A. 1. Saturn  
2. Jupiter  
3. Mercury and Mars
- B. An object's mass determines its gravitational force. The gravitational force of Phobos is weaker than the gravitational force of a neutron star.

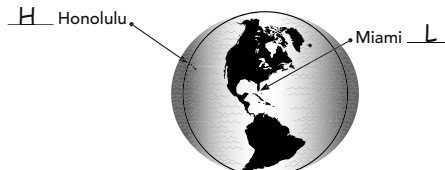
**Big Idea 4: Week 1 • Day 5**

- A. 1. gravitational force  
2. weight  
3. mass
- B. 1. Mass is the amount of matter in an object, and weight is measured by the pull of gravity on a given mass.  
2. because the gravitational force is nearly the same everywhere on Earth
- C. 1. an object's mass  
2. the distance between the objects

**Big Idea 4: Week 2 • Day 1**

- A. 1. 8 feet  
2. 3 feet
- B. Answers will vary—e.g., No, because you are so far out to sea that you won't notice the change of the water rising a couple of feet. It also happens too slowly to see the small change.

**Big Idea 4: Week 2 • Day 2**

- A. 
- B. 1. 2  
2. The tides would be even more exaggerated, with bigger bulges and lower dips in the ocean.

**Big Idea 4: Week 2 • Day 3**

1. 24
2. because it is so much closer to Earth
3. spring tides, because when the sun, moon, and Earth are aligned, there are higher high tides and lower low tides

**Big Idea 4: Week 2 • Day 4**

- A. Answers will vary—e.g., Newton realized that both the sun and the moon exert gravitational force on the tides, and these forces combine during full or new moons, which is when the sun, Earth, and moon are aligned.
- B. Answers will vary—e.g., full moon, because it provides more light

**TALK:** Answers will vary—e.g., when you want to launch a boat in the harbor, so you will know if there will be enough water for safe passage

**Big Idea 4: Week 2 • Day 5**

- A. spring tides, tidal range, neap tides, navigate
- B. 1. new moon  
2. June 22  
3. June 16

**Big Idea 4: Week 3 • Day 1**

- A. basketball
- B. 1. They are spherical.  
2. They orbit the sun.  
3. Their gravity controls all objects in the area around them.

**TALK:** Answers will vary—e.g., moons and rings

**Big Idea 4: Week 3 • Day 2**

- A. 1. true      2. false      3. false
- B. 1. coalesce      2. accretion

**Big Idea 4: Week 3 • Day 3**

- A. Center of mass is to planet as axis is to Earth.
- B. Answers will vary—e.g., As the mass of an object increases, gravity pulls more matter to the center. Finally, when the object becomes very massive, gravity forces it into a round shape so that all the mass is as close to the center of mass as possible.

**Big Idea 4: Week 3 • Day 4**

1. Earth's rotation creates centrifugal force that pushes out Earth's surface at the equator.
2. It would have to stop rotating.
3. When you are farther from the center of mass, gravity is less, so you weigh less.

**Big Idea 4: Week 3 • Day 5**

- A. 1. centrifugal force  
2. spherical, center of mass  
3. coalesced, accretion
- B. Answers will vary—e.g., Gravity acts to pull everything toward an object's center of mass. When objects are as massive as planets, gravity forces them into a round shape so that all their mass can be as close to the center of mass as possible.
- C. 1. orbit the sun  
2. control all objects in its region

**Big Idea 4: Week 4 • Day 1**

- A. 1. inertia 2. gravity
- B. 1. Gravity Inertia  
2. unaffected determined  
3. less more

**Big Idea 4: Week 4 • Day 2**

- A. 1. inertia 2. friction 3. orbit  
B. elliptical

**Big Idea 4: Week 4 • Day 3**

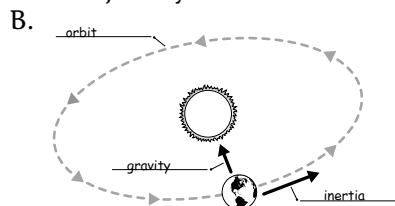
trajectory, free fall, gravity, inertia

**Big Idea 4: Week 4 • Day 4**

1. false 2. true 3. false
- TALK: Answers will vary—e.g., Many scientists believe an asteroid collision led to the extinction of dinosaurs. This allowed mammals to thrive and eventually paved the way for humans.

