Grade 6

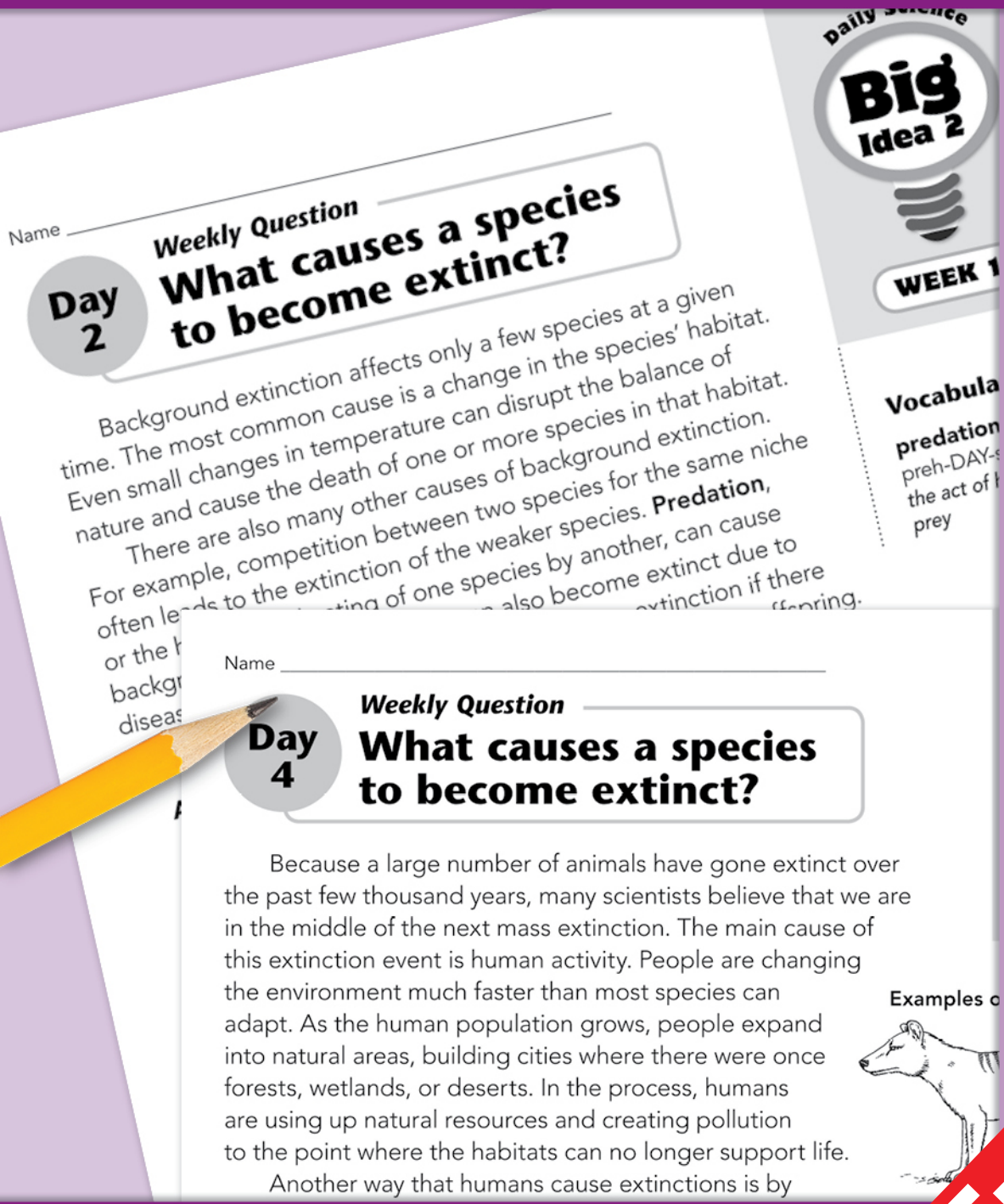
Evan-Moor
EMC 5016

Daily Science

GRADE 6

Correlated to State and Common Core State Standards

- 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



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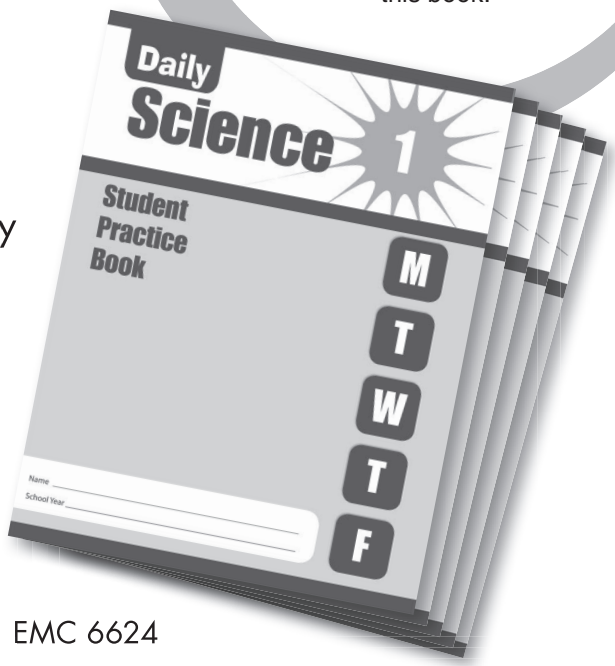

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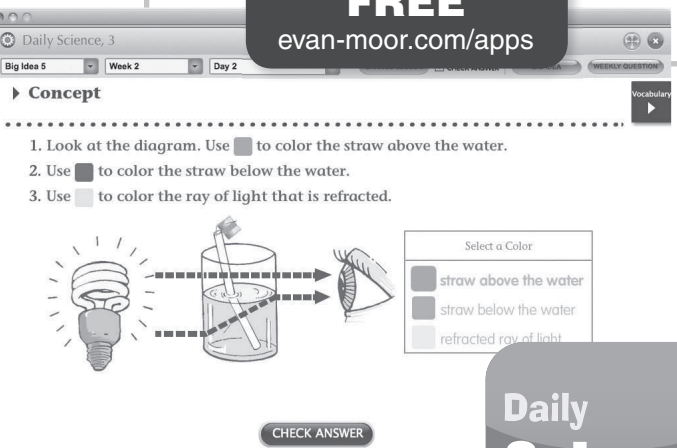

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Daily Science

GRADE 6

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18 Lower Ragsdale Drive, Monterey, CA 93940-5746. Printed in USA.

CPSIA: Printed by McNaughton & Gunn, Saline, MI USA.[5/2015]

Contents

What's in This Book?

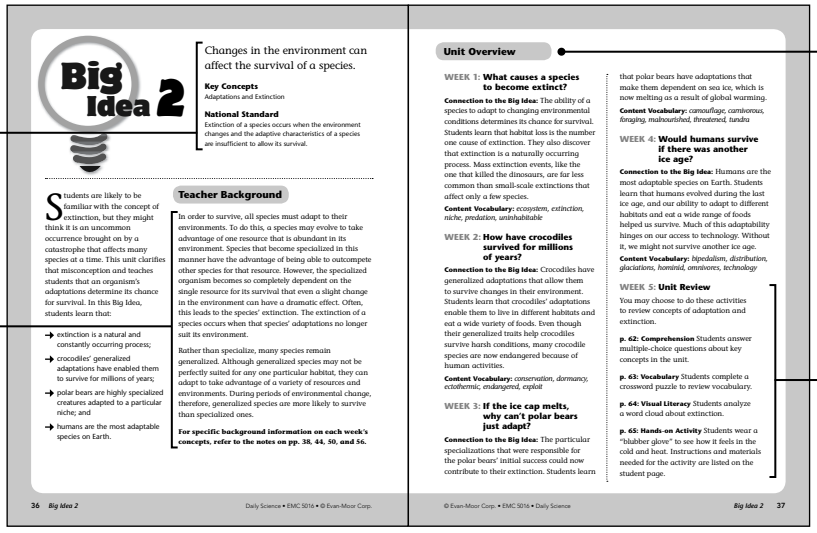
Daily Science provides daily activity pages grouped into six units, called Big Ideas, that explore a wide range of topics based on the national standards for life, earth, and physical sciences. Every Big Idea includes five weekly lessons. The first four weeks each center around an engaging question that 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 2

Changes in the environment can affect the survival of a species.

Key Concepts
Adaptations and Extinction

National Standard
Extinction of a species occurs when the environment changes and the adaptive characteristics of a species are insufficient to allow its survival.

Teacher Background

Students are likely to be familiar with the concept of extinction, but they might think it is an uncommon occurrence brought on by a catastrophe that affects many species at a time. This unit clarifies that misconception and teaches students that an organism's adaptations determine its chance for survival. In this Big Idea, students learn that:

- extinction is a natural and constantly occurring process;
- crocodiles' generalized adaptations have enabled them to survive for millions of years;
- polar bears are highly specialized creatures adapted to a particular niche; and
- humans are the most adaptable species on Earth.

In order to survive, all species must adapt to their environments. To do this, a species may evolve to take advantage of one resource that is abundant in its environment. Species that become specialized in this manner have the advantage of being able to outcompete other species for that resource. However, the specialized organism becomes so completely dependent on the single resource for its survival that even a slight change in the environment can have a dramatic effect. Often, this leads to the species' extinction. The extinction of a species occurs when that species' adaptations no longer suit its environment.

Rather than specialize, many species remain generalized. Although generalized species may not be perfectly suited for any one particular habitat, they can adapt to take advantage of a variety of resources and environments. During periods of environmental change, therefore, generalized species are more likely to survive than specialized ones.

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

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Unit Overview

WEEK 1: What causes a species to become extinct?

Connection to the Big Idea: The ability of a species to adapt to changing environmental conditions determines its chance for survival. Students learn that habitat loss is the number one cause of extinction. They also discover that extinction is a naturally occurring process. Mass extinction events, like the one that killed the dinosaurs, are far less common than small-scale extinctions that affect only a few species.

Content Vocabulary: *ecosystem, extinction, niche, predation, uninhabitable*

WEEK 2: How have crocodiles survived for millions of years?

Connection to the Big Idea: Crocodiles have generalized adaptations that allow them to survive changes in their environment. Students learn that crocodiles' adaptations enable them to live in different habitats and eat a wide variety of foods. Even though their generalized traits help crocodiles survive harsh conditions, many crocodile species are now endangered because of human activities.

Content Vocabulary: *conservation, dormancy, ectothermic, endangered, exploit*

WEEK 3: If the ice cap melts, why can't polar bears just adapt?

Connection to the Big Idea: The particular specializations that were responsible for the polar bears' initial success could now contribute to their extinction. Students learn that polar bears have adaptations that make them dependent on sea ice, which is now melting as a result of global warming.

Content Vocabulary: *camouflage, carnivorous, foraging, malnourished, threatened, tundra*

WEEK 4: Would humans survive if there was another ice age?

Connection to the Big Idea: Humans are the most adaptable species on Earth. Students learn that humans evolved during the last ice age, and our ability to adapt to different habitats and eat a wide range of foods helped us survive. Much of this adaptability hinges on our access to technology. Without it, we might not survive another ice age.

Content Vocabulary: *bipedalism, distribution, glaciations, hominid, omnivores, technology*

WEEK 5: Unit Review

You may choose to do these activities to review concepts of adaptation and extinction.

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

p. 63: Vocabulary Students complete a crossword puzzle to review vocabulary.

p. 64: Visual Literacy Students analyze a word cloud about extinction.

p. 65: Hands-on Activity Students wear a "rhabber glove" to see how it feels in the cold and heat. Instructions and materials needed for the activity are listed on the student page.

Big Idea 2 37

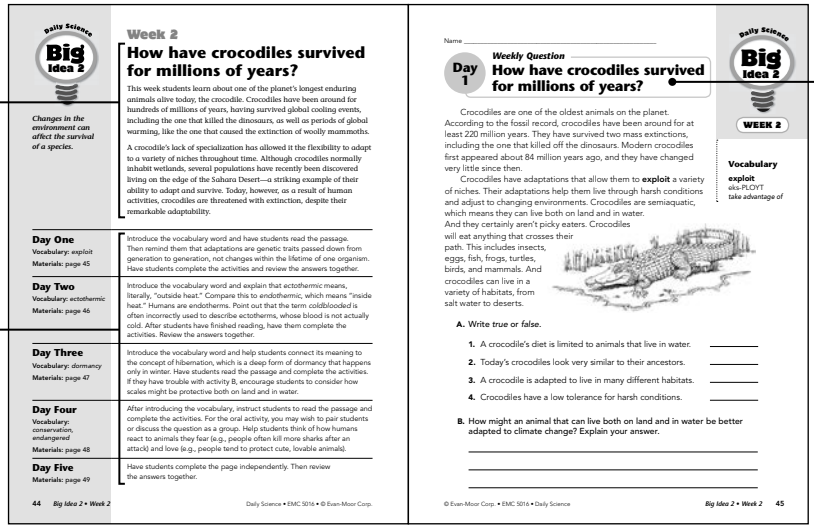
An overview of the four weekly lessons shows you each weekly question, explains what students will learn, and lists content vocabulary.

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.



Daily Science Big Idea 2

Week 2

How have crocodiles survived for millions of years?

This week students learn about one of the planet's longest enduring animals alive today, the crocodile. Crocodiles have been around for hundreds of millions of years, having survived global cooling events, including the one that killed the dinosaurs, as well as periods of global warming, like the one that caused the extinction of woolly mammoths.

A crocodile's lack of specialization has allowed it the flexibility to adapt to a variety of niches throughout time. Although crocodiles normally inhabit wetlands, several populations have recently been discovered living on the edge of the Sahara Desert—a striking example of their ability to adapt and survive. Today, however, as a result of human activities, crocodiles are threatened with extinction, despite their remarkable adaptability.

Changes in the environment can affect the survival of a species.

Day One
Vocabulary: *exploit*
Materials: page 45
Introduce the vocabulary word and have students read the passage. Then remind them that adaptations are genetic traits passed down from generation to generation, not changes within the lifetime of one organism. Have students complete the activities and review the answers together.

Day Two
Vocabulary: *ectothermic*
Materials: page 46
Introduce the vocabulary word and explain that *ectothermic* means, literally, "outside heat." Compare this to *endothermic*, which means "inside heat." Humans are endotherms. Point out that the term *coldblooded* is often incorrectly used to describe ectotherms, whose blood is not actually cold. After students have finished reading, have them complete the activities. Review the answers together.

Day Three
Vocabulary: *dormancy*
Materials: page 47
Introduce the vocabulary word and help students connect its meaning to the concept of hibernation, which is a deep form of dormancy that happens only in winter. Have students read the passage and complete the activities. If they have trouble with activity B, encourage students to consider how scales might be protective both on land and in water.

Day Four
Vocabulary: *conservation, endangered*
Materials: page 48
After introducing the vocabulary, instruct students to read the passage and complete the activities. For the oral activity, you may wish to pair students or discuss the question as a group. Help students think of how humans react to animals they fear (e.g., people often kill more sharks after an attack) and love (e.g., people tend to protect cute, lovable animals).

Day Five
Materials: page 49
Have students complete the page independently. Then review the answers together.

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Name _____

Daily Science Big Idea 2 WEEK 2

Weekly Question

Day 1 **How have crocodiles survived for millions of years?**

Crocodiles are one of the oldest animals on the planet. According to the fossil record, crocodiles have been around for at least 220 million years. They have survived two mass extinctions, including the one that killed off the dinosaurs. Modern crocodiles first appeared about 84 million years ago, and they have changed very little since then.

Crocodiles have adaptations that allow them to **exploit** a variety of niches. Their adaptations help them live through harsh conditions and adjust to changing environments. Crocodiles are semiaquatic, which means they can live both on land and in water. And they certainly aren't picky eaters. Crocodiles will eat anything that crosses their path. This includes insects, eggs, fish, frogs, turtles, birds, and mammals. And crocodiles can live in a variety of habitats, from salt water to deserts.

Vocabulary
exploit eks-PLOYT *take advantage of*

A. Write true or false.

1. A crocodile's diet is limited to animals that live in water. _____
2. Today's crocodiles look very similar to their ancestors. _____
3. A crocodile is adapted to live in many different habitats. _____
4. Crocodiles have a low tolerance for harsh conditions. _____

B. How might an animal that can live both on land and in water be better adapted to climate change? Explain your answer.

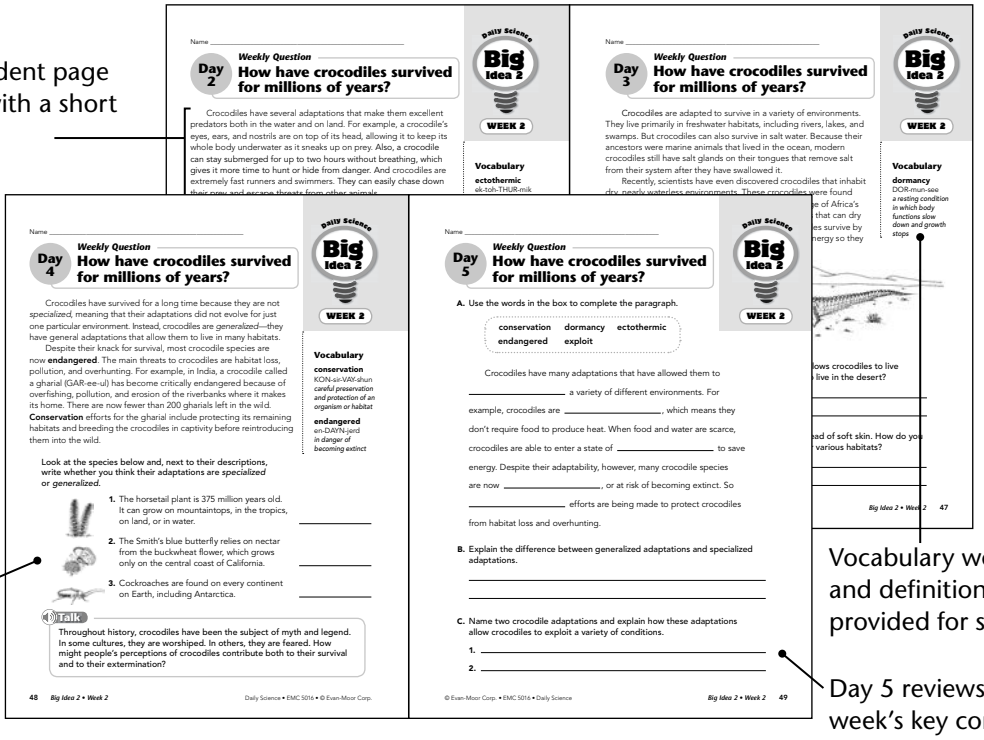
Big Idea 2 • Week 2 45

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.

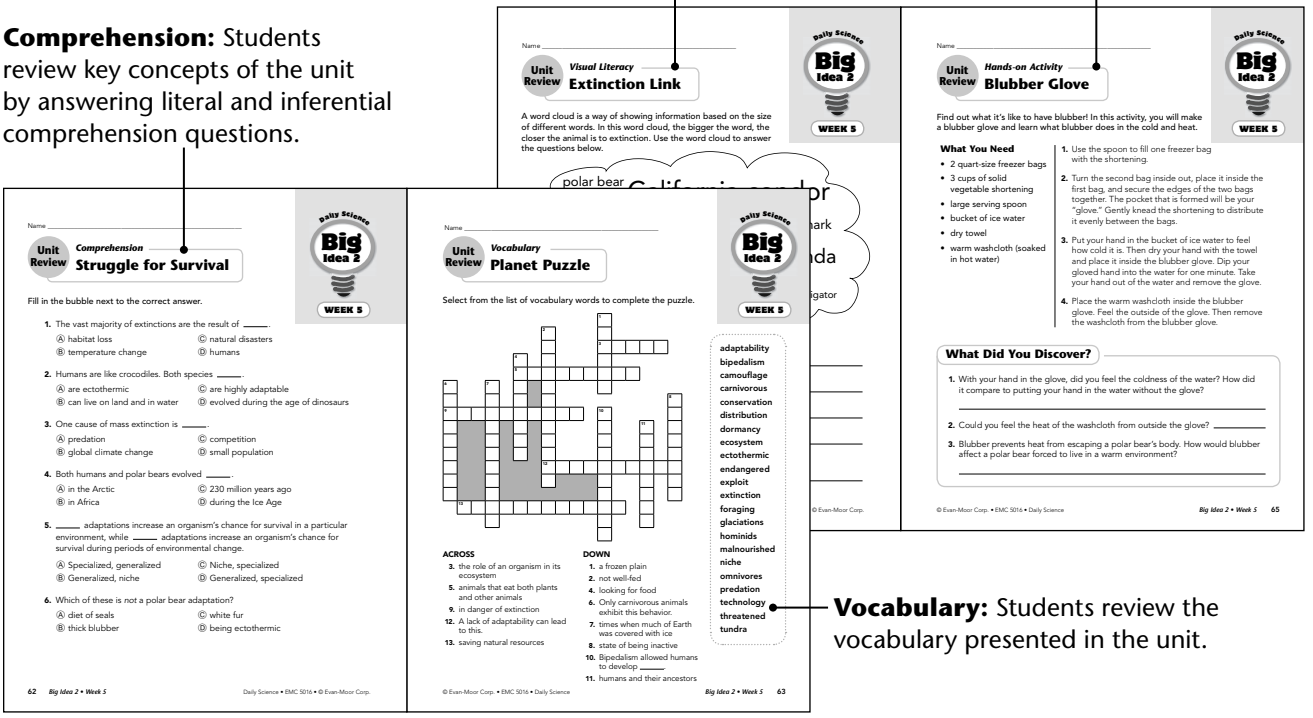


Unit Review (Week 5)

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.



Vocabulary: Students review the vocabulary presented in the unit.

Living things inherit a combination of traits from their parents.

Key Concepts
Traits and Heredity

National Standard
Every organism requires a set of instructions for specifying its traits. Heredity is the passage of these instructions from one generation to the next.

By the sixth grade, students understand that offspring resemble their parents. However, most students are likely to be unfamiliar with the underlying concepts of heredity and genetics. This Big Idea teaches students that:

- organisms inherit traits from their parents;
- the gene is the basic unit of heredity;
- the differences in traits between individuals are the result of genetic variation; and
- life experiences and environment can influence the expression of traits.

Teacher Background

Genetics is the science of heredity. The set of instructions for an organism's traits are passed from one generation to the next through genes. Genetic information is transferred from parent to offspring at the cellular level. Inside the nucleus of a human cell, there are 46 chromosomes. Half of them come from one parent, and half from the other. A chromosome is made up of a single strand of DNA, where hundreds of genes may reside. Dominant and recessive genes combine to produce an organism's traits. In addition, environmental factors ranging from the amount of nutrients received in the womb to language acquisition influence a person's traits.

Humans have begun manipulating the genes of many types of organisms in order to control the traits that the offspring inherit. People have bred organisms from different species together in order to create favorable combinations of traits. Humans also selectively breed plants and animals of the same species in order to capitalize on natural genetic variation.

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

Unit Overview

WEEK 1: Can horses and zebras have babies together?

Connection to the Big Idea: Animals from separate but closely related species can produce offspring with a combination of each species' traits. Students learn that inherited traits are passed down from parents to offspring. Students also discover that horses and zebras belong to different species. When these animals mate, they create a hybrid offspring.

Content Vocabulary: *fertile, genus, hybrid, inherited traits, species, sterile*

WEEK 2: Why are some people left-handed?

Connection to the Big Idea: The basic unit of heredity is the gene. Students learn that a gene can be either dominant or recessive. An offspring inherits two copies of each gene from its parents, and that offspring's visible traits depend on the combination of dominant and recessive genes it receives. A dominant gene will be visible over a recessive gene. Only when both copies of a gene are recessive will the recessive trait be visible. Students discover that left-handedness is a recessive trait.

Content Vocabulary: *chromosome, DNA, dominant, gene, heredity, recessive*

WEEK 3: How can corn be yellow, white, or blue?

Connection to the Big Idea: Traits within a species can vary, and those traits can be manipulated through breeding. Students learn that the traits of corn are highly variable. This is because corn DNA contains "jumping genes." Students learn that selective breeding allows farmers to emphasize certain traits, and that modern-day corn colors are a result of selective breeding.

Content Vocabulary: *genetic variation, mutate, selective breeding*

WEEK 4: Are identical twins exactly alike?

Connection to the Big Idea: Students learn that identical twins form from a single fertilized egg with the same set of chromosomes inherited from their parents. While they share the same DNA, identical twins can develop unique traits because of differences in their environment and experiences. In addition, chemical changes and copy errors made to the DNA can result in genetic differences in identical twins.

Content Vocabulary: *embryo, epigenome, genome, monozygotic*

WEEK 5: Unit Review

You may choose to do these activities to review concepts of heredity and genetics.

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

p. 33: Vocabulary Students match vocabulary words from the unit to their definitions.

p. 34: Visual Literacy Students fill in Punnett squares to determine possible gene combinations.

p. 35: Hands-on Activity Students conduct an experiment to extract DNA from a banana. Instructions and materials needed for the activity are listed on the student page.

Living things inherit a combination of traits from their parents.

Week 1

Can horses and zebras have babies together?

This week students are introduced to the concept of heredity and traits. Scientists arrange living things into groups based on the traits they have in common. Horses and zebras share enough traits to belong to the same genus, but not the same species. Organisms within the same species are able to reproduce and create fertile offspring. Yet, some closely related species, like the horse and the zebra, are still able to breed. Their offspring are called hybrids. As with all offspring, hybrids inherit traits from both parents. In hybrids, this combination of traits from two different species produces an appearance that is unpredictable.

Day One

Vocabulary: *inherited traits*

Materials: page 9

Introduce the vocabulary word and explain that traits can be learned as well as passed down from parent to offspring. While most physical traits are inherited, behavioral traits can be either passed down or learned. After students have read the passage, confirm their understanding of any unfamiliar or difficult words, such as *agile* (able to move easily) and *drought* (a period without water). Then have students complete the activities. Review the answers together.

Day Two

Vocabulary: *fertile, genus, species*

Materials: page 10

Before students read the passage, consider building background by discussing the classification system (kingdom, phylum, class, order, family, genus, species). Then introduce the vocabulary words. After students have finished reading, have them complete the activities. If students have trouble with activity C, help them brainstorm animals that look, act, or make sounds like cats.

Day Three

Vocabulary: *hybrid*

Materials: page 11; pictures of hybrids such as a zebroid, mule, and liger (optional)

Introduce the vocabulary word and show students pictures of different hybrid animals, if you have them. You might also ask students what other "hybrids" they have heard of. (e.g., hybrid cars, which are both gas- and electric-powered) After students have finished reading, direct them to complete the activities. Review the answers together.

Day Four

Vocabulary: *sterile*

Materials: page 12

Explain that horses, mules, donkeys, and other domesticated animals are sometimes called pack animals because they are used to carry people and supplies. This is why people sometimes breed zebroids in Africa. Then have students read the passage and direct them to complete the activities. For the oral activity, pair students or discuss the topic as a group.

Day Five

Materials: page 13

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

Name _____

Daily Science
Big Idea 1
WEEK 1

Day 1

Weekly Question

Can horses and zebras have babies together?

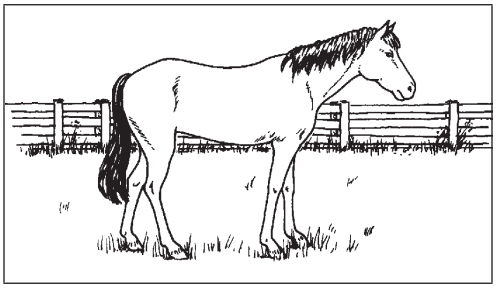
Horses are ideal animals for riding. They are tame, swift, and agile. They are also easy and comfortable to sit on because of the shape of their backs. But horses are delicate animals. They don't do well in hot, dry conditions. And they are prone to catching certain diseases.

Zebras, on the other hand, are very strong. They are sturdy and tolerant of heat and drought. Also, they are more resistant to disease. But zebras can't be easily tamed, and their body shape makes them difficult to ride.

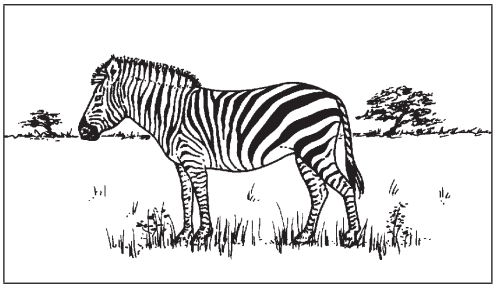
These characteristics of horses and zebras are **inherited traits**, which are features that are passed down from parents to offspring. Inherited traits may be physical, such as a zebra's stripes, or behavioral, such as a horse's gentle nature.

Vocabulary

inherited traits
in-HAIR-ih-tid TRAYTZ
physical or behavioral characteristics that are passed down from parents to offspring



horse



zebra

A. Identify each trait as either *physical* or *behavioral*.

1. agile _____

2. tame _____

3. shy _____

4. strong _____

5. curly hair _____

B. Name two traits that you have inherited from either of your parents. Write whether each trait is *physical* or *behavioral*.

1. _____

2. _____

Name _____

Daily Science
Big Idea 1
WEEK 1

Day 2

Weekly Question

Can horses and zebras have babies together?

Scientists arrange living organisms into groups based on common inherited traits. Horses and zebras have several traits in common. Both have hooves. Both have manes and long tails. Both eat grasses, leaves, and twigs. Because of these and other traits, horses and zebras belong to the same **genus**.

Yet horses and zebras have their own unique traits, which is why they belong to separate **species**. Organisms within a species have many more traits in common than organisms in the same genus. In fact, it is often difficult to distinguish between members of the same species. The most important trait of a species is that its members are able to breed with each other to produce **fertile** offspring. A horse can breed with other horses, and a zebra can breed with other zebras. The offspring will look very similar to their parents.

Vocabulary

fertile
FUR-tul
able to reproduce

genus
JEE-nus
a group of closely related species that share major traits

species
SPEE-sheez
a type of organism that can reproduce with others of the same type

A. Write *true* or *false*.

1. Animals within the same species can produce fertile offspring. _____
2. It is often hard to distinguish between animals in the same genus. _____
3. Scientists group organisms mostly according to size. _____

B. In your own words, explain the differences between a species and a genus.

_____

_____

C. Based on what you have read, name an animal that would likely be in the same genus as a lion. Explain your answer.

_____

Name _____

Daily Science Big Idea 1 WEEK 1

Day 3

Weekly Question

Can horses and zebras have babies together?

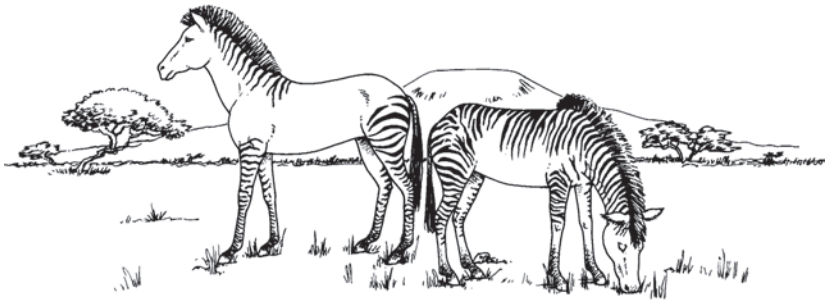
Some closely related species, such as zebras and horses, can reproduce with each other. When two organisms from different species mate, they produce a **hybrid**. The hybrid offspring of a horse and a zebra is called a *zebroid* (ZEH-broyd).

Like all offspring, hybrids inherit traits from both parents. In general, a zebroid resembles a horse in body shape and size and can be easily tamed. But it also has the telltale stripes, spiky mane, and resistance to disease of a zebra.

Vocabulary

hybrid
HI-brid
the offspring of two organisms from different species

A. Write a caption for the picture, explaining why a zebroid is different from a horse or a zebra. Use the words *hybrid* and *traits* in your caption.



_____

_____

B. According to the passage, which traits does a zebroid get from a zebra, and which does it get from a horse? Fill in the chart.

Zebra Traits	Horse Traits

Name _____

Daily Science
Big Idea 1
WEEK 1

Day 4

Weekly Question

Can horses and zebras have babies together?

The special combination of traits that zebroids have makes them excellent pack animals. Today, these unique creatures are bred for just this purpose in Kenya and South Africa, where the climate is hot and dry.

Many people, including some scientists, believe that hybrids should not be bred at all. Zebroids don't exist in nature. Also, they are **sterile**, which means they can't produce offspring. Finally, a hybrid's inherited traits can be unpredictable. One zebroid, for example, can look and act much differently from another zebroid.

Vocabulary

sterile
STAIR-ul
infertile, or unable to reproduce

A. Name three differences between hybrids and offspring of the same species.

1. _____ **3.** _____

2. _____

B. *Sterile* is a word that has more than one meaning. Write what you think the word *sterile* means in each of the following sentences.

1. Wendy cut her finger and needed a sterile bandage.

_____

2. Andy couldn't get sterile seeds to grow in her garden.

_____

3. Patrick fell asleep listening to the sterile lecture.

_____

Talk

Do you think people should be creating hybrids? Why or why not? Discuss your opinions with a partner.

Name _____

Daily Science
Big Idea 1
WEEK 1

Day 5

Weekly Question

Can horses and zebras have babies together?

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

genus	**hybrid**	**sterile**
fertile	**species**	**inherited traits**

_____ are passed down from parents to offspring.

Organisms in the same _____ share similar traits.

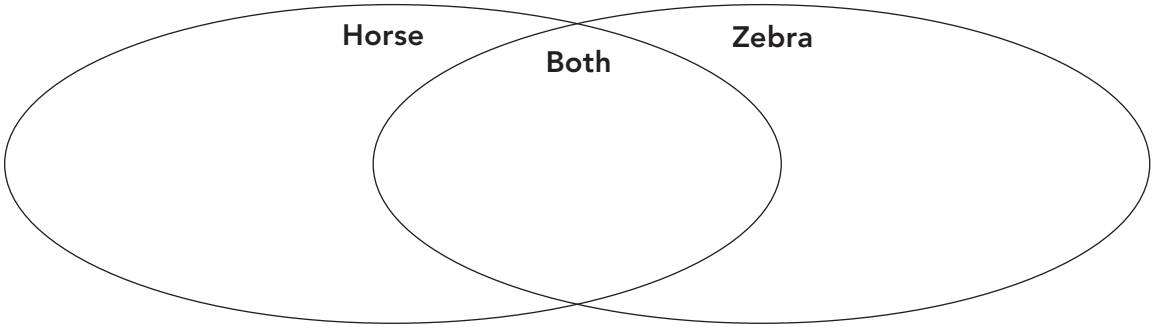
However, unlike those within the same _____, they

are unable to breed and produce _____ offspring.

When two organisms from closely related species mate, they create a

_____ that is _____.

B. In the outer parts of the diagram, write two different traits of each species. In the middle, write two traits that the species share.



C. State one reason why someone might want to breed a zebroid. Then state one possible reason why zebroids should not be bred.

_____

_____

Living things inherit a combination of traits from their parents.

Week 2

Why are some people left-handed?

As students continue to explore the concepts of traits and heredity, the focus this week is on genes. Students learn that the gene, a segment of DNA, is the basic unit of heredity. A strand of DNA contains many genes and forms a single chromosome. Humans have 23 pairs of chromosomes located in the nucleus of every cell, and each pair includes a chromosome from each parent. Whether a child inherits a particular trait from the mother or the father depends on whose genes are dominant. Students also learn that while genetics play a large role in determining a trait, the environment is a factor as well.

Day One

Vocabulary: *gene, heredity*

Materials: page 15

Introduce the vocabulary and explain that a single gene can control several traits, or a single trait can be controlled by many genes. After students have read the passage, have them complete the activities. Review the answers together.

Day Two

Vocabulary: *chromosome, DNA*

Materials: page 16

Introduce the vocabulary and explain to students that DNA stands for *deoxyribonucleic acid* (dee-OCK-see-RYE-boh-new-CLAY-ick AS-sid). Write the term on the board, capitalizing the letters *D, N,* and *A* so that students understand the acronym. After students have finished reading, have them complete the activities. Review the answers together.

Day Three

Vocabulary: *dominant, recessive*

Materials: page 17

After introducing the vocabulary and having students read the passage, you may want to use Punnett squares as a way of explaining dominant and recessive genes. Examples of Punnett squares can be found on pages 19 and 34. Then direct students to complete the activity.

Day Four

Materials: page 18

After students have finished reading the passage, direct them to complete the activities. For activity A, prompt students to think about things such as sports equipment and how using one hand instead of the other might affect the way a ball is thrown, hit, or caught. Review the answers together.

Day Five

Materials: page 19

Have students complete the page independently. For activity C, if necessary, explain how to read the Punnett square. Then review the answers together.

Name _____

Daily Science
Big Idea 1
WEEK 2

Day 1

Weekly Question

Why are some people left-handed?

Do you look more like your mom or your dad? Do you have your mother's eyes, or your father's nose? Looking in the mirror, you probably can see in yourself at least a couple of traits from each parent. All living organisms inherit traits from their parents through the process of **heredity**. In some cases, traits don't show up in one generation but are evident in the next. This is why some people have traits that their grandparents have but that their parents do not.

The smallest, most basic unit of heredity is the **gene**. Each person has approximately 25,000 genes. Genes control all of your inherited traits, from how you look and grow to the way your body functions. They even help determine which hand you write with.

Vocabulary

gene
jeen
a part of the code that controls the development of traits

heredity
huh-RED-ih-tee
the transmission of traits from parent to offspring

A. List four traits you have that your genes control. For each trait, write whom you think you inherited it from.

1. _____

2. _____

3. _____

4. _____

B. Traits aren't the only thing that can be inherited. Some diseases can also be inherited. How do you think our understanding of genes might affect doctors' ability to treat or prevent disease in the future?

_____

_____

C. Use the vocabulary words to complete the sentence.

Your inherited traits are determined by thousands of _____ passed down through the process of _____.

Name _____

Daily Science
Big Idea 1
WEEK 2

Day 2

Weekly Question

Why are some people left-handed?

A gene is a segment of **DNA**. There may be hundreds of genes on each strand of DNA. A single strand of DNA coils up to form a **chromosome**. The chromosomes are located inside the nucleus of a cell. Humans have 23 pairs of chromosomes, and each parent contributes one chromosome per pair. This means that half of your DNA comes from your mother and half comes from your father. The DNA that your parents give you is copied over and over again as your cells reproduce and you continue to grow.

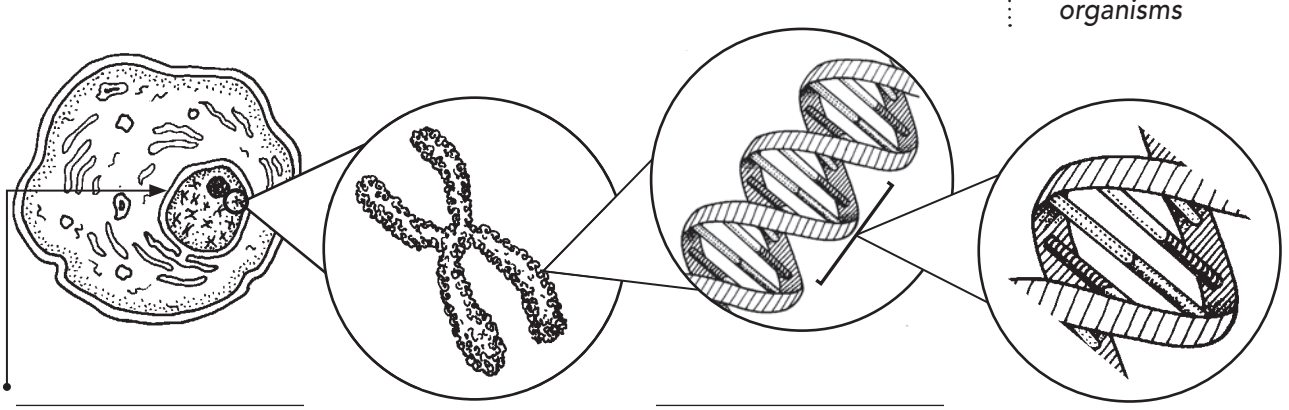
DNA is often compared to a recipe because it contains all the instructions needed to create an organism. Almost every living thing has DNA, from plants to animals to microscopic bacteria.