**Big Idea 4: Week 4 • Day 5**

- A. 1. free fall 4. Inertia  
2. elliptical 5. comets  
3. trajectory

**Big Idea 4: Week 5 • Unit Review 1**

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

**Big Idea 4: Week 5 • Unit Review 2**

- |                        |                       |
|------------------------|-----------------------|
| 1. elliptical          | 9. inertia            |
| 2. gravitational force | 10. tidal range       |
| 3. spherical           | 11. centrifugal force |
| 4. coalesce            | 12. mass              |
| 5. accretion           | 13. neap tides        |
| 6. weight              | 14. trajectory        |
| 7. free fall           | 15. navigate          |
| 8. spring tides        |                       |

**Big Idea 4: Week 5 • Unit Review 3**

1. inertia, because the hockey puck is continuing its forward motion
2. gravity and inertia, because gravity pulls the car down while inertia makes the hat fly off the person's head
3. gravity, because the sky diver is falling down toward Earth's surface
4. inertia, because the boy and the skateboard are moving forward in a straight line
5. gravity, because gravity makes the rain fall to the ground

**Big Idea 4: Week 5 • Unit Review 4**

1. ball and rock
2. feather
3. the feather and wad of cotton, because they took longer to fall
4. They would all hit the ground at the same time.

**Big Idea 5: Week 1 • Day 1**

- A. 1. slower faster  
2. Heat Temperature  
3. heat kinetic  
4. color mass
- B. Temperature is the measure of a molecule's kinetic energy, and heat is energy that flows between objects of different temperatures.

**Big Idea 5: Week 1 • Day 2**

- A. more thermal energy, because a higher temperature means the air molecules have more kinetic energy, which means they transfer more thermal energy
- B. because you have to wait for the molecules of the thermometer to reach the same temperature as the molecules in your mouth

**Big Idea 5: Week 1 • Day 3**

- A. 3, 4, 2, 5, 1  
B. snow being formed into a snowball

**Big Idea 5: Week 1 • Day 4**

- A. B  
B. 1. temperature  
2. the properties of substances change when the temperature changes

**Big Idea 5: Week 1 • Day 5**

- A. 1. kinetic energy  
2. temperature  
3. Thermal energy  
4. phase change  
5. Heat
- B. When you apply heat to ice, its molecules speed up and their kinetic energy increases. The ice goes through a phase change and turns into water. Then, with even more heat, the water molecules gain kinetic energy and turn into gas.
- C. kinetic energy is to motion

**Big Idea 5: Week 2 • Day 1**

1. shorter longer
2. X-ray radiation Microwaves are
3. most least OR longest shortest
4. matter energy

**Big Idea 5: Week 2 • Day 2**

- A. 1. absorbs 5. neither  
2. reflects 6. neither  
3. neither 7. reflects  
4. absorbs 8. absorbs
- B. 1. They are easily absorbed by water molecules, fats, and sugar found in food.  
2. They are not absorbed by plastics, glass, paper, or ceramics.

**Big Idea 5: Week 2 • Day 3**

- A. 1. conventional oven  
2. microwave oven  
3. both  
4. microwave oven
- B. electromagnetic fields, molecules

**Big Idea 5: Week 2 • Day 4**

1. cold floor ← bare feet
2. microwaved dinner → plate
3. egg ← frying pan
4. ice cream ← bowl

**TALK:** Answers will vary—e.g., to conduct an orchestra is to *lead* musicians *through* the music they are playing; to conduct an experiment is to *go through* the process of doing something to see what happens; etc.