Vocabulary

chromosome
KROH-muh-SOHM
a package of DNA and protein found within the nucleus of a cell

DNA
the genetic material of most living organisms

A. Label the pictures in the diagram using the terms *gene*, *cell nucleus*, *DNA*, and *chromosome*.



_____ _____ _____ _____

B. Write *true* or *false*.

1. Genes are found in the nucleus of a cell. _____

2. Each parent contributes 23 pairs of chromosomes. _____

3. There are hundreds of DNA strands in each chromosome. _____

4. Genes are located on the chromosomes. _____

Name _____

Daily Science
Big Idea 1
WEEK 2

Day 3

Weekly Question

Why are some people left-handed?

Remember that your chromosomes come in pairs. Therefore, the genes on those chromosomes are in pairs, too. Each of your parents contributes one gene to each pair. The **dominant** gene in a gene pair is the one that controls the appearance of a trait. If one or both genes in a pair are dominant, the dominant form of the trait is visible. For example, the gene for brown eyes is dominant over the gene for blue eyes. This means that if you receive a gene for brown eyes from at least one of your parents, you are guaranteed to have brown eyes.

By comparison, **recessive** genes have little or no observable effect on a trait. Only when both genes in a pair are recessive will the recessive form of the trait be visible. So if you have blue eyes, you know that both of your parents passed on the recessive gene for eye color to you.

Vocabulary

dominant
DAH-mih-nent
controlling; tending to be expressed

recessive
ree-SESS-iv
tending to recede, or disappear from view

Answer the questions.

1. If a girl has blue eyes, does she have two dominant genes, one dominant and one recessive gene, or two recessive genes for eye color?

_____

2. If a boy has brown eyes, what two combinations of genes for eye color could he have?

_____

3. If two parents each have a dominant and a recessive gene for eye color and have a baby, how many possible combinations of genes could there be? List them.

_____

4. Will a person with two dominant genes for brown eyes ever be able to have a baby with blue eyes? Why or why not?

_____

Name _____

Daily Science
Big Idea 1
WEEK 2

Day 4

Weekly Question

Why are some people left-handed?

Left-handedness is a recessive trait that is inherited, like blue eyes or red hair. But left- and right-handedness are not always determined by genes alone. Your environment can play a factor in which hand you use. For example, because there are more tools, such as scissors or can openers, made for right-handed people, left-handed people must learn how to use these tools with their right hand.

Also, the way people think and behave can affect a trait. In some countries, it is considered customary to use your right hand to greet someone or to eat. So people in these cultures learn how to perform daily tasks with their right hand. Similarly, some people may learn how to write with their left hand in order to stand out and be able to do what only 10% of the world can do!

A. Think about a sport you know. Name one disadvantage and one advantage that a left-handed athlete might have over a right-handed athlete in playing that sport.

Disadvantage: _____

_____

Advantage: _____

_____

B. Complete the analogies.

1. **Right-handed** is to **brown eyes** as **left-handed** is to _____.
2. **Brown hair** is to **dominant** as **red hair** is to _____.

C. Are you right-handed or left-handed? Complete the sentence and then rewrite it with your other hand!

I am _____-handed. _____

Name _____

Daily Science
Big Idea 1
WEEK 2

Day 5

Weekly Question

Why are some people left-handed?

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

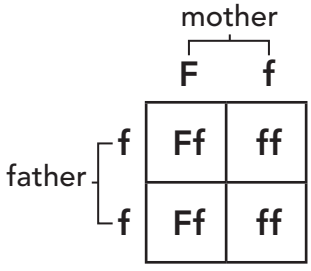
____	**1.** gene	**a.**	made of DNA and proteins
____	**2.** chromosome	**b.**	disappears from view
____	**3.** dominant	**c.**	provides cells with detailed instructions
____	**4.** heredity	**d.**	controlling
____	**5.** DNA	**e.**	transmission of traits from parents to offspring
____	**6.** recessive	**f.**	smallest unit of heredity

B. A right-handed woman and a right-handed man have a baby. Could the baby be left-handed? Explain your reasoning.

_____

_____

C. The squares on the right show different combinations of genes that may be inherited from a mother who has freckles and a father who doesn't. The gene for freckles (F) is dominant, and the gene for no freckles (f) is recessive. Study the combinations and then answer the questions.



1. What are the chances that the mother and father above will have a baby with freckles? _____ out of 4, or _____%

2. What are the chances that the mother and father will have a baby with no freckles? _____ out of 4, or _____%

Living things inherit a combination of traits from their parents.

Week 3

How can corn be yellow, white, or blue?

Because of the high degree of variability of its traits, corn provides a wonderful example of genetic variation, the subject of this week's lessons. The genetics of corn have been extensively studied, most notably by pioneering geneticist Barbara McClintock, who discovered "jumping genes" and demonstrated that the variation seen in corn was due to the susceptibility of corn genes to mutate and recombine.

Genetic variation is the reason that so many types of corn exist today. Over the course of thousands of years, native peoples have capitalized on corn's inherent variation to selectively breed hundreds of varieties of corn, including those that are yellow, white, and blue.

Day One

Materials: page 21; pictures of different varieties of corn (or actual ears of corn, if possible)

Show students the pictures of corn, and ask them to name some corn traits. (kernel color, kernel size, ear length, plant height, sweetness, etc.) Write their responses on the board. After students have read the passage, instruct them to complete the activities. Review the answers together.

Day Two

Vocabulary: *genetic variation, mutate*

Materials: page 22

Introduce the vocabulary. Then remind students that a *species* is a group of organisms that share many similar traits. After students have finished reading the passage, direct them to complete the activities. Then go over the answers together.

Day Three

Materials: page 23

Tell students that today they will learn about a discovery made by the scientist Barbara McClintock through her experiments on blue corn. The discovery of "jumping genes" won her the Nobel Prize. Instruct students to read the passage. Then have them complete the activities. When students have finished, review the answers together.

Day Four

Vocabulary: *selective breeding*

Materials: page 24

Introduce the vocabulary word and instruct students to read the passage. If necessary, explain that *cultivate* means "to grow plants in a planned way." After students have finished reading, ask them to think of other examples of organisms, besides corn, that have been selectively bred. (e.g., horses, dogs, tomatoes, roses, etc.) Direct students to complete the activities. For the oral activity, pair students together or discuss as a group.

Day Five

Materials: page 25

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

Name _____

Daily Science
Big Idea 1
WEEK 3

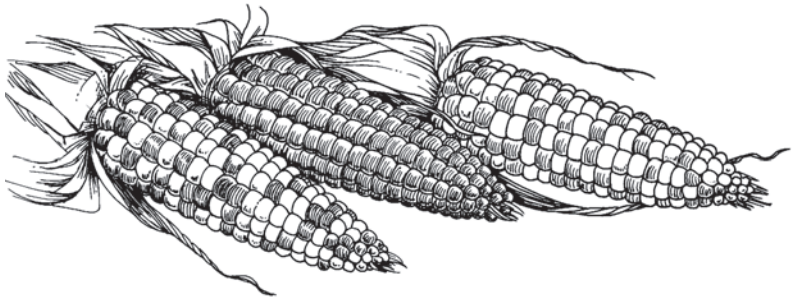
Day 1

Weekly Question

How can corn be yellow, white, or blue?

Corn, like many other plants, passes down its traits through its seeds. When you look at an ear of corn, you are actually looking at a collection of seeds. Each corn kernel is one seed with its own unique set of genes. When you plant a kernel, a new corn plant springs up with a set of traits that are inherited from that seed.

Corn exhibits a huge variety of traits. Corn plants can differ in plant height, ear size, sweetness, and rate of growth. The kernels can also come in a range of colors, including yellow, white, and even blue. Because of this variation, corn is useful as both a food crop and a tool for scientists who study genes and traits.



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

1. **Kernel** is to **corn** as _____.
   - ❒ **flower** is to **petal**
   - ❒ **egg** is to **chicken**
   - ❒ **color** is to **trait**
   - ❒ **DNA** is to **gene**

2. **Ear size** is to **corn plant** as _____.
   - ❒ **blue** is to **kernel**
   - ❒ **kernel** is to **corn plant**
   - ❒ **trait** is to **gene**
   - ❒ **sweetness** is to **height**

B. If you plant all the kernels of one ear of corn, do you think the new corn plants will share all the same traits? Why or why not?

_____

_____

Name _____

Daily Science
Big Idea 1
WEEK 3

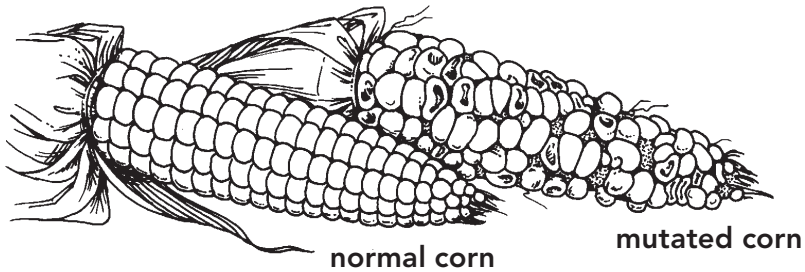
Day 2

Weekly Question

How can corn be yellow, white, or blue?

The wide variety of corn colors is an example of **genetic variation**, or all of the possible differences in inherited traits among members of a species. Variations are due to differences in the genes of individual members.

There are several causes of genetic variation. The genes of an organism can randomly **mutate**, or change, into new genes. Genetic variation also results from genes getting shuffled around to form new combinations of genes. These new combinations give rise to new traits not seen in the organism's parents. A third cause of genetic variation is the introduction of new genes into a population of organisms. For example, in plants, new genes can be introduced through the movement of pollen from one location to another.



normal corn **mutated corn**

Vocabulary

genetic variation
juh-NET-ik VAIR-ee-AY-shun
differences in inherited traits among the members of a species

mutate
MYOO-tayt
to permanently change in form

A. Name three causes of genetic variation in corn.

1. _____
2. _____
3. _____

B. Write *true* or *false*.

1. Genetic variation causes a plant's genes to mutate. _____
2. Insects can introduce new genes into a corn crop. _____
3. New traits are produced when genes get shuffled around. _____
4. A mutated gene can go back to its original form. _____

Name _____

Daily Science
Big Idea 1
WEEK 3

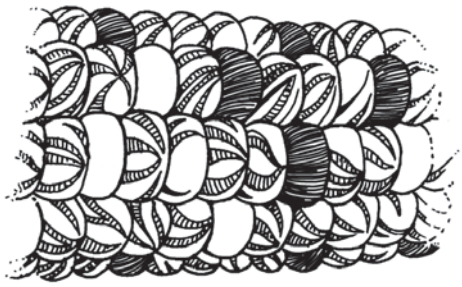
Day 3

Weekly Question

How can corn be yellow, white, or blue?

Much of the genetic variation seen in corn is due to the actions of DNA sequences called transposons (trans-POH-zahnz), or "jumping genes." Nearly 75% of the DNA in corn consists of jumping genes. Jumping genes can move from place to place along a strand of DNA while a new kernel is forming. As the jumping gene moves, it "turns off" the gene it lands next to, preventing that gene from functioning. When a jumping gene moves to another location, the blocked gene is again "turned on" and the trait that the gene controls becomes active.

For example, jumping genes are the reason why a single kernel of corn can be both blue and white. When a jumping gene lands next to a gene that makes a kernel blue, the blue-color gene is turned off. This produces a mottled effect of white streaks or spots. The amount of mottling depends on how long the blue gene is turned off. If the jumping gene stays in the same location long enough, the gene that makes a kernel blue is totally blocked and the kernel will be completely white.



mottled corn kernels

A. Cross out the incorrect word in each statement and write the correct word above it to make the statement true.

1. Jumping genes are a minor source of genetic variation in corn.

2. Corn color is unaffected by jumping genes.

3. Jumping genes turn on the genes they land next to.

4. Jumping genes are sequences of kernels.

B. Fill in the bubble next to the meaning of *mottled*.

Ⓐ moving Ⓑ blue Ⓒ speckled

Name _____

Daily Science
Big Idea 1
WEEK 3

Day 4

Weekly Question

How can corn be yellow, white, or blue?

Genetic variation and jumping genes are only part of the reason that corn can be yellow, white, or blue. Corn was first cultivated in southern Mexico nearly 10,000 years ago. Ancient farmers used the natural variations in corn to create plants with the traits they liked. Through the process of **selective breeding**, they developed many strains of corn, including those that were yellow, white, and blue.

Selective breeding begins when a farmer mates two closely related plants that both have a certain positive trait. From the offspring that are produced, the farmer again breeds the plants that strongly display the desired trait and prevents those without the trait from reproducing. Doing this again and again reinforces the trait in the offspring.

Vocabulary

selective breeding
seh-LECK-tiv BREED-ing
human-directed mating of organisms for desirable traits

A. Explain in your own words how the process of selective breeding can be used to decrease the presence of a trait.

_____

_____

_____

B. *Grafting* is a process that involves putting together part of one plant with part of another plant. One odd example of grafting is merging potatoes and tomatoes to grow on the same plant. Why do you suppose this plant must be grafted instead of selectively bred? Explain your answer.

_____

_____

Talk

What other traits besides color, sweetness, and size might a farmer want to selectively breed in corn? Think about things such as what might affect the growing process, or what corn is used for besides food for humans.

Name _____

Daily Science
Big Idea 1
WEEK 3

Day 5

Weekly Question

How can corn be yellow, white, or blue?

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

selective breeding	genetic variation	mutate

Differences in traits between individuals of the same species are known as _____. This can happen when genes _____, or permanently change. People also use _____ to redirect the variation in an organism to strengthen or eliminate a trait.

B. Today there are many types of dogs, from toy poodles to Great Danes, that have been selectively bred for certain positive traits. What can you say about the traits of early dog ancestors to explain the wide variety of dog breeds today? Explain your answer.

_____

_____

C. The pictures to the right show two sunflowers that were planted at the same time and grown under identical conditions. Which traits in the cultivated flower do you think were the result of selective breeding?

_____

_____

_____

wild cultivated

Living things inherit a combination of traits from their parents.

Week 4

Are identical twins exactly alike?

Students learn about the genetic makeup of identical twins this week. They discover that identical twins are formed from a single fertilized egg called a zygote. The zygote, which contains genetic material inherited from the parents, divides into two, creating two individuals that share the same DNA. However, environmental influences such as position in the womb and life experiences can change an organism's traits. In addition, changes to the DNA can take place both during early fetal development in the form of mutations and throughout a person's lifetime in the form of chemical modifications to the genes. This means that both nature (genetics) and nurture (environment) create differences in identical twins.

Day One

Vocabulary: *embryo, monozygotic*

Materials: page 27

Begin the lesson by reviewing the basic concept of human reproduction. (Females produce eggs and males produce sperm. An egg and sperm come together to form a fertilized egg, which later develops into a fetus.) Then introduce the vocabulary words. After students have read the passage, have them complete the activities. Review the answers together.

Day Two

Vocabulary: *genome*

Materials: page 28

Review the vocabulary words *gene*, *chromosome*, and *DNA*. Remind students that DNA is contained in the chromosomes, which are located inside the nucleus of a cell. Then have students read the passage and complete the activity. Review the answers together.

Day Three

Materials: page 29

Before students read the passage, you may want to discuss the process of fetal development. Tell students that a fetus grows inside a woman's uterus. It is protected by a membrane called the amniotic sac and receives nutrients from its mother through an organ called the placenta. The fetus is connected to the placenta by the umbilical cord. Identical twins often share a placenta, usually have separate amniotic sacs, and always have their own umbilical cords.

Day Four

Vocabulary: *epigenome*

Materials: page 30

Introduce the vocabulary word. After students have finished reading the passage, tell them that even if identical twins do have some genetic differences, the vast majority of their DNA is the same. For the oral activity, pair students together. Then discuss your answers as a group.

Day Five

Materials: page 31

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

Name _____

Daily Science
Big Idea 1
WEEK 4

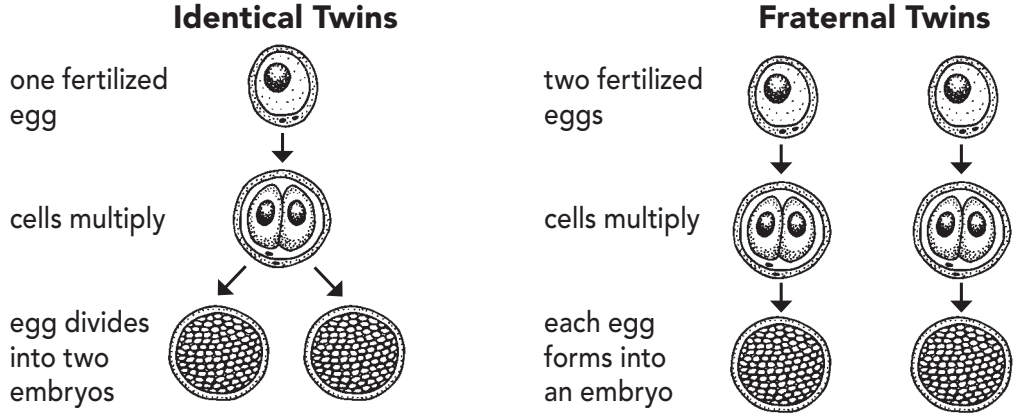
Day 1

Weekly Question

Are identical twins exactly alike?

A common belief about identical twins is that they are exactly the same. They look alike, they act alike, and they think alike. But the term "identical" might be misleading. Identical twins are called **monozygotic** twins. *Monozygotic* means that the twins form from a single fertilized egg. The fertilized egg, called a zygote, splits into two parts after conception. This results in two individual **embryos**. The embryos will always be the same sex—either two boys or two girls.

Identical twins are different from fraternal twins. Fraternal twins develop when two separate eggs are fertilized by two sperm. Fraternal twins can be the same sex, or they can be a boy and a girl.



Vocabulary

embryo
EM-bree-oh
an unborn offspring in development

monozygotic
ma-noh-zie-GAH-tik
formed from a single fertilized egg

A. How are identical twins and fraternal twins alike? How are they different?

_____

_____

_____

B. The prefix *mono-* means "single." Why do you think identical twins are called monozygotic?

_____

_____

Name _____

Daily Science
Big Idea 1
WEEK 4

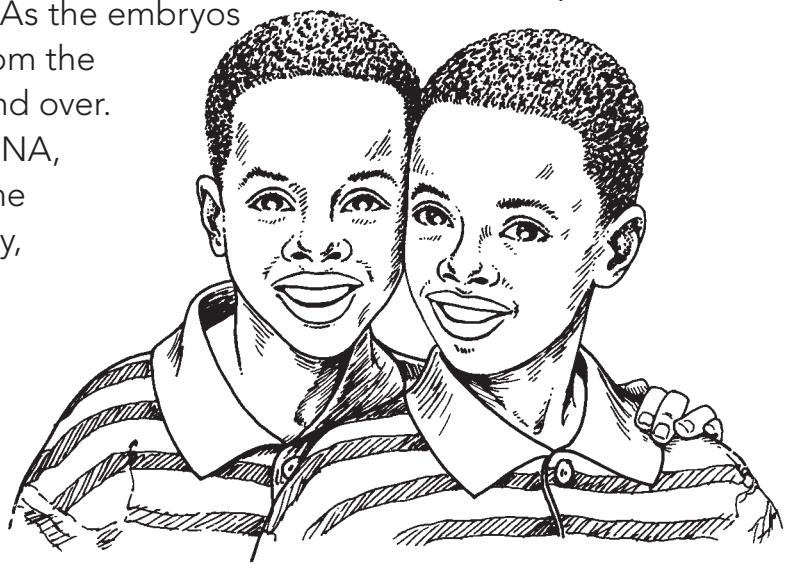
Day 2

Weekly Question

Are identical twins exactly alike?