**Big Idea 5: Week 2 • Day 5**

- A. microwave, radiation, wavelength, conventional, electromagnetic, conduction
- B. 1. radiation      4. conduction  
2. conduction    5. reflection  
3. reflection

**Big Idea 5: Week 3 • Day 1**

- A. Answers will vary—e.g.,  
1. strong winds  
2. heavy rains  
3. high seas  
4. spiral of clouds
- B. satellite, hurricane
- C. because heat moves from warmer places to cooler ones

**Big Idea 5: Week 3 • Day 2**

- A. 1. true      3. false  
2. false      4. true
- B. B

**Big Idea 5: Week 3 • Day 3**

- A. 1. heat of condensation  
2. heat of condensation  
3. convection
- B. Heat is absorbed during evaporation in the waters off the coast of Africa and then released during heat of condensation when the vapor condenses over Texas.

**Big Idea 5: Week 3 • Day 4**

- A. 1. Water    2. magma    3. Air  
B. sun, Earth's core

**Big Idea 5: Week 3 • Day 5**

- A. 1. hurricane    4. condensation  
2. convection    5. Circulating  
3. satellite
- B. 1. freezes condenses  
2. equator poles  
3. snow rain
- C. 1. convection  
2. heat of condensation

**Big Idea 5: Week 4 • Day 1**

- A. 1. container, hands  
2. hand, container
- B. 1. warmer colder  
2. warm cold  
3. condensation conduction

**Big Idea 5: Week 4 • Day 2**

- A. 1. It has an inner bottle that has little contact with the outer bottle.  
2. Any places where the bottles touch are made from insulators.
- B. Answers will vary—e.g., I would make the bottom of the pot from good conductors so it could cook the spaghetti quickly. I would make the handles from insulators so I wouldn't burn my hands when lifting up the pot.

**Big Idea 5: Week 4 • Day 3**

- A. 1. true      3. true  
2. false      4. false
- B. 1. vacuum    2. Convection

**Big Idea 5: Week 4 • Day 4**

- A. Inside shiny surfaces block heat loss by radiation, keeping hot drinks hot. Outside shiny surfaces reflect heat from outside and keep it from entering the thermos, which keeps things cold.
- B. Answers will vary—e.g.,  
1. *thermometer*: a device for measuring temperature  
2. *thermal*: having to do with heat  
3. *thermostat*: a device that regulates temperature

**Big Idea 5: Week 4 • Day 5**

- A. 1. insulator  
2. vacuum  
3. conductors  
4. room temperature
- B. Answers will vary—e.g., The insulators limit heat transfer by conduction, the vacuum limits convection, and the shiny surfaces slow down radiation.

**Big Idea 5: Week 5 • Unit Review 1**

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

**Big Idea 5: Week 5 • Unit Review 2**

- |                   |                  |
|-------------------|------------------|
| 1. kinetic energy | 9. temperature   |
| 2. phase change   | 10. satellite    |
| 3. heat           | 11. conventional |
| 4. radiation      | 12. microwave    |
| 5. wavelength     | 13. heat of      |
| 6. circulating    | condensation     |
| 7. insulator      | 14. convection   |
| 8. conduction     | 15. vacuum       |

**Big Idea 5: Week 5 • Unit Review 3**

Answers will vary—e.g., Heat rises from the fire as smoke and warms the air by convection. Heat from the grill toasts the marshmallow by radiation. And the hamburger is cooked by conduction where it touches the hot metal grill.

**Big Idea 5: Week 5 • Unit Review 4**

1. Water moves from the side above the hot cup to the side above the cold cup because heat flows from warmer objects to cooler ones.
2. convection and conduction
3. Foam cups act as insulators so they keep hot water hot and cold water cold.
4. the red and blue dye mixed to make purple water

**Big Idea 6: Week 1 • Day 1**

- A. 1. carbonated  
2. mixture
- B. When the bottle is opened, the gas escapes into the air in the form of bubbles.

**Big Idea 6: Week 1 • Day 2**

1. gold      3. gold  
2. nitrogen    4. water, mercury

**Big Idea 6: Week 1 • Day 3**

- A. 1. sugar  
2. carbon dioxide  
3. oxygen
- B. No, because peanut butter is oily and does not dissolve well in water.