What makes identical twins so similar? Unlike fraternal twins, identical twins inherit the same set of chromosomes from their parents. A single fertilized egg contains 23 pairs of chromosomes, half from the father and half from the mother. Since fraternal twins come from two separate fertilized eggs, they share only about 50% of the same genetic material—the same amount as siblings born at different times. However, because identical twins come from the same fertilized egg, they share the same DNA.

After a fertilized egg divides into two embryos, the cells of each embryo continue to multiply. As the embryos grow, the set of genes inherited from the original zygote copies itself over and over. Since they started with the same DNA, monozygotic twins are born with the same **genome**. They are, essentially, genetically identical.



Vocabulary

genome
JEE-nohm
the complete set of genes in an organism

Write *true* or *false*.

1. Identical twins share more genetic material than fraternal twins. _____
2. Fraternal twins have more genes in common than regular siblings do. _____
3. Identical twins have the same DNA. _____
4. Parents give each identical twin a separate set of chromosomes. _____
5. Identical twins share about 50% of their genes. _____

Name _____

Daily Science
Big Idea 1
WEEK 4

Day 3

Weekly Question

Are identical twins exactly alike?

Although twins share the same genetic makeup, no two life experiences are exactly the same. The slightest changes in environment can alter a person's traits. In fact, before identical twins are even born, they may go through some changes. For example, most identical twins share a placenta, which is an organ that develops in the mother during pregnancy and provides the fetus with oxygen and nutrients. If one fetus receives more nutrients from the placenta than the other, that baby may weigh more or be taller at birth.

Life experiences outside the womb also impact the development of twins. Studies show that identical twins who live apart have more differing traits than those who grow up in the same household. However, even twins who go to the same school and participate in the same activities do not have exactly the same traits. Many circumstances can lead to differences in children's personalities, interests, and even appearances. For example, one twin could be influenced by a separate group of peers, and thus listen to different music, be more outgoing, and wear different clothes than the other twin. Only the traits that are determined by genes alone, such as eye color, are identical in monozygotic twins.

A. How do life experiences inside and outside of the womb impact a person's traits?

_____

_____

B. What kind of changes in appearance could an identical twin make that are not determined by genetics?

_____

_____

Name _____

Daily Science
Big Idea 1
WEEK 4

Day 4

Weekly Question

Are identical twins exactly alike?

Because life experiences and environment can influence traits, identical twins are not exactly alike. In addition, recent research indicates that monozygotic twins may even have some genetic differences. Natural chemical changes occur within a person's genome as he or she ages. The changes act like a gas pedal or a brake, marking certain genes for higher or lower activity. These chemical changes are referred to as the **epigenome**. Scientists have discovered that identical twins are born with a similar epigenome, but as they age, their epigenomes become less and less alike.

In addition to changes in the epigenome, scientists have discovered that not all monozygotic twins are born with the exact same DNA. During early development of the embryos, identical twins might undergo hundreds of genetic mutations called *copy errors*. These copy errors could result in genetic differences between identical twins ranging from personality traits to whether or not a twin suffers from certain diseases.

Vocabulary

epigenome
eh-pih-JEE-nohm
a record of the chemical changes to the DNA of an organism

A. Name two ways that identical twins can be genetically different.

_____

_____

B. Why is the term "identical twins" misleading? Explain your answer.

_____

_____

_____

Talk

Scientists have debated the impact of "nature" (genetics) versus "nurture" (environment) on a person's development for many decades. Which do you think is more important—nature or nurture? Discuss with a partner.

Name _____

Daily Science
Big Idea 1
WEEK 4

Day 5

Weekly Question

Are identical twins exactly alike?

A. Write the letter of the correct vocabulary word next to its definition.

____ **1.** coming from a single fertilized egg	**a.** genome
____ **2.** chemical changes to an organism's DNA	**b.** embryo
____ **3.** an unborn offspring in development	**c.** monozygotic
____ **4.** an organism's complete set of genes	**d.** epigenome

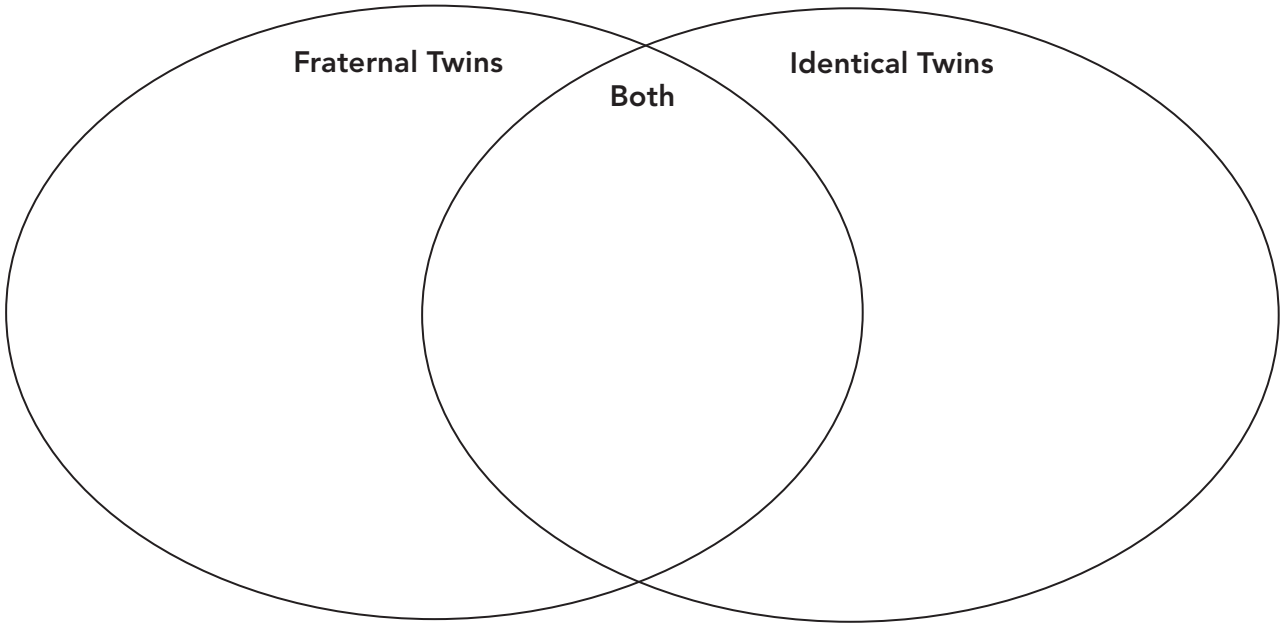
B. Describe three ways in which identical twins are not identical.

_____

_____

_____

C. Compare and contrast fraternal twins and identical twins. How are they similar? How are they different? Write your answers in the diagram.



Name _____

Daily Science Big Idea 1 WEEK 5

Unit Review

Comprehension

Focus on Heredity

Fill in the bubble next to the correct answer.

1. Humans play a role in all of the following methods of changing an organism's traits except _____.

Ⓐ grafting
Ⓑ selective breeding
Ⓒ genetic mutation
Ⓓ creating hybrids

2. A group of closely related organisms that can reproduce with one another and create fertile offspring is called a _____.

Ⓐ genus
Ⓑ species
Ⓒ hybrid
Ⓓ embryo

3. The gene that controls the appearance of a trait is _____.

Ⓐ dominant
Ⓑ recessive
Ⓒ superior
Ⓓ competitive

4. Hundreds of genes are found in the _____, which in turn makes up the _____.

Ⓐ DNA, species
Ⓑ chromosome, nucleus
Ⓒ nucleus, DNA
Ⓓ DNA, chromosomes

5. Corn plants have many variable traits because corn has a lot of _____.

Ⓐ genomes
Ⓑ kernels
Ⓒ dominant genes
Ⓓ genetic variation

6. The basic unit of heredity is _____.

Ⓐ DNA
Ⓑ the chromosome
Ⓒ the gene
Ⓓ the nucleus

7. What kind of trait is left-handedness?

Ⓐ recessive
Ⓑ selective
Ⓒ dominant
Ⓓ isolated

Name _____

Daily Science Big Idea 1 WEEK 5

Unit Review

Vocabulary

Traits Terminology

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

____ **1.** species
____ **2.** DNA
____ **3.** selective breeding
____ **4.** genome
____ **5.** genus
____ **6.** recessive
____ **7.** epigenome
____ **8.** fertile
____ **9.** chromosomes
____ **10.** mutate
____ **11.** inherited traits
____ **12.** dominant
____ **13.** genetic variation
____ **14.** hybrid
____ **15.** sterile
____ **16.** gene
____ **17.** embryo
____ **18.** heredity
____ **19.** monozygotic

a. chemical changes to DNA
b. able to have offspring
c. the passing down of traits from parent to offspring
d. A zebroid is an example.
e. the gene for right-handedness, for example
f. an unborn offspring in development
g. Humans have 23 pairs.
h. unable to reproduce
i. the smallest unit that controls a trait
j. Horses and zebras are in the same _____.
k. ribbon-like strand of genetic material
l. features you receive from your parents
m. the gene for left-handedness, for example
n. an organism's complete set of genes
o. Two organisms in the same _____ can have fertile offspring.
p. mating for desirable traits
q. coming from a single fertilized egg
r. for example, the many different colors that corn can be
s. to permanently change in form

Name _____

Daily Science
Big Idea 1
WEEK 5

Unit Review

Visual Literacy

Punnett Squares

Scientists use diagrams called Punnett squares to predict the probability, or likelihood, that an offspring will have certain traits based on the genes of its parents.

Look at the Punnett squares below. Fill in the squares to determine the possible combinations of the baby's genes. (Always write the capital letters first. For example, write Bb, not bB.) The first one has been done for you. Then answer the questions.

A. Mom has a dominant gene for dimples and a recessive gene for no dimples (Dd), and Dad has two dominant genes for dimples (DD).

	D	d
D	DD	
D		

1. Probability is written as _____**: 4**, or a certain number out of four. What is the probability that the baby will have dimples? _____:_____

2. What are the possible gene combinations that the baby can have? _____

B. Both Mom and Dad have a dominant gene for brown hair and a recessive gene for blond hair (Bb).

	B	b
B	BB	
b		

1. What is the probability that the baby will have blond hair? _____:_____

2. What color hair do Mom and Dad have? _____

Name _____

Daily Science
Big Idea 1
WEEK 5

Unit Review

Hands-on Activity

DNA Extraction Lab

Are you wondering what DNA looks like? Here's your chance to find out, using a banana!

What You Need

- ¼ cup rubbing alcohol
- ½ cup distilled water
- 2 large pinches of salt
- 2 tablespoons liquid soap
- ½ very ripe banana, peeled
- 3 clear glasses
- bowl of ice
- sealable plastic bag
- paper coffee filter
- rubber band

1. Pour the rubbing alcohol into one of the glasses and place the glass in the bowl of ice.
2. Pour the distilled water into the second glass. Add the salt and soap and stir until the salt is dissolved. This is the extraction solution.
3. Seal the banana in the plastic bag and mash it up. Then open the bag and add the extraction solution one spoonful at a time. Mix the contents of the bag after each spoonful. Add solution until the mixture is runny. Then mix for another 60 seconds.
4. Use the rubber band to secure the coffee filter over the third glass. Slowly pour the banana mixture onto the filter and let it sit for 10 minutes or until the liquid collects in the glass.
5. Remove the glass of alcohol from the ice and slowly pour the filtered liquid into the alcohol. Let it sit for 5 minutes. A clumpy, white solid should become visible. This is the banana's DNA!

What Did You Discover?

1. Describe how the DNA looks. _____

_____

2. DNA dissolves in water. Why do you think you poured the filtered liquid into alcohol?

_____

Changes in the environment can affect the survival of a species.

Key Concepts
Adaptations and Extinction

National Standard
Extinction of a species occurs when the environment changes and the adaptive characteristics of a species are insufficient to allow its survival.

Students are likely to be familiar with the concept of extinction, but they might think it is an uncommon occurrence brought on by a catastrophe that affects many species at a time. This unit clarifies that misconception and teaches students that an organism's adaptations determine its chance for survival. In this Big Idea, students learn that:

- extinction is a natural and constantly occurring process;
- crocodiles' generalized adaptations have enabled them to survive for millions of years;
- polar bears are highly specialized creatures adapted to a particular niche; and
- humans are the most adaptable species on Earth.

Teacher Background

In order to survive, all species must adapt to their environments. To do this, a species may evolve to take advantage of one resource that is abundant in its environment. Species that become specialized in this manner have the advantage of being able to outcompete other species for that resource. However, the specialized organism becomes so completely dependent on the single resource for its survival that even a slight change in the environment can have a dramatic effect. Often, this leads to the species' extinction. The extinction of a species occurs when that species' adaptations no longer suit its environment.

Rather than specialize, many species remain generalized. Although generalized species may not be perfectly suited for any one particular habitat, they can adapt to take advantage of a variety of resources and environments. During periods of environmental change, therefore, generalized species are more likely to survive than specialized ones.

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

Unit Overview

WEEK 1: What causes a species to become extinct?

Connection to the Big Idea: The ability of a species to adapt to changing environmental conditions determines its chance for survival. Students learn that habitat loss is the number one cause of extinction. They also discover that extinction is a naturally occurring process. Mass extinction events, like the one that killed the dinosaurs, are far less common than small-scale extinctions that affect only a few species.

Content Vocabulary: *ecosystem, extinction, niche, predation, uninhabitable*

WEEK 2: How have crocodiles survived for millions of years?

Connection to the Big Idea: Crocodiles have generalized adaptations that allow them to survive changes in their environment. Students learn that crocodiles' adaptations enable them to live in different habitats and eat a wide variety of foods. Even though their generalized traits help crocodiles survive harsh conditions, many crocodile species are now endangered because of human activities.

Content Vocabulary: *conservation, dormancy, ectothermic, endangered, exploit*

WEEK 3: If the ice cap melts, why can't polar bears just adapt?

Connection to the Big Idea: The particular specializations that were responsible for the polar bears' initial success could now contribute to their extinction. Students learn that polar bears have adaptations that make them dependent on sea ice, which is now melting as a result of global warming.

Content Vocabulary: *camouflage, carnivorous, foraging, malnourished, threatened, tundra*

WEEK 4: Would humans survive if there was another ice age?

Connection to the Big Idea: Humans are the most adaptable species on Earth. Students learn that humans evolved during the last ice age, and our ability to adapt to different habitats and eat a wide range of foods helped us survive. Much of this adaptability hinges on our access to technology. Without it, we might not survive another ice age.

Content Vocabulary: *bipedalism, distribution, glaciations, hominid, omnivores, technology*

WEEK 5: Unit Review

You may choose to do these activities to review concepts of adaptation and extinction.

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

p. 63: Vocabulary Students complete a crossword puzzle to review vocabulary.

p. 64: Visual Literacy Students analyze a word cloud about extinction.

p. 65: Hands-on Activity Students wear a "blubber glove" to see how it feels in the cold and heat. Instructions and materials needed for the activity are listed on the student page.

Changes in the environment can affect the survival of a species.

Week 1

What causes a species to become extinct?

Contrary to what most students may believe, extinction is an ongoing process. However, the rate of extinction fluctuates. Constantly occurring extinctions of a small number of species are punctuated by periods of mass extinction. Extinction is critical to the diversity of life, providing opportunities for new species to spread out and adapt to new environments.

This week students explore the various causes of extinction and learn that even small changes in the environment can have a profound effect on a species' ability to survive. Habitat loss, the primary cause of extinctions, may result from natural phenomena, but increasingly, wild habitats are being affected by human activity. As a result, some scientists believe that there may be another mass extinction in the near future, or perhaps already in progress.

Day One

Vocabulary: *ecosystem, extinction, niche*

Materials: page 39

Ask students if they can think of any examples of extinct species. (dinosaurs, woolly mammoths, the dodo, etc.) Then ask if they know the reasons why these animals became extinct. Introduce the vocabulary and instruct students to read the passage. Before having them complete activity A, you may want to go over the graph together and make sure students understand how to read it. Review the answers together.

Day Two

Vocabulary: *predation*

Materials: page 40

Introduce the vocabulary word. Then explain that a species usually becomes extinct when it is unable to survive or reproduce in its environment. After students have finished reading the passage, instruct them to complete the activities. After students have completed activity B, explain that when one species becomes extinct because of another species' extinction, it is called *coextinction.* Review the answers together.

Day Three

Vocabulary: *uninhabitable*

Materials: page 41

Introduce the vocabulary word. After students have read the passage, explain that some scientists believe the asteroid impact that led to the extinction of the dinosaurs also wiped out 65% of all species on Earth. Then have students complete the activities. For activity C, you may want to work as a group. Review the answers together.

Day Four

Materials: page 42

Before students read the passage, direct them to the illustrations of the extinct animals. Explain that these animals went extinct because of human activities. Then have students read the passage and complete the activity.

Day Five

Materials: page 43

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

Name _____

Daily Science Big Idea 2 WEEK 1

Day 1

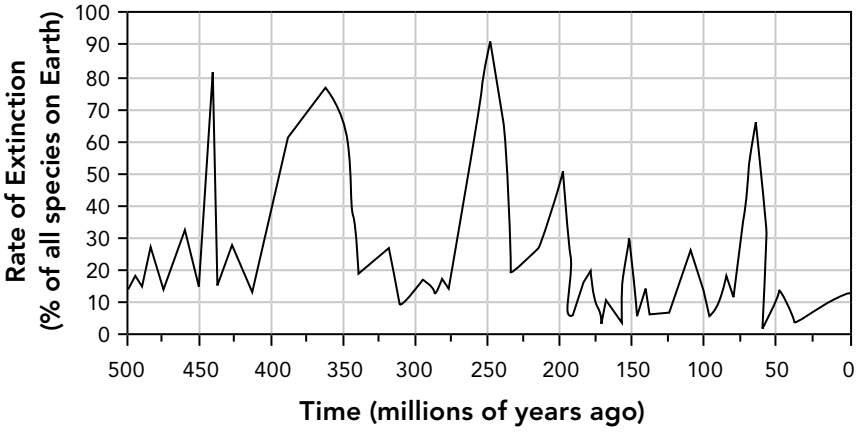
Weekly Question

What causes a species to become extinct?

Extinction is a natural and common process. In fact, 99.9% of all species that have ever existed on Earth are now extinct! Extinction plays an important role in creating diversity of life. Each species on the planet occupies a specific **niche**, so when a species becomes extinct, it leaves a vacant space in an **ecosystem** that is eventually filled by one or more new species.

There are two basic types of extinctions. *Background extinctions* are the most frequent kind. They happen constantly and affect only a few species at a time. *Mass extinctions* occur infrequently and affect a great many species at once. Mass extinctions account for only 5% of all extinctions.

Mass Extinctions



Vocabulary

ecosystem
EE-koh-SIS-tum
a community of interacting organisms and their physical environment

extinction
ek-STINK-shun
the act of ceasing to exist

niche
nich
the position or role of an organism in its environment

A. Use the graph above to answer the questions.

1. When did the biggest mass extinction in Earth's history occur? _____
2. How long ago was the most recent mass extinction event? _____
3. How many mass extinction events have happened in Earth's history? _____

B. What happens to a species' niche when the species becomes extinct?

_____

Name _____

Daily Science
Big Idea 2
WEEK 1

Day 2

Weekly Question

What causes a species to become extinct?

Background extinction affects only a few species at a given time. The most common cause is a change in the species' habitat. Even small changes in temperature can disrupt the balance of nature and cause the death of one or more species in that habitat.

There are also many other causes of background extinction. For example, competition between two species for the same niche often leads to the extinction of the weaker species. **Predation**, or the hunting and eating of one species by another, can cause background extinction. Species can also become extinct due to disease. Finally, small population size can cause extinction if there aren't enough members of the species to produce healthy offspring.

Vocabulary

predation
preh-DAY-shun
the act of hunting prey

A. Next to each example of something that can lead to a background extinction, write the letter of the reason for it.

____ **1.** A virus infects all the members of a bat species.

____ **2.** A species of shark feeds on a rare species of octopus.

____ **3.** Members of a rare salamander species are born with a genetic defect and are unable to reproduce.

____ **4.** Two species of hawks live in the same place and eat the same food.

____ **5.** A forest that is the home of a species of bear is destroyed by fire and replaced with grassland.

Reasons for Background Extinction

a. competition
b. habitat loss
c. disease
d. population size
e. predation

B. Pandas feed almost entirely on bamboo. If the bamboo plant became extinct, what do you think would happen to the pandas?

_____

_____

Name _____

Daily Science
Big Idea 2
WEEK 1

Day 3

Weekly Question

What causes a species to become extinct?

As with background extinctions, the leading cause of mass extinction is change in habitat. However, the change happens on a global scale and affects many organisms over a short period of time. Mass extinctions may be caused by one-time natural disasters, such as volcanic eruptions and asteroid impacts, both of which throw dust and debris into the air and block out the sun. Most scientists believe that an asteroid hitting Earth is what led to the extinction of the dinosaurs.

Mass extinction can also occur as a result of continuous processes that change Earth's climate over time. Global climate change can lead to dramatic shifts in sea levels, ocean currents, and temperatures. Together, these factors can significantly alter the environment to the point where it is **uninhabitable** for a great number of species. If these species can't adapt to the changes, they will become extinct. For example, the global warming that occurred at the end of the Ice Age contributed to the extinction of several species, including the saber-toothed tiger and the woolly mammoth.

Vocabulary

uninhabitable
un-in-HAB-it-ih-bul
not fit for living in

A. Name two ways mass extinction is different from background extinction.

1. _____

2. _____

B. What are two things that can cause mass extinction to occur?

1. _____

2. _____

C. Do you think it is easier for a species to adapt to a sudden change in its environment or a gradual change? Explain.

_____

_____

Name _____

Daily Science
Big Idea 2
WEEK 1

Day 4

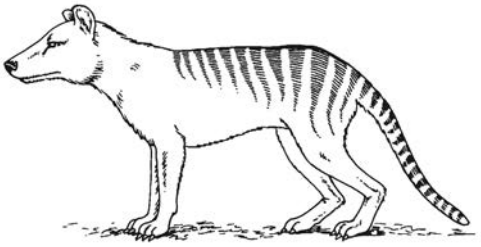
Weekly Question

What causes a species to become extinct?

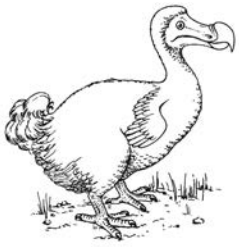
Because a large number of animals have gone extinct over the past few thousand years, many scientists believe that we are in the middle of the next mass extinction. The main cause of this extinction event is human activity. People are changing the environment much faster than most species can adapt. As the human population grows, people expand into natural areas, building cities where there were once forests, wetlands, or deserts. In the process, humans are using up natural resources and creating pollution to the point where the habitats can no longer support life.

Another way that humans cause extinctions is by introducing "nonnative" species into ecosystems where they do not belong. These species often outcompete, prey on, or pass along diseases to the native ones. For example, rats that have escaped from ships are threatening the survival of many native island birds. Some scientists estimate that as a result of human activities, half of all species that exist today may be extinct by the year 2100.

Examples of Extinct Species



Tasmanian wolf



dodo

passenger pigeon

Write *true* or *false*.

1. The growing human population is contributing to the extinction of other species. _____
2. There are signs that by 2100, most species will be extinct. _____
3. Building a road through a forest has no impact on the environment. _____
4. A nonnative species can be brought into an ecosystem by humans. _____

Name _____

Daily Science
Big Idea 2
WEEK 1

Day 5

Weekly Question

What causes a species to become extinct?

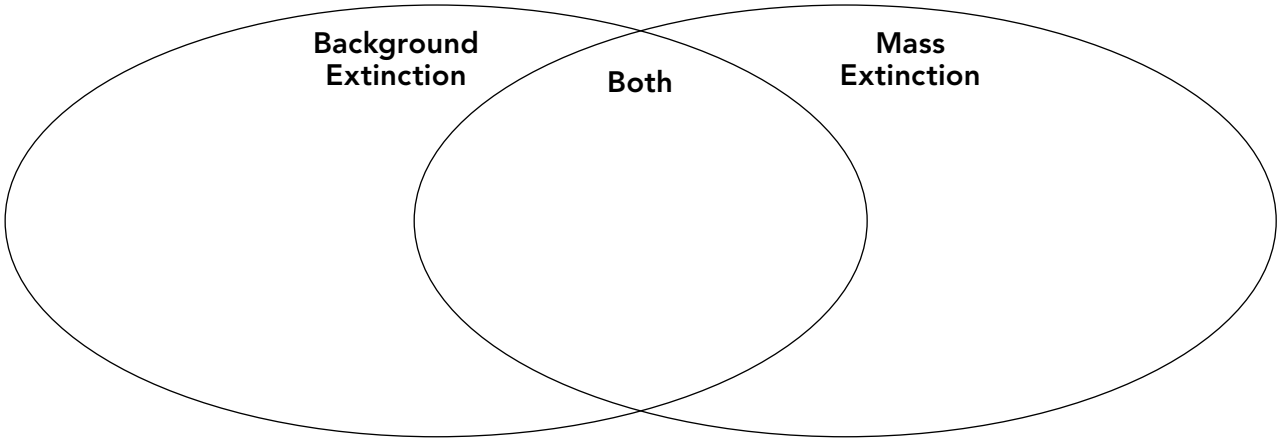
A. Use the words in the box to complete the paragraph.

predation	**uninhabitable**	**niche**
extinction	**ecosystem**	

Each species fills a particular _____ in an _____. The _____ of a species produces a hole in the biological community. This may be caused by _____ of one species by another, if the prey species is hunted until it becomes extinct. But species are most likely to become extinct when their environment becomes _____.

B. Use the words in the box to write the causes of background extinction and the causes of mass extinction in the outer parts of the diagram. In the middle, write any causes that are common to both.

humans	**predation**	**competition**	**volcanic eruption**
asteroid	**habitat loss**	**climate change**	**small population size**



Changes in the environment can affect the survival of a species.

Week 2

How have crocodiles survived for millions of years?

This week students learn about one of the planet's longest enduring animals alive today, the crocodile. Crocodiles have been around for hundreds of millions of years, having survived global cooling events, including the one that killed the dinosaurs, as well as periods of global warming, like the one that caused the extinction of woolly mammoths.

A crocodile's lack of specialization has allowed it the flexibility to adapt to a variety of niches throughout time. Although crocodiles normally inhabit wetlands, several populations have recently been discovered living on the edge of the Sahara Desert—a striking example of their ability to adapt and survive. Today, however, as a result of human activities, crocodiles are threatened with extinction, despite their remarkable adaptability.

Day One

Vocabulary: *exploit*

Materials: page 45

Introduce the vocabulary word and have students read the passage. Then remind them that adaptations are genetic traits passed down from generation to generation, not changes within the lifetime of one organism. Have students complete the activities and review the answers together.

Day Two

Vocabulary: *ectothermic*

Materials: page 46

Introduce the vocabulary word and explain that *ectothermic* means, literally, "outside heat." Compare this to *endothermic*, which means "inside heat." Humans are endotherms. Point out that the term *coldblooded* is often incorrectly used to describe ectotherms, whose blood is not actually cold. After students have finished reading, have them complete the activities. Review the answers together.

Day Three

Vocabulary: *dormancy*

Materials: page 47

Introduce the vocabulary word and help students connect its meaning to the concept of hibernation, which is a deep form of dormancy that happens only in winter. Have students read the passage and complete the activities. If they have trouble with activity B, encourage students to consider how scales might be protective both on land and in water.

Day Four

Vocabulary: *conservation, endangered*

Materials: page 48

After introducing the vocabulary, instruct students to read the passage and complete the activities. For the oral activity, you may wish to pair students or discuss the question as a group. Help students think of how humans react to animals they fear (e.g., people often kill more sharks after an attack) and love (e.g., people tend to protect cute, lovable animals).

Day Five

Materials: page 49

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

Name _____

Daily Science
Big Idea 2
WEEK 2

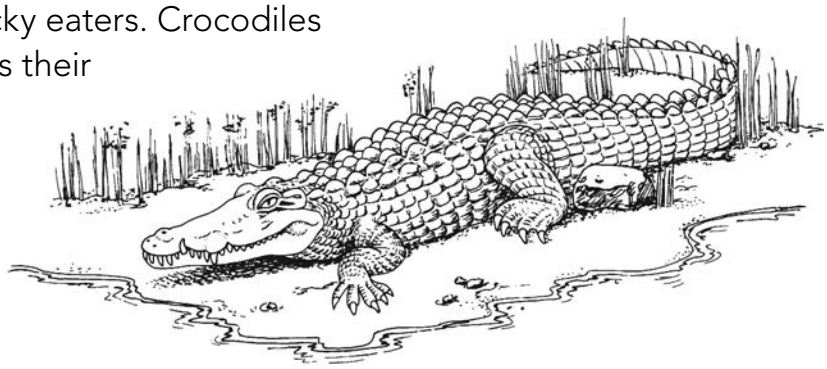
Day 1

Weekly Question

How have crocodiles survived for millions of years?

Crocodiles are one of the oldest animals on the planet. According to the fossil record, crocodiles have been around for at least 220 million years. They have survived two mass extinctions, including the one that killed off the dinosaurs. Modern crocodiles first appeared about 84 million years ago, and they have changed very little since then.

Crocodiles have adaptations that allow them to **exploit** a variety of niches. Their adaptations help them live through harsh conditions and adjust to changing environments. Crocodiles are semiaquatic, which means they can live both on land and in water. And they certainly aren't picky eaters. Crocodiles will eat anything that crosses their path. This includes insects, eggs, fish, frogs, turtles, birds, and mammals. And crocodiles can live in a variety of habitats, from salt water to deserts.



Vocabulary

exploit
eks-PLOYT
take advantage of

A. Write *true* or *false*.

1. A crocodile's diet is limited to animals that live in water. _____
2. Today's crocodiles look very similar to their ancestors. _____
3. A crocodile is adapted to live in many different habitats. _____
4. Crocodiles have a low tolerance for harsh conditions. _____

B. How might an animal that can live both on land and in water be better adapted to climate change? Explain your answer.

_____

_____

_____

Name _____

Daily Science
Big Idea 2
WEEK 2

Day 2

Weekly Question

How have crocodiles survived for millions of years?

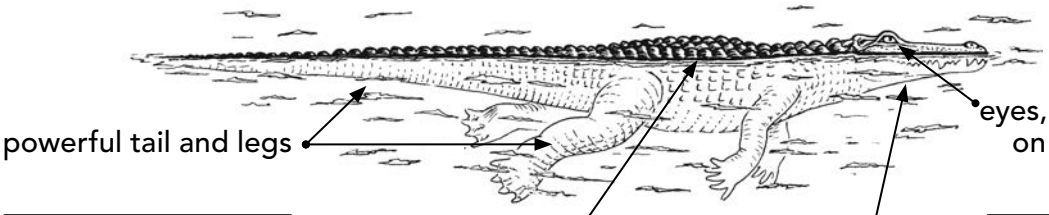
Crocodiles have several adaptations that make them excellent predators both in the water and on land. For example, a crocodile's eyes, ears, and nostrils are on top of its head, allowing it to keep its whole body underwater as it sneaks up on prey. Also, a crocodile can stay submerged for up to two hours without breathing, which gives it more time to hunt or hide from danger. And crocodiles are extremely fast runners and swimmers. They can easily chase down their prey and escape threats from other animals.

In addition to their speed, crocodiles have cone-shaped teeth and powerful jaws, perfect for capturing prey and crushing bones. And their digestive systems are able to process every part of their prey, including hides and hooves. But when food is scarce, crocodiles can survive up to two years without eating. This is because they are **ectothermic**—they don't depend on calories from food to produce heat. Much of their heat energy comes from the sun.

Vocabulary

ectothermic
ek-toh-THUR-mik
dependent upon the sun as a source of heat

A. Explain how each trait labeled in the diagram helps the crocodile survive.



_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____

_____ _____

B. Because crocodiles are ectothermic, what habitats might not be suitable for them? Explain your answer.

_____

_____

Name _____

Daily Science
Big Idea 2
WEEK 2

Day 3

Weekly Question

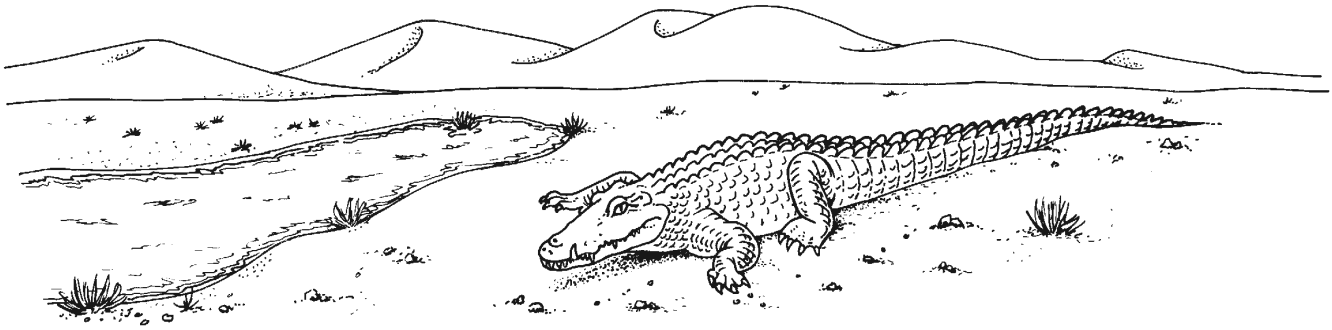
How have crocodiles survived for millions of years?

Crocodiles are adapted to survive in a variety of environments. They live primarily in freshwater habitats, including rivers, lakes, and swamps. But crocodiles can also survive in salt water. Because their ancestors were marine animals that lived in the ocean, modern crocodiles still have salt glands on their tongues that remove salt from their system after they have swallowed it.

Recently, scientists have even discovered crocodiles that inhabit dry, nearly waterless environments. These crocodiles were found living in caves, in burrows, and under rocks on the edge of Africa's Sahara Desert. The crocodiles live near watering holes that can dry up for months at a time. During droughts, the crocodiles survive by entering a state of **dormancy**, which conserves their energy so they require little food or water.

Vocabulary

dormancy
DOR-mun-see
a resting condition in which body functions slow down and growth stops



A. According to the passage, which adaptation allows crocodiles to live in salt water? Which adaptation allows them to live in the desert?

Salt water: _____

Desert: _____

B. Like all reptiles, crocodiles have scaly skin instead of soft skin. How do you think their skin helps crocodiles survive in their various habitats?

_____

_____

Name _____

Daily Science
Big Idea 2
WEEK 2

Day 4

Weekly Question

How have crocodiles survived for millions of years?

Crocodiles have survived for a long time because they are not *specialized*, meaning that their adaptations did not evolve for just one particular environment. Instead, crocodiles are *generalized*—they have general adaptations that allow them to live in many habitats.

Despite their knack for survival, most crocodile species are now **endangered**. The main threats to crocodiles are habitat loss, pollution, and overhunting. For example, in India, a crocodile called a gharial (GAR-ee-ul) has become critically endangered because of overfishing, pollution, and erosion of the riverbanks where it makes its home. There are now fewer than 200 gharials left in the wild. **Conservation** efforts for the gharial include protecting its remaining habitats and breeding the crocodiles in captivity before reintroducing them into the wild.

Vocabulary

conservation
KON-sir-VAY-shun
careful preservation and protection of an organism or habitat

endangered
en-DAYN-jerd
in danger of becoming extinct

Look at the species below and, next to their descriptions, write whether you think their adaptations are *specialized* or *generalized*.

1. The horsetail plant is 375 million years old. It can grow on mountaintops, in the tropics, on land, or in water. _____

2. The Smith's blue butterfly relies on nectar from the buckwheat flower, which grows only on the central coast of California. _____

3. Cockroaches are found on every continent on Earth, including Antarctica. _____

Talk

Throughout history, crocodiles have been the subject of myth and legend. In some cultures, they are worshiped. In others, they are feared. How might people's perceptions of crocodiles contribute both to their survival and to their extermination?

Name _____

Daily Science
Big Idea 2
WEEK 2

Day 5

Weekly Question

How have crocodiles survived for millions of years?

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

conservation	**dormancy**	**ectothermic**
endangered	**exploit**	

Crocodiles have many adaptations that have allowed them to _____ a variety of different environments. For example, crocodiles are _____, which means they don't require food to produce heat. When food and water are scarce, crocodiles are able to enter a state of _____ to save energy. Despite their adaptability, however, many crocodile species are now _____, or at risk of becoming extinct. So _____ efforts are being made to protect crocodiles from habitat loss and overhunting.

B. Explain the difference between generalized adaptations and specialized adaptations.

_____

_____

C. Name two crocodile adaptations and explain how these adaptations allow crocodiles to exploit a variety of conditions.

1. _____

2. _____

Changes in the environment can affect the survival of a species.

Week 3

If the ice cap melts, why can't polar bears just adapt?

This week students learn that because the planet is warming, the Arctic's polar ice cap is melting and polar bears are being threatened with extinction. Polar bears are highly specialized animals that depend on the sea ice for survival. They have a diet consisting almost entirely of seals, which the bears hunt directly from the sea ice. Polar bears also have white fur and extra layers of blubber that would hinder their ability to live in warmer conditions. However, the bears are making an effort to adapt to changes in their environment. Growing numbers have been spotted on land, foraging for a wider variety of foods. If the bears have enough time to alter their behavior and evolve physical adaptations for warmer climates, they may be able to survive.

Day One

Vocabulary: *threatened, tundra*

Materials: page 51

Introduce the vocabulary and review the term *niche* (the ecological role of an organism in its community) before students read the passage. After students have finished reading, have them complete the activities. Review the answers together.

Day Two

Vocabulary: *carnivorous*

Materials: page 52

Before students read the passage, you may want to reiterate that the snowy white cap seen at the North Pole is actually completely composed of ice, with no land underneath it. Then introduce the vocabulary word and have students read the passage and complete the activities. Review the answers together.

Day Three

Vocabulary: *malnourished*

Materials: page 53

To introduce the vocabulary word, ask students to think about situations that might cause people to be malnourished. (not enough food, too much junk food, only one type of food, etc.) Then instruct students to read the passage and complete the activity. Review the answers together.

Day Four

Vocabulary: *camouflage, foraging*

Materials: page 54

After introducing the vocabulary, direct students to read the passage and complete the activities. For activity B, you may want to discuss the difference between behavioral adaptations and physical adaptations. (Behavior can be changed in a single generation, while physical traits cannot.)

Day Five

Materials: page 55

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

Name _____

Daily Science Big Idea 2 WEEK 3

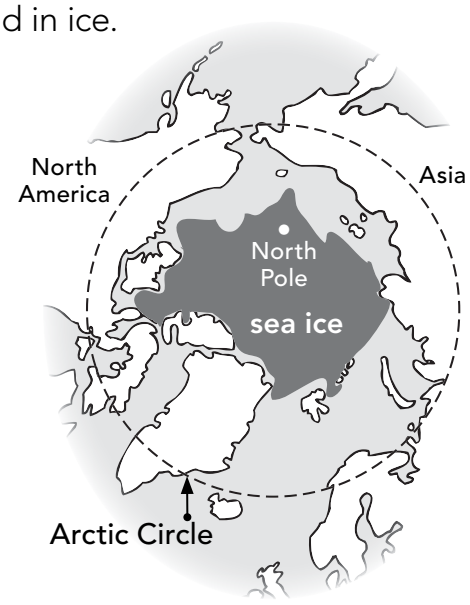
Day 1

Weekly Question

If the ice cap melts, why can't polar bears just adapt?

Polar bears live in a world of snow and ice. They make their home along the **tundra** of the Arctic Circle, in the northern parts of Alaska, Canada, Greenland, Norway, and Russia. Although the bears do spend time on land and in the ocean, most of their lives are spent on a layer of sea ice called the *polar ice cap*.

Polar bears evolved during the Ice Age, when a large part of the Northern Hemisphere was covered in ice. During this time, polar bears developed specialized adaptations for the arctic conditions. These adaptations allowed the bears to exploit the most plentiful resources. But today, their niche has been greatly reduced. Their sea ice habitat is rapidly shrinking due to global warming. So polar bear populations are getting smaller, and the species is now **threatened**. There are currently only 20,000 to 25,000 polar bears left in the wild.