**Big Idea 6: Week 1 • Day 4**

- A. 1. pure water    2. pure water  
 B. B  
 C. A pond would freeze first because the ocean is made of salt water, and salt lowers the freezing point of water.

**Big Idea 6: Week 1 • Day 5**

- A. 1. mixture, solution  
 2. boiling point  
 3. carbonated  
 4. freezing point  
 B. 1. ~~solid~~ liquid  
 2. ~~oxygen~~ CO<sub>2</sub>/carbon dioxide  
 3. ~~increases~~ decreases  
 4. ~~solution~~ mixture  
 C. B

**Big Idea 6: Week 2 • Day 1**

- A. 1. corrosion  
 2. chemical reaction  
 B. A substance that goes through a physical change keeps the same chemical makeup. A substance that goes through a chemical reaction changes into a new substance with a different chemical makeup.

**Big Idea 6: Week 2 • Day 2**

- A. 1. takes up more space  
 2. crumbles easily  
 B. 1. ~~oxide~~ oxygen  
 2. ~~a single element~~ two or more elements  
 3. ~~the same as~~ different from  
 C. product

**Big Idea 6: Week 2 • Day 3**

- A. 1. apple    3. food  
 2. stain    4. iron key  
 B. B

**Big Idea 6: Week 2 • Day 4**

- A. 1. by painting it  
 2. by adding a substance that makes it less able to give away its electrons  
 B. 1. It doesn't oxidize as quickly.  
 2. It has carbon and chromium added to it.  
 C. plate

**Big Idea 6: Week 2 • Day 5**

- A. chemical reaction, reactants, compound, product, oxidized, reduced, corrosion  
 B. 1. true    3. false    5. false  
 2. true    4. true

**Big Idea 6: Week 3 • Day 1**

- A. 1. false    2. true    3. true  
 B. 1. size  
 2. cost  
 3. lifetime  
 4. amount of electric current produced

**Big Idea 6: Week 3 • Day 2**

- A. 1. chemical    4. chemical  
 2. physical    5. physical  
 3. chemical  
 B. Physical properties can be observed without changing the composition of a substance, while chemical properties can be observed only when a substance undergoes a chemical change.

**Big Idea 6: Week 3 • Day 3**

- A. product  
 B. lead sulfate, produces, removes

**Big Idea 6: Week 3 • Day 4**

- A. 2, 1, 3, 4  
 B. Answers will vary—e.g.,  
 1. MP3 player: wall outlet/house current  
 2. cell phone: wall outlet/house current

**Big Idea 6: Week 3 • Day 5**

- A. 1. electrochemical, electrodes  
 2. acid  
 3. chemical properties  
 4. current  
 B. 1. true    4. true  
 2. false    5. false  
 3. true

**Big Idea 6: Week 4 • Day 1**

- A. 1. ignite  
 2. combustion  
 B. Matches couldn't start burning if they had no source of oxygen.

**Big Idea 6: Week 4 • Day 2**

- Potassium chlorate and antimony sulfide are relatively stable substances.  
 Rubbing your hands together is an example of friction.  
 TALK: Answers will vary—e.g., It keeps us from slipping when we walk or ride a bike; we can skin our knees when we fall, or get rug burn if we slide around on a rug.

**Big Idea 6: Week 4 • Day 3**

- A. A strike-anywhere match has both reactants on the tip. On a safety match, the reactants are physically separated.  
 B. phosphorous  
 C. ~~stable~~ reactive

**Big Idea 6: Week 4 • Day 4**

- A. 1. The reactants are all used up.  
 2. The products of the reaction are not reactive.  
 3. The chemical reaction is irreversible.  
 B. *Obvious:* fire/smoke, soot  
*Not obvious:* potassium chloride and phosphorous oxides