Vocabulary

threatened
THREH-tind
at risk of becoming endangered

tundra
TUN-druh
a vast arctic plain of permanently frozen ground

A. What are the three types of habitats in the Arctic where polar bears spend their time?

1. _____ **2.** _____ **3.** _____

B. Explain how the polar bears' niche has changed since they first evolved.

_____

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

Tundra is to **land** as _____.

- ❒ **Alaska** is to **Arctic Circle**
- ❒ **Ice Age** is to **ice cap**
- ❒ **sea ice** is to **ocean**
- ❒ **Arctic Circle** is to **North Pole**

Name _____

Daily Science
Big Idea 2
WEEK 3

Day 2

Weekly Question

If the ice cap melts, why can't polar bears just adapt?

Polar bears are highly dependent on sea ice. Because there are no plants in the polar bears' habitat, they have adapted to a **carnivorous** diet that consists almost entirely of seals. Polar bears hunt seals using the sea ice as a platform. A polar bear will sit near a hole in the ice and wait for a seal to pop its head up to breathe. Polar bears also stalk seals that rest on the edges of the ice.

The bears' hunting season follows the natural changes of the ice. In the wintertime, the Arctic Ocean freezes over, providing polar bears more ice from which to hunt. The larger hunting grounds, in turn, allow the bears to catch more seals. In the summertime, the ice cap partially melts, and the polar bears cannot hunt as much. The bears rely on stores of fat that they build up during the winter to last them through the lean summer months.

Vocabulary

carnivorous
kar-NIV-uh-rus
eating only meat

A. Answer the questions.

1. Why do polar bears hunt less during the summer?

_____

_____

2. What are two ways that polar bears hunt seals?

_____

_____

B. Complete the sentence.

Polar bears are _____, which means that they do not eat plants.

Name _____

Daily Science
Big Idea 2
WEEK 3

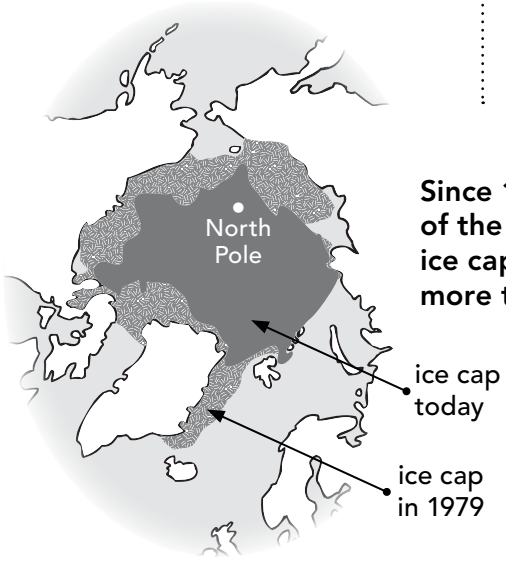
Day 3

Weekly Question

If the ice cap melts, why can't polar bears just adapt?

Because global warming is causing the sea ice to melt earlier each spring and to form later each fall, the polar bears' hunting season is getting shorter. As a result, they have less time to build up fat. This has an especially negative impact on their reproduction. Most female polar bears leave the ice in the fall to give birth on land. The mothers feed the cubs with milk and survive off their own fat reserves. However, since the bears now have less time to hunt, they aren't storing up enough nutrients and are giving birth to **malnourished** cubs.

In the early spring, the mothers and cubs must return to the ice to hunt or they will starve. But because the ice is melting sooner and retreating farther from the coast, the bears must now swim a greater distance to reach their hunting grounds. Polar bears are strong swimmers, but the longer distances are taking their toll. More and more bears are drowning before they reach the ice.



Since 1979, the size of the summer polar ice cap has shrunk more than 20%.

Vocabulary

malnourished
mal-NUR-isht
affected by improper nutrition or not enough food

Cross out the incorrect word or words and write the correct ones above them to make each statement true.

1. Female polar bears return to the ice in the fall to have their cubs.

2. Polar bear cubs live off their fat reserves all winter.

3. Some cubs are well-fed because their mothers aren't getting enough nutrients.

4. Because the ice is melting later in spring, polar bears have farther to swim.

Name _____

Daily Science
Big Idea 2
WEEK 3

Day 4

Weekly Question

If the ice cap melts, why can't polar bears just adapt?

Despite their specialized adaptations for arctic conditions, polar bears are adjusting to the melting ice by extending their range southward and spending more time on land. They are changing their diet to include reindeer, rodents, seabirds, and vegetation. People have even found them rummaging around in their garbage!

However, polar bears aren't very well adapted for this new environment. With a four-inch-thick layer of blubber that provides warmth, polar bears get overheated at temperatures above 50°F. Their thick, white fur, which offers additional warmth and perfect **camouflage** in snow-covered landscapes, makes them obvious on dry land. For polar bears to survive, they will need to develop new hunting and **foraging** techniques before the polar ice cap completely melts. They will also need to evolve physical adaptations that are better suited to warm-weather conditions. No one knows exactly how long it will take for the ice to disappear, but with luck, the polar bears will have enough time to adapt.

Vocabulary

camouflage
KAM-oh-flahj
an organism's natural coloring or form that enables it to blend into its surroundings

foraging
FORE-uh-jing
searching for food

A. Use the vocabulary words to complete the sentences.

1. An owl's spotted feathers provide _____ in the trees.
2. We often see deer _____ for acorns in the woods.

B. Blubber and a polar bear's diet are two examples of adaptations. Which one is likely to change faster? Explain your answer.

_____

_____

C. Some people say that evidence of polar bears on land is a sign that the bears' population is growing. Do you agree or disagree with this statement? Why or why not?

_____

_____

Name _____

Daily Science

Big Idea 2

WEEK 3

Day 5

Weekly Question

If the ice cap melts, why can't polar bears just adapt?

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

foraging	**camouflage**	**malnourished**
tundra	**carnivorous**	**threatened**

1. Not only are polar bears _____, but they are also adapted specifically to eat seals.
2. Polar bears make their home in the arctic _____.
3. Because the sea ice is melting, polar bears have less time to hunt and are often _____. This has _____ the survival of the species.
4. Polar bears are extending their range south, _____ for food along the coastline.
5. While a polar bear's white fur acts as _____ on the ice, it stands out on land.

B. Which of these adaptations will improve a polar bear's chance for survival in warmer weather? Fill in the bubble next to the correct answer.

Ⓐ having white fur
Ⓑ having a thick layer of blubber
Ⓒ being a strong swimmer
Ⓓ hunting on sea ice

C. Most bears eat both plants and meat. Explain why polar bears have adapted to become carnivorous.

_____

_____

_____

Changes in the environment can affect the survival of a species.

Week 4

Would humans survive if there was another ice age?

This week students learn that the remarkable adaptability of humans has allowed our species not only to survive but to thrive and populate the entire planet in a relatively short period of geological time. The fact that our ancestors were omnivores gave them the freedom to move from place to place. The ability to walk on two legs instead of four freed their hands and resulted in more use of tools. Through technology, hominids, including humans, found new ways to adapt to different environments. Our ancestors also evolved during the Ice Age, a time when temperatures fluctuated between extreme highs and lows, which further reinforced our adaptable nature. With sufficient food resources and our technological knowledge to rely on, we are likely to survive another ice age.

Day One

Vocabulary: *distribution, hominid*

Materials: page 57

Introduce the vocabulary and have students read the passage. Then point out the illustrations and confirm students' understanding of the difference between *hominid* and *human*. Explain that the picture of *Australopithecus afarensis* is based on a famous hominid known as "Lucy," whose bones were discovered in 1974 in Ethiopia. Discuss the differences between the three hominids pictured and how they compare to modern humans. Then have students complete the activities. Review the answers together.

Day Two

Vocabulary: *omnivores*

Materials: page 58

Introduce the vocabulary word. You may also want to review the term *savanna* before instructing students to read the passage. Then ask students what crocodiles and humans have in common in terms of their diet. (Both are highly adaptable and can eat a wide variety of foods.) Have students complete the activities and review the answers together.

Day Three

Vocabulary: *bipedalism, technology*

Materials: page 59

After introducing the vocabulary, explain that *technology* is not just the newest computers or cell phones. It means any basic human invention, from a rock used as a hammer to pencils or eyeglasses. Ask students how much they use technology in their everyday lives. Instruct students to read the passage and complete the activities. You may want to guide students through activity A if they have trouble reading the timeline.

Day Four

Vocabulary: *glaciations*

Materials: page 60

Introduce the vocabulary word and explain to students the difference between glaciations (times when much of Earth was covered with ice) and glaciers (moving masses of ice). Direct students to read the passage. Then model how to read the graph before students complete the activity.

Day Five

Materials: page 61

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

Name _____

Daily Science Big Idea 2 WEEK 4

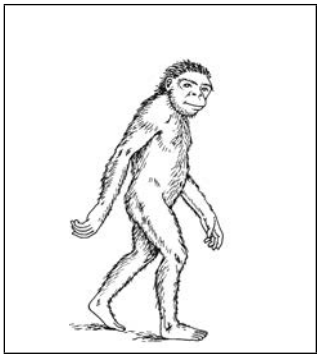
Day 1

Weekly Question

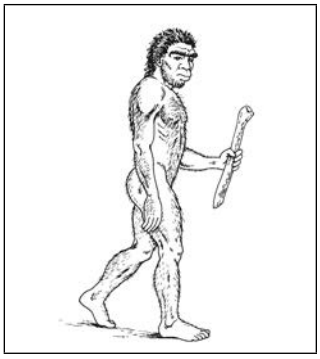
Would humans survive if there was another ice age?

The origins of the human race can be traced back as far as 6 million years. This may seem like a long time, but in terms of Earth's history, **hominid** species are relatively new to the planet. The earliest members of the genus *Homo* appeared in Africa a mere 2.5 million years ago, around the start of the Ice Age. And our own species, *Homo sapiens* (SAYP-ee-enz), evolved less than 200,000 years ago. "Human" is the common name for *Homo sapiens*.

Humans have shown that we are the most adaptable species on Earth. We have a diet that is very flexible. And we can survive in all types of climates and habitats, from the arctic tundra to hot, dry deserts. Today, our **distribution** is worldwide.



Genus: *Australopithecus*
Species: *afarensis*
Lived 3.2 million years ago



Genus: *Homo*
Species: *erectus*
Lived 1.8 million years ago

Genus: *Homo*
Species: *sapiens*
Lived 200,000 years ago

Vocabulary

distribution
DIS-trih-BEW-shun
the natural geographic range of an organism

hominid
HAHM-uh-nid
any member of the group that includes humans and their ancestors

A. Based on the pictures above, list three physical traits of hominids that have changed over time.

1. _____ **2.** _____ **3.** _____

B. The distribution of the human population may be worldwide, but we favor certain climates. In which climates do you think most people live and why?

_____

_____

Name _____

Daily Science
Big Idea 2
WEEK 4

Day 2

Weekly Question

Would humans survive if there was another ice age?

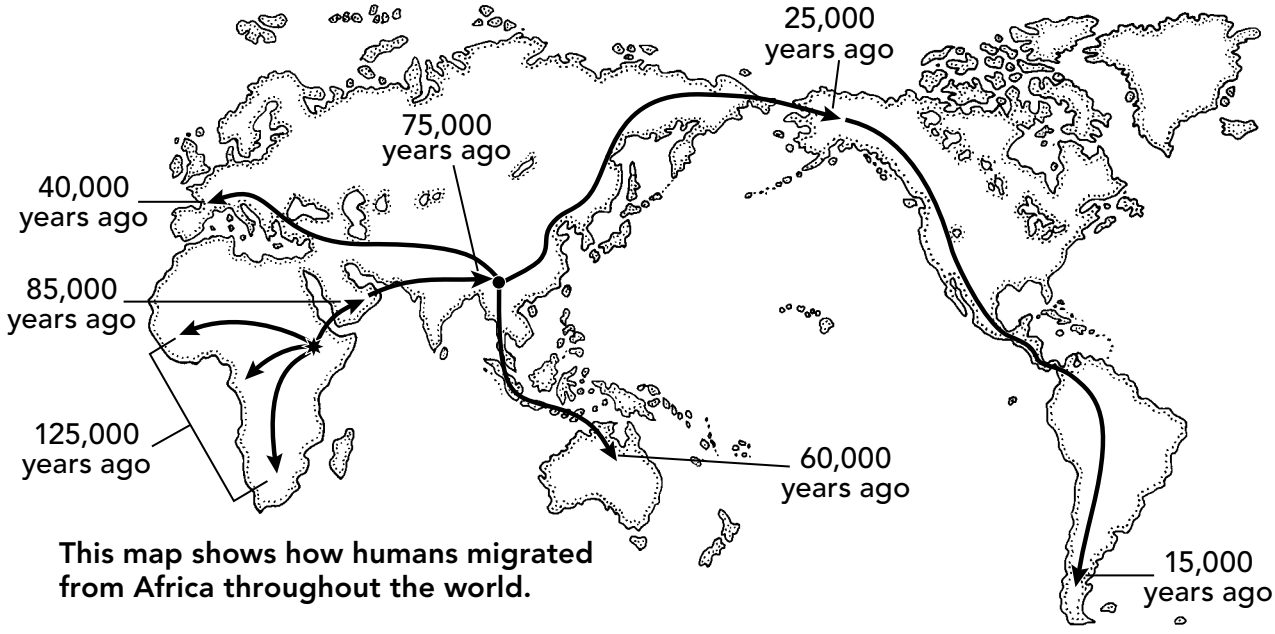
We humans are **omnivores**, so our diet is broad. Because we don't depend on a specific type of food, we are not restricted to one area for finding food. We are able to seek out new habitats where there is less competition or more plentiful resources.

The earliest hominids lived in the forests of Africa and ate mostly leaves and fruit. When climate change altered their habitat from forest to savanna, they were able to adapt their diet. In the grasslands, hominids learned how to hunt big game animals.

However, around 125,000 years ago, the savanna began drying up. Humans competed with other hominid species for scarce food resources. Groups of humans made their way to the coast, where they learned how to eat shellfish. And from the coast, humans were able to migrate out of Africa and throughout the world.

Vocabulary

omnivores
AHM-nih-vorz
animals that eat both plants and animals



This map shows how humans migrated from Africa throughout the world.

A. What are two factors that caused humans to migrate?

1. _____ **2.** _____

B. Why do omnivores have an advantage over organisms with a specialized diet?

_____

Name _____

Daily Science Big Idea 2 WEEK 4

Day 3

Weekly Question

Would humans survive if there was another ice age?

The first and most important adaptation of the earliest human ancestors was **bipedalism**. The ability to walk upright freed early hominids' hands for uses other than helping them move. Hominids began to make tools, and **technology** was born. Using tools stimulated the brain, which grew over time. This, in turn, allowed for the development of more complex technology. Hominids learned how to control fire, and later, humans created the wheel.

The use of technology continues to help humans survive. Compared to other mammals, we move very slowly, which makes us easy prey. We have no fur to keep us warm. And we have small teeth and jaws, which makes it hard to process food. But tools such as weapons keep us safe from predators. Shelter, fire, and clothing keep us warm. Fire and utensils also enable us to cook and cut our food, which makes it easier to digest. Today, we are so reliant on even simple technology that we would be unlikely to survive without it.

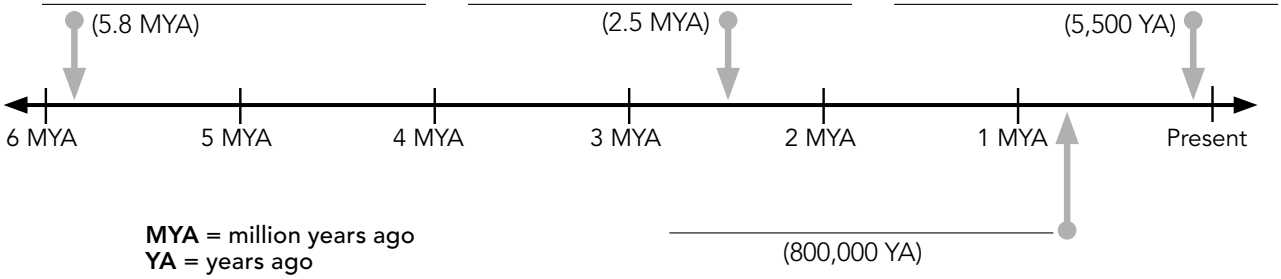
Vocabulary

bipedalism
by-PED-ul-izm
the ability to walk on two legs

technology
tek-NAWL-uh-jee
knowledge and usage of tools to control and adapt to one's environment

A. Write each hominid adaptation or achievement from the box in its correct position on the timeline.

invention of wheel **use of fire** **bipedalism** **use of tools**



MYA = million years ago
YA = years ago

B. Describe three ways that technology helps humans survive, even though we lack other important adaptations.

_____

_____

Name _____

Daily Science
Big Idea 2
WEEK 4

Day 4

Weekly Question

Would humans survive if there was another ice age?

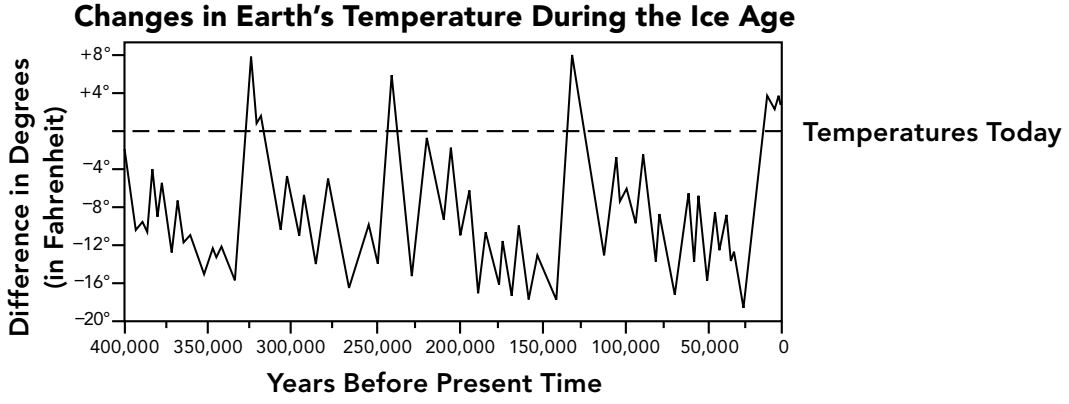
About 2.5 million years ago, Earth entered the Ice Age, a period that lasted until 10,000 years ago. Numerous **glaciations** occurred during this time. The glaciers alternately advanced and retreated, and Earth's temperature changed constantly. Because humans evolved during this time, they were continually adjusting to shifting climates. And the unstable environment meant that our ancestors did not have a chance to specialize. This contributed greatly to our adaptability.

Humans would likely survive another natural ice age because the decrease in temperatures would happen slowly enough for us to adapt. However, a sudden ice age that results from a large volcanic eruption or other event that instantly affects our climate would pose a much greater threat. If another ice age does occur, continued access to food and technology would be key to our survival.

Vocabulary

glaciations
GLAY-shee-AY-shunz
geologic events during which large portions of Earth were covered with slowly moving masses of ice

This graph shows the differences in temperatures during the Ice Age compared to temperatures today. Use the graph to answer the questions.



1. The term "Ice Age" is not an entirely accurate description for that time period. Why do you think this is so? Use the word *glaciations* in your answer.

_____

2. When was it colder on Earth, 250,000 or 375,000 years ago? _____

3. About how much warmer than today's temperatures was the warmest temperature of the last 300,000 years? Approximately when did it occur?

_____

Name _____

Daily Science
Big Idea 2
WEEK 4

Day 5

Weekly Question

Would humans survive if there was another ice age?

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

bipedalism	**glaciations**	**distribution**
omnivores	**technology**	**hominids**

Much of human evolution occurred during the Ice Age. Early _____ were _____, so they were able to eat a wide variety of foods and adapt to changing environmental conditions that were caused by repeated _____. Another adaptation that contributed greatly to the success of the human species was _____, or the ability to walk on two legs. This adaptation led to the development of _____, which, along with our overall adaptability, has allowed humans to grow in population and achieve worldwide _____.

B. For a while, *Homo sapiens* lived in the same place and at the same time as other hominid species. Why do you think our species survived while other hominids went extinct?

_____

_____

C. Explain how the rise of technology contributed to the adaptability of humans.

_____

_____

_____

Name _____

Daily Science
Big Idea 2
WEEK 5

Unit Review

Comprehension

Struggle for Survival

Fill in the bubble next to the correct answer.

1. The vast majority of extinctions are the result of _____.

Ⓐ habitat loss
Ⓑ temperature change
Ⓒ natural disasters
Ⓓ humans

2. Humans are like crocodiles. Both species _____.

Ⓐ are ectothermic
Ⓑ can live on land and in water
Ⓒ are highly adaptable
Ⓓ evolved during the age of dinosaurs

3. One cause of mass extinction is _____.

Ⓐ predation
Ⓑ global climate change
Ⓒ competition
Ⓓ small population

4. Both humans and polar bears evolved _____.

Ⓐ in the Arctic
Ⓑ in Africa
Ⓒ 230 million years ago
Ⓓ during the Ice Age

5. _____ adaptations increase an organism's chance for survival in a particular environment, while _____ adaptations increase an organism's chance for survival during periods of environmental change.

Ⓐ Specialized, generalized
Ⓑ Generalized, niche
Ⓒ Niche, specialized
Ⓓ Generalized, specialized

6. Which of these is *not* a polar bear adaptation?

Ⓐ diet of seals
Ⓑ thick blubber
Ⓒ white fur
Ⓓ being ectothermic

Name _____

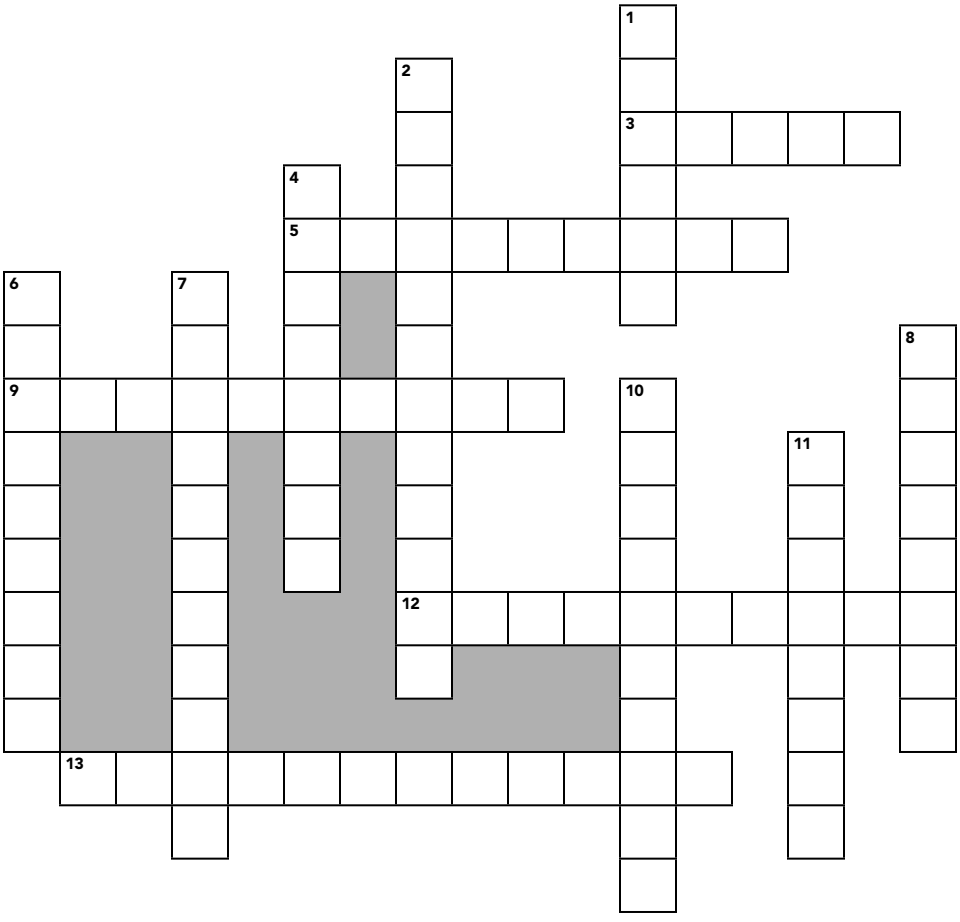
Daily Science Big Idea 2 WEEK 5

Unit Review

Vocabulary

Planet Puzzle

Select from the list of vocabulary words to complete the puzzle.



ACROSS

3. the role of an organism in its ecosystem

5. animals that eat both plants and other animals

9. in danger of extinction

12. A lack of adaptability can lead to this.

13. saving natural resources

DOWN

1. a frozen plain

2. not well-fed

4. looking for food

6. Only carnivorous animals exhibit this behavior.

7. times when much of Earth was covered with ice

8. state of being inactive

10. Bipedalism allowed humans to develop _____.

11. humans and their ancestors

adaptability
bipedalism
camouflage
carnivorous
conservation
distribution
dormancy
ecosystem
ectothermic
endangered
exploit
extinction
foraging
glaciations
hominids
malnourished
niche
omnivores
predation
technology
threatened
tundra

Name _____

Daily Science
Big Idea 2
WEEK 5

Unit Review

Visual Literacy

Extinction Link

A word cloud is a way of showing information based on the size of different words. In this word cloud, the bigger the word, the closer the animal is to extinction. Use the word cloud to answer the questions below.

1. The dodo is extinct. Which organism is most likely to become extinct next? _____
2. If the California condor population grows, would you expect the word to become bigger or smaller? _____
3. Which two organisms are least likely to become extinct? _____
4. If the sea ice continues to melt, would you expect the word *polar bear* to become bigger or smaller? _____
5. If we added the word *dinosaur* to this word cloud, which word do you think it would be the same size as? _____

Name _____

Daily Science
Big Idea 2
WEEK 5

Unit Review

Hands-on Activity

Blubber Glove

Find out what it's like to have blubber! In this activity, you will make a blubber glove and learn what blubber does in the cold and heat.

What You Need

- 2 quart-size freezer bags
- 3 cups of solid vegetable shortening
- large serving spoon
- bucket of ice water
- dry towel
- warm washcloth (soaked in hot water)

1. Use the spoon to fill one freezer bag with the shortening.
2. Turn the second bag inside out, place it inside the first bag, and secure the edges of the two bags together. The pocket that is formed will be your "glove." Gently knead the shortening to distribute it evenly between the bags.
3. Put your hand in the bucket of ice water to feel how cold it is. Then dry your hand with the towel and place it inside the blubber glove. Dip your gloved hand into the water for one minute. Take your hand out of the water and remove the glove.
4. Place the warm washcloth inside the blubber glove. Feel the outside of the glove. Then remove the washcloth from the blubber glove.

What Did You Discover?

1. With your hand in the glove, did you feel the coldness of the water? How did it compare to putting your hand in the water without the glove?

   _____

2. Could you feel the heat of the washcloth from outside the glove? _____

3. Blubber prevents heat from escaping a polar bear's body. How would blubber affect a polar bear forced to live in a warm environment?

   _____

The tilt of Earth's axis and energy from the sun affect seasons and weather patterns.

Key Concepts
Solar Energy and the Weather

National Standard
The sun is the primary source of energy for weather phenomena on the surface of Earth. Seasons result from variations in the amount of solar energy that reaches the surface due to the tilt of Earth's axis and the length of the day.

Although students surely understand that the sun affects temperatures on Earth, they may be surprised to learn that it also controls the wind and precipitation. This unit investigates the causes of weather at various times and locations on Earth, teaching students that:

- the sun is the fundamental source of all weather on Earth;
- hurricanes are powered by solar energy and are also influenced by Earth's rotation;
- the position of the sun in the sky and the length of the day determine temperatures on Earth; and
- the tilt of Earth's axis and its orbit around the sun govern the seasons.

Teacher Background

Light from the sun fuels all of the weather that we experience on Earth. Solar energy is absorbed by Earth and its atmosphere, where it is transformed into heat. The heat causes changes in air pressure, and this gives rise to wind. Heat also powers the water cycle, and therefore precipitation. Generated by the sun, the three elements of temperature, wind, and precipitation combine in a variety of ways to produce not only everyday patterns of weather, but also extreme weather events, such as hurricanes.

Seasons and weather patterns are also determined by the amount of solar energy that a particular location on Earth receives. Because Earth's surface is curved and its axis tilts at an angle, the sun's position overhead and the daily amount of light change as Earth orbits the sun. As a result, the seasons are reversed on opposite sides of the equator. Each hemisphere receives the most solar energy during the summer and the least during winter, and their temperatures increase and decrease accordingly.

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

Unit Overview

WEEK 1: What causes the weather?

Connection to the Big Idea: Energy from the sun powers the weather on Earth. Students learn that the sun controls temperature, wind, and precipitation. These elements create both common and uncommon meteorological conditions and events.

Content Vocabulary: *atmosphere, condense, convection current, evaporate, humidity, precipitation, radiate, solar energy*

WEEK 2: Why don't hurricanes happen at the equator?

Connection to the Big Idea: Hurricanes are powered by the sun but are also influenced by Earth's rotation. Students learn that hurricanes are intense spiraling storms that begin over sun-warmed ocean waters. The winds spin as a result of the Coriolis force, which is produced by Earth's rotation. Because this force does not exist at the equator, hurricanes cannot develop there.

Content Vocabulary: *diameter, disturbance, latitude, updraft*

WEEK 3: Why are the North and South Poles so cold?

Connection to the Big Idea: The North and South Poles receive the least amount of solar energy on Earth. Students learn that because the sun sits low on the horizon at the poles, solar energy is less intense than when the sun is directly overhead. Sunlight has to travel farther to reach Earth's surface at the poles and spreads over a wider area than it does at the equator.

Content Vocabulary: *climate, curvature, horizon, landscape*

WEEK 4: Are the seasons reversed on the other side of the world?

Connection to the Big Idea: The tilt of Earth's axis is the reason for the seasons. Students learn that when one hemisphere tilts toward the sun, it receives more direct sunlight. At the same time, the other hemisphere tilts away from the sun and receives less direct sunlight. As Earth completes its orbit, the hemispheres' positions change in relation to the sun.

Content Vocabulary: *axis, equinox, hemisphere, orbit, solstice*

WEEK 5: Unit Review

You may choose to do these activities to review the concepts of solar energy and the weather.

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

p. 93: Vocabulary Students decipher clues to review vocabulary words from the unit.

p. 94: Visual Literacy Students label the five major circles of latitude to reinforce their understanding of axial tilt, Earth's orbit, and the position of the sun in the sky.

p. 95: Hands-on Activity Students explore the effect of the Coriolis force. Instructions and materials needed for the activity are listed on the student page.

The tilt of Earth's axis and energy from the sun affect seasons and weather patterns.

Week 1

What causes the weather?

This week students learn that by controlling the individual elements of temperature, wind, and precipitation, the sun is the ultimate source of all weather on our planet. Solar energy absorbed by Earth's surface is converted to heat and radiated back into the atmosphere, warming the air and causing temperatures to rise. Air near the surface of Earth is warmer and exerts less pressure than the air at higher altitudes. The pressure difference between warm air and cold air causes the warm air to rise and the cold air to sink. This movement of convection currents produces wind. Solar energy also warms Earth's oceans and other bodies of water, causing some of the water to evaporate. As the water vapor rises, it cools and condenses, falling back down to Earth as precipitation. Extreme weather events such as tornadoes occur along the boundaries that separate air masses of differing levels of heat, pressure, and humidity.

Day One

Vocabulary: *humidity, precipitation, solar energy*

Materials: page 69

Ask students: **When you think of the weather, what words come to mind?** (cloudy, rainy, sunny, windy, etc.) Then introduce the vocabulary and discuss with students whether there is a lot of humidity or precipitation where you live. Instruct students to read the passage and complete the activities. Then review the answers together.

Day Two

Vocabulary: *atmosphere, radiate*

Materials: page 70

Introduce the vocabulary and instruct students to read the passage. Then ask students what else they have heard about the greenhouse effect. (It is related to global warming, the increase of the average surface temperatures on Earth.) Explain that human activities such as agriculture, manufacturing, and transportation are increasing the natural greenhouse effect. Direct students to complete the activity. Review the answers together.

Day Three

Vocabulary: *convection current*

Materials: page 71

Introduce the vocabulary word and instruct students to read the passage. Tell students that although convection currents move air vertically, we feel wind blowing in a horizontal direction. This is because we feel the horizontal part of the circular motion as air moves over Earth's surface. Have students complete the activities and review the answers together.

Day Four

Vocabulary: *condense, evaporate*

Materials: page 72

Discuss with students how the weather can often be unpredictable and dangerous. Invite them to recall recent dramatic weather events in your area. (hurricanes, tornadoes, blizzards, etc.) Then introduce the vocabulary. For *evaporate*, draw students' attention to the word *vapor* and discuss its meaning. You may also want to review the terms *humidity* and *precipitation*. Then instruct students to read the passage and complete the activities.

Day Five

Materials: page 73

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

Name _____

Daily Science Big Idea 3

WEEK 1

Day 1

Weekly Question

What causes the weather?

Although it is 93 million miles away, the sun has a powerful influence on Earth. Ultimately, the sun is the source of all energy on our planet. Energy from the sun reaches Earth in the form of light. It is this **solar energy** that drives the weather. In fact, if it were not for the sun, there would be no weather.

All three elements that make up the weather—temperature, wind, and **precipitation**—are controlled by the sun. Solar energy determines the amount of heat on Earth. And heat, in turn, controls temperature. The sun also causes changes in air pressure, and these changes produce wind. Finally, the sun affects **humidity**, the increase of which results in precipitation.

Vocabulary

humidity
hew-MID-ih-tee
the amount of water vapor in the air

precipitation
prih-SIP-ih-TAY-shun
water droplets that fall to Earth's surface in the form of rain, snow, sleet, or hail

solar energy
SO-lur EN-ur-jee
power from the sun in the form of light

A. Rewrite each sentence, replacing the underlined phrase with the correct vocabulary word.

1. During the summer months, <u>moisture in the air</u> increases.

   _____

2. Without <u>light from the sun</u>, there would be no life on Earth.

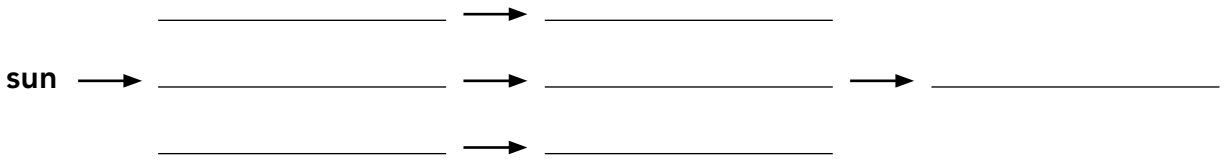
   _____

3. Rainforests receive a lot of <u>water from the sky</u>.

   _____

B. Write each word in its correct place on the flowchart to show how the sun causes all weather.

humidity **wind** **temperature** **pressure**
weather **heat** **precipitation**



Name _____

Daily Science
Big Idea 3
WEEK 1

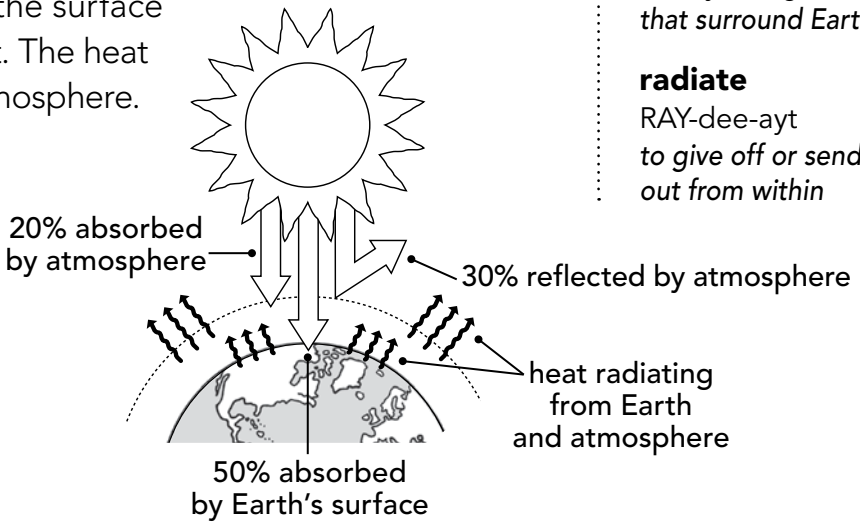
Day 2

Weekly Question

What causes the weather?

Air temperatures vary from day to night and from season to season. This is due to differences in the amount of solar energy that Earth receives. At night, Earth receives less solar energy than during the day. Earth also receives less solar energy during winter than during summer. With decreased solar energy, temperatures drop.

Thirty percent of the solar energy that reaches Earth's **atmosphere** is reflected back into space. The remaining 70% is absorbed by the atmosphere and Earth's surface, which become warmer as a result. The energy that is absorbed by the surface of Earth is transformed into heat. The heat is then **radiated** back into the atmosphere. This process is known as the *greenhouse effect*. It makes Earth's atmosphere about 15°C (59°F) warmer than it would be otherwise. The greenhouse effect is one of the main reasons that life on Earth is possible.



Vocabulary

atmosphere
AT-muh-sfeer
the layer of gases that surround Earth

radiate
RAY-dee-ayt
to give off or send out from within

Use information from the passage and the diagram above to fill in the blanks.

Earth has an "energy budget," which is the amount of energy that Earth receives and gives off. Earth's energy budget is similar to the budget that you use to manage your money. The money that goes into your bank account is like the amount of _____ that is _____ by Earth. The money that you spend is like the amount of solar energy that is _____ or _____ into space. Because the amount of absorption equals the amount of reflection and radiation, Earth's budget is always balanced!

Name _____

Daily Science Big Idea 3

WEEK 1

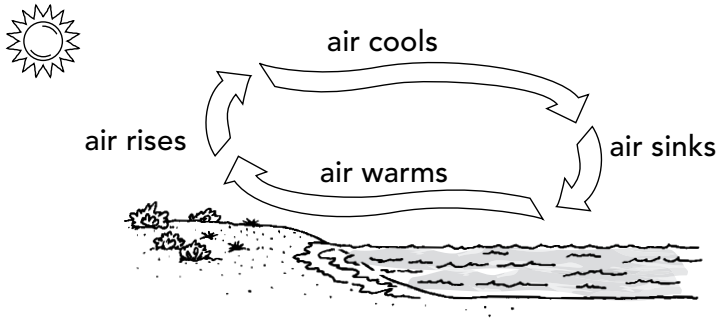
Day 3

Weekly Question

What causes the weather?

Just as the sun regulates temperature, it also regulates the wind. Wind is created when solar energy is absorbed, transformed into heat, and radiated from Earth's surface, warming the air close to the ground. The heated air molecules move faster and push against each other, causing the air to expand and become lighter. The air close to the ground is under high pressure because of the weight of all the air above it. But when the warm air expands, it decreases the pressure. This causes the warm air to rise.

As the air rises, it cools and contracts. Cold air is heavier, exerts more pressure, and therefore tends to sink. Once near the ground, the cold air again becomes warm, expands, and rises, forming a continuous cycle called a **convection current**. This movement of air from areas of high pressure to areas of low pressure is what we recognize as wind.



Vocabulary

convection current
kun-VEK-shun KER-int
the circular flow of a substance due to pressure and temperature differences

A. Summarize why warm air rises and cool air sinks.

_____

_____

B. On a sunny day at the beach, the land heats up faster than the ocean. The warmer air over the land rises, so the cooler air over the ocean rushes in to take its place. This creates a wind called a sea breeze. After sunset, the land cools faster than the water, so the air over the ocean is warmer. Describe what you think happens to the movement of air and the direction of the wind.

_____

_____

Name _____

Daily Science
Big Idea 3
WEEK 1

Day 4

Weekly Question

What causes the weather?