**Big Idea 6: Week 4 • Day 5**

- A. ignites, reactive, combustion, stable, friction, irreversible  
 B. Answers will vary—e.g.,  
 1. use more stable reactants  
 2. physically separate the reactants

**Big Idea 6: Week 5 • Unit Review 1**

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

**Big Idea 6: Week 5 • Unit Review 2**

- |                 |                    |
|-----------------|--------------------|
| 1. reactive     | 8. friction        |
| 2. soluble      | 9. solution        |
| 3. irreversible | 10. boiling point  |
| 4. ignite       | 11. mixture        |
| 5. product      | 12. stable         |
| 6. chemical     | 13. freezing point |
| 7. combustion   | 14. reactant       |
|                 | 15. corrosion      |

**Big Idea 6: Week 5 • Unit Review 3**

- A. Answers will vary—e.g.,  
 1. solid wax  
 2. melted wax  
 3. the flame from the match  
 4. fire  
 B. 1. physical  
 2. chemical  
 3. chemical

**Big Idea 6: Week 5 • Unit Review 4**

1. Bubbles formed on the pennies.  
 2. They were much shinier than the untreated pennies.  
 3. The half that was in the solution was coated in copper from the pennies.



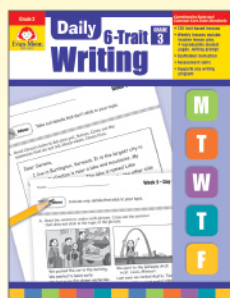
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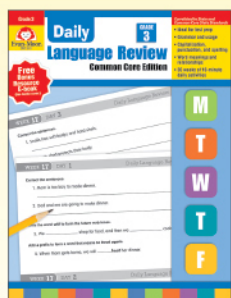
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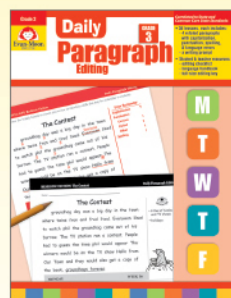
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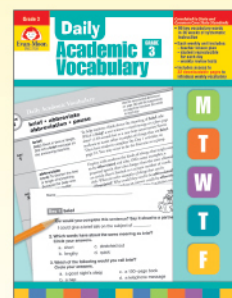
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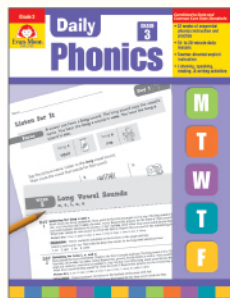
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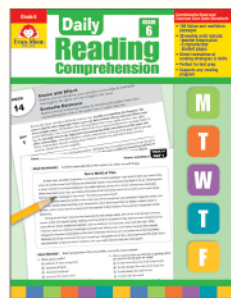
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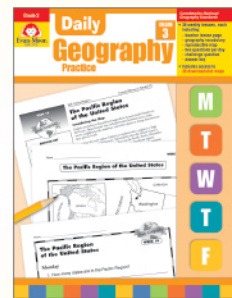
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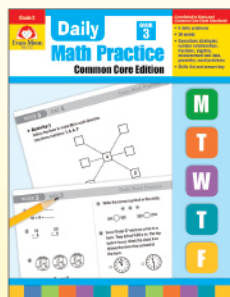
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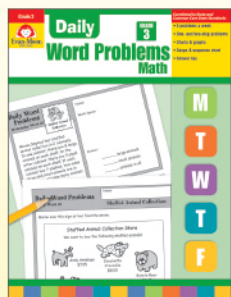
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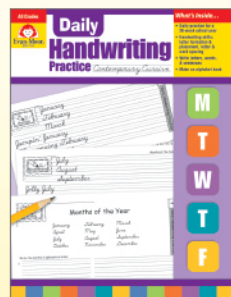
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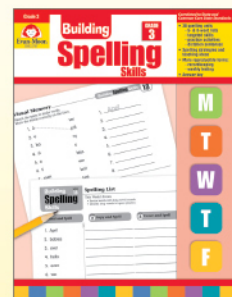
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