In addition to temperature and wind, the sun also affects precipitation. As solar energy heats Earth's oceans, rivers, and lakes, it causes some of the water to **evaporate** into water vapor. The water vapor rises and increases humidity in the atmosphere, where it begins to cool. As it cools, the water **condenses** into droplets. The droplets collect in clouds, which get heavier and heavier until they can hold no more water. Finally, the water is released, and it falls to Earth as precipitation. This cycle of evaporation, condensation, and precipitation is called the *water cycle*.

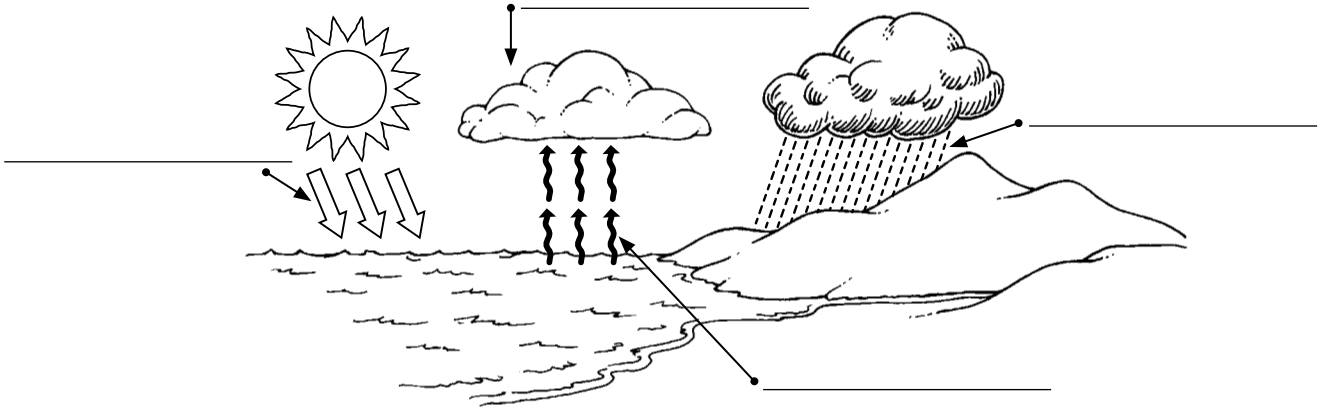
Certain combinations of temperature, wind, and precipitation can sometimes result in dramatic weather events, such as tornadoes. These storm systems usually occur where two air masses of different levels of heat, pressure, and humidity meet. In this way, even the darkest, fiercest storms are driven by the sun.

Vocabulary

condense
kun-DENSS
to convert a gas into a liquid

evaporate
ih-VAP-ur-AYT
to convert a liquid into a gas

A. Label each step in the water cycle, using the words *condensation*, *evaporation*, *precipitation*, and *solar energy*.



B. What often occurs where two air masses of different levels of heat, pressure, and humidity meet?

_____

Name _____

Daily Science
Big Idea 3
WEEK 1

Day 5

Weekly Question

What causes the weather?

A. Write the letter of the correct vocabulary word next to its definition.

____ **1.** wetness in the atmosphere

____ **2.** to change from a liquid into a gas

____ **3.** the envelope of gases that surround Earth

____ **4.** rain, snow, hail, and sleet

____ **5.** the process that produces wind

____ **6.** to change from a gas into a liquid

____ **7.** to give off rays or waves

____ **8.** light from the sun

a. evaporate

b. radiate

c. precipitation

d. solar energy

e. convection current

f. humidity

g. condense

h. atmosphere

B. Check the box next to the phrase that completes the analogy.

Evaporation is to **water vapor** as _____.

❒ **condensation** is to **precipitation**

❒ **humidity** is to **evaporation**

❒ **precipitation** is to **sunlight**

❒ **evaporation** is to **condensation**

C. In your own words, explain how the sun causes the weather.

_____

_____

_____

_____

_____

The tilt of Earth's axis and energy from the sun affect seasons and weather patterns.

Week 2

Why don't hurricanes happen at the equator?

This week students learn about the characteristics and causes of hurricanes, which are violent tropical storms of rotating wind and rain. The four essential ingredients of a hurricane are latitude, wind, temperature, and moisture. The majority of hurricanes occur in late summer and early fall when the power of the sun is at its peak. Solar energy is absorbed by the surface waters of the ocean, which then evaporate. The rising water vapor releases heat when it condenses, causing evaporation to increase. This process is initiated by the sun and provides the steady supply of energy needed to generate and maintain a hurricane.

Meanwhile, the Coriolis force produces a hurricane's characteristic spiraling winds. Created by the rotation of Earth, the Coriolis force is absent at the equator. Because of this, hurricanes don't happen there.

Day One

Vocabulary: *diameter*

Materials: page 75; world map with latitude lines

After introducing the vocabulary word and reading the passage, ask students to locate the Tropic of Cancer, the Tropic of Capricorn, and the equator on the map. Explain that the word *tropical*, as in *tropical storm,* refers to anything in the area between the Tropic of Cancer and the Tropic of Capricorn. Then have students complete the activities.

Day Two

Vocabulary: *disturbance, latitude, updraft*

Materials: page 76; United States map with latitude lines

Introduce the vocabulary. Before students read the passage, ask them to think back to the previous week's lesson about how the sun controls temperature, wind, and precipitation. Use the map of the United States to help students find the latitude of your own city or town. Then ask them whether they think your location could experience a hurricane. Guide students by clarifying that while hurricanes can only develop in certain latitudes, they can travel far north or south of 30°. Have students complete the activities and review the answers together.

Day Three

Materials: page 77

Ask students to describe recent hurricanes that they've experienced or heard about in the news. Explain that every hurricane is rated based on how severe it is. A category 1 hurricane is the weakest and least destructive, while a category 5 is the strongest and most destructive. Then instruct students to read the passage and complete the activities. Review the answers together.

Day Four

Materials: page 78; world map

Have students read the passage and the two questions in activity A. Help students locate Miami, Toronto, Cape Town, and Rio de Janeiro on the map. Then have them complete the activities individually. Review the answers as a group.

Day Five

Materials: page 79

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

Name _____

Daily Science
Big Idea 3
WEEK 2

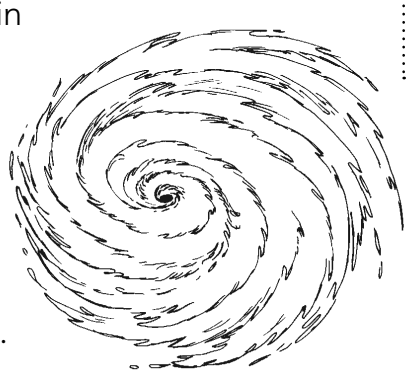
Day 1

Weekly Question

Why don't hurricanes happen at the equator?

Anyone who has lived on the East Coast of the United States is probably familiar with hurricanes. A hurricane is a severe tropical storm that forms over the ocean, producing strong winds and heavy rains that rotate around a central "eye." The eye of a hurricane is the calmest part of the storm, with only light winds and fair weather. It typically ranges in size from 20 to 40 miles in **diameter**, while the hurricane itself may stretch as many as 600 miles across.

As the winds of a hurricane spiral around and around, they push seawater up into a rising swell within the eye. This is called a *storm surge*. As it approaches land, the storm surge becomes a huge wave that may extend as high as 9 meters (30 feet) above sea level! When the wave reaches land, it causes flooding along the coast. In fact, storm surges are often the most dangerous part of a hurricane.



Vocabulary

diameter
dye-AM-ih-tur
the distance across a circle through its center

A. Write *true* or *false*.

1. Hurricanes form over land. _____
2. The eye is the most dangerous part of a hurricane. _____
3. As it moves toward land, a storm surge will grow. _____
4. Hurricanes are tropical storms. _____

B. Fill in the blanks with words from the passage.

1. We heard on the news that the hurricane was so large, its _____ measured more than 400 miles.
2. In the _____ of the storm, it was sunny and calm.
3. When the hurricane reached shore yesterday, the _____ destroyed many homes along the coast.

Name _____

Daily Science
Big Idea 3
WEEK 2

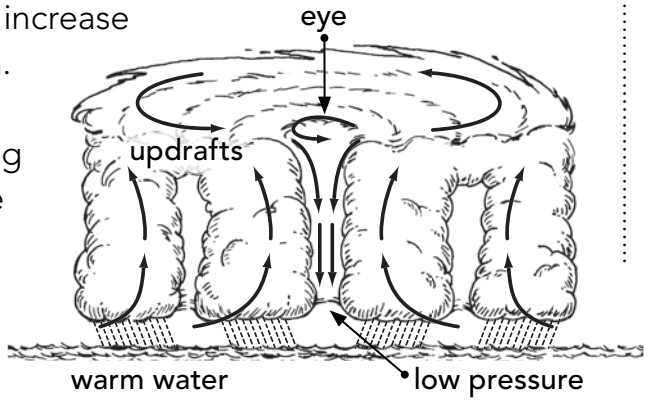
Day 2

Weekly Question

Why don't hurricanes happen at the equator?

Where and when a hurricane forms depends on four basic factors. The first is **latitude**. Most hurricanes occur at latitudes of either 5 to 30° north or 5 to 30° south of the equator. The second factor is wind, which must blow in the same direction between the ocean and 40,000 feet and at a continuous speed of at least 74 miles per hour. The third factor is the surface temperature of the ocean, which must be at least 26.5°C (80°F). Finally, the atmosphere must contain a lot of moisture to fuel the hurricane.

A hurricane begins as a tropical **disturbance**. As the ocean's surface water absorbs solar energy, it becomes heated and starts to evaporate. The water vapor condenses as it rises, releasing heat energy in the process. This causes the winds to speed up, produces **updrafts**, and lowers the air pressure within the eye of the storm. These forces work together to increase evaporation and condensation. The cycle continues and the storm intensifies, lasting as long as three weeks. However, once on land and without the warm ocean waters to supply heat and moisture, a hurricane usually dies out quickly.



Vocabulary

disturbance
dih-STER-bints
a variation from normal or average wind conditions

latitude
LAT-ih-tood
the distance north or south of the equator, measured in degrees

updraft
UP-draft
the upward, vertical movement of air

A. What are the four factors required to form a hurricane?

1. _____ **3.** _____

2. _____ **4.** _____

B. Write a vocabulary word to complete each sentence.

1. Sensing the _____ in the atmosphere, the captain turned his ship toward shore.

2. The hawk used the _____ to soar higher.

Name _____

Daily Science
Big Idea 3
WEEK 2

Day 3

Weekly Question

Why don't hurricanes happen at the equator?

Hurricane season officially lasts from June 1st through November 30th. Hurricanes occur during this period because the sun warms the oceans throughout the summer and fall. Surface waters reach their highest temperatures during late August and September, and this is when most hurricanes develop. For example, Hurricane Katrina, one of the worst hurricanes in recent U.S. history, devastated New Orleans in August 2005. The wind reached speeds of 175 miles per hour over the Gulf of Mexico.

Strictly speaking, hurricanes occur only in the Atlantic and eastern Pacific oceans. The same type of storm in the northwestern Pacific Ocean is called a *typhoon*. In the Indian and southern Pacific oceans, it is called a *cyclone*.

A. Hurricanes are divided into five categories based on wind speed and the height of the storm surge. Use the chart to answer the questions.

Category	Wind Speed (in miles per hour)	Height of Storm Surge (in feet)
1	74–95	4–5
2	96–110	6–8
3	111–130	9–12
4	131–155	13–18
5	more than 155	more than 18

1. In 1954, Hurricane Hazel traveled from the Caribbean Sea up the U.S. east coast into Canada. Hazel reached a maximum wind speed of about 150 mph. What category of hurricane was Hazel? _____

2. Based on the information in the passage, what category was Hurricane Katrina before it reached land? _____

3. The Galveston Hurricane of 1900 had a storm surge in excess of 15 feet. What category was the hurricane? _____

B. Why do you think hurricanes, cyclones, and typhoons happen between tropical latitudes and not at the higher latitudes?

_____

_____

Name _____

Daily Science
Big Idea 3
WEEK 2

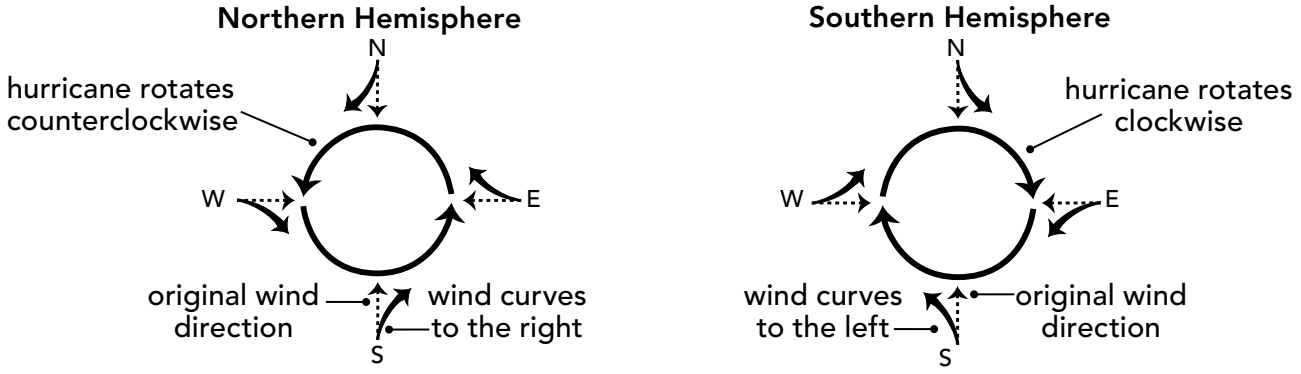
Day 4

Weekly Question

Why don't hurricanes happen at the equator?

Even though hurricanes form over waters *near* the equator, they do not develop at the equator itself. This is due to the *Coriolis* (kor-ee-OH-liss) *force*, the apparent shift of a moving object produced by the rotation of Earth. Because Earth rotates from west to east, wind in the Northern Hemisphere appears to curve to the right. In the Southern Hemisphere, wind appears to curve to the left. The wind itself does not actually change directions, however. Instead, it is Earth that moves beneath it.

The Coriolis force creates the spin of a hurricane. In the Northern Hemisphere, hurricanes rotate counterclockwise, while in the Southern Hemisphere, they rotate clockwise. The Coriolis force is strongest at the poles, gets weaker with decreasing latitude, and is absent at the equator. Without the Coriolis force, the air will not rotate, and a storm cannot develop.



A. Answer the questions.

1. If you were in an airplane flying from Miami, Florida, to Toronto, Canada, would the plane drift to the right or left as it flew? _____

2. If you were on a ship sailing from Cape Town, South Africa, to Rio de Janeiro, Brazil, would the ship drift to the right or left as it sailed? _____

B. In your own words, explain why the Coriolis force must be present in order for a hurricane to form.

_____

Name _____

Daily Science
Big Idea 3
WEEK 2

Day 5

Weekly Question

Why don't hurricanes happen at the equator?

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

diameter	**disturbance**
latitudes	**updrafts**

Beginning as a _____ in the atmosphere at _____ near the equator, a hurricane is a powerful tropical storm, with an average _____ of 300 miles. A constant supply of energy causes winds to speed up and produces _____, increasing the strength of the storm.

B. Answer the questions.

1. Why do hurricanes form mostly in August and September?

_____

2. Why do hurricanes weaken over land?

_____

3. Where is the Coriolis force strongest?

_____

4. Why don't hurricanes form at the equator?

_____

C. Explain how solar energy contributes to the formation of a hurricane.

_____

_____

Week 3

Why are the North and South Poles so cold?

The tilt of Earth's axis and energy from the sun affect seasons and weather patterns.

This week students learn that many factors combine to produce the frigid temperatures at the North and South Poles. The uneven distribution of daylight over the course of a year, with extended periods of darkness, allows temperatures at the poles to drop severely. Because the position of the sun at the poles remains low on the horizon, the solar energy that reaches these locations is relatively weak. In addition, the vast majority of this energy is reflected back into space by the snow and ice that blanket the poles. The prevailing dry and windy conditions function to further accelerate heat loss. Because the South Pole sits high atop a landlocked plateau, its temperatures are markedly colder than those at the North Pole, which lies at sea level surrounded by ocean waves that absorb heat.

Day One

Vocabulary: *climate*

Materials: page 81; globe, dot stickers, flashlight

Introduce the vocabulary word and invite students to discuss the climate in your area. Then have students read the passage. To demonstrate how every location on Earth rotates in and out of darkness, mark several spots on the globe with stickers. Be sure to place them at different latitudes, including the equator and near the poles. Then dim the lights and shine the flashlight on the spinning globe. Have students complete the activity.

Day Two

Vocabulary: *curvature, horizon*

Materials: page 82; globe, penlight

Introduce the vocabulary. Then use the penlight and globe to demonstrate the relationship between Earth's curvature and the angle of the sun. Shine the penlight at the equator, holding it parallel to the floor and directly in line with the equator. Then, keeping the penlight parallel, raise it to the level of the North Pole. Ask students to comment on the size and shape of the beam of light where it hits the surface at each location. Instruct students to read the passage and complete the activities. For activity A, allow students to use a map or a globe to find Seattle and Miami.

Day Three

Vocabulary: *landscape*

Materials: page 83

Introduce the vocabulary word and then ask students if they have ever seen "waves" of heat radiating off pavement. Explain that pavement absorbs sunlight, which makes it heat up. After students have read the passage, have them complete the activities. Review the answers together.

Day Four

Materials: page 84

Ask students which continent is positioned over the South Pole. (Antarctica) Then explain that the North Pole is in a region called "the Arctic." Ask students if they know why the region is called this. (It is in the Arctic Ocean.) Instruct students to read the passage and complete the activities. Then review the answers together.

Day Five

Materials: page 85

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

Name _____

Daily Science
Big Idea 3
WEEK 3

Day 1

Weekly Question

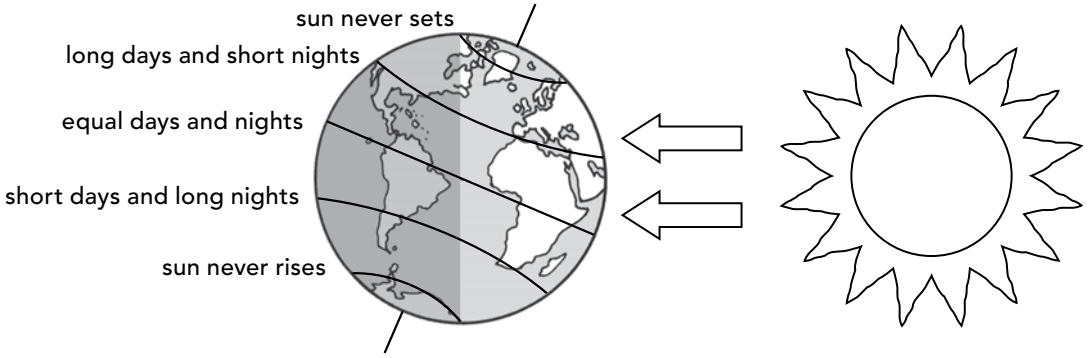
Why are the North and South Poles so cold?

Earth's **climate** varies greatly from region to region and season to season. One reason for this is patterns of daylight. Over the course of a year, every place on Earth receives the same amount of daylight. But how and when the light is received differs by location and time of year. At the poles, the sun rises and sets only once each year. Six months of continuous daylight are followed by six months of darkness. Because it is dark for such a long time, the poles get very cold. And because they are frozen, it is difficult to heat them up once the sun does shine.

The situation is much different at the equator. There, the daily amount of light does not change much. Within each 24-hour period, there are roughly 12 hours of daylight and 12 hours of darkness. As a result, the temperature at the equator is nearly constant—and warm—throughout the year. With the same amount of light and darkness every day, the areas near the equator do not have a chance to get cold like the poles do.

Vocabulary

climate
KLY-mit
the average weather conditions of a particular area



This chart shows the amount of daylight that four cities get in January and July. Use the information to list the cities in order of their distance from the North Pole.

North Pole

_____

_____

_____

_____

Equator

City	Hours of Daylight	
	January	July
Shanghai, China	10	14
Barrow, Alaska, U.S.	0	24
Bogota, Colombia	12	12
St. Petersburg, Russia	6	18

Name _____

Daily Science
Big Idea 3
WEEK 3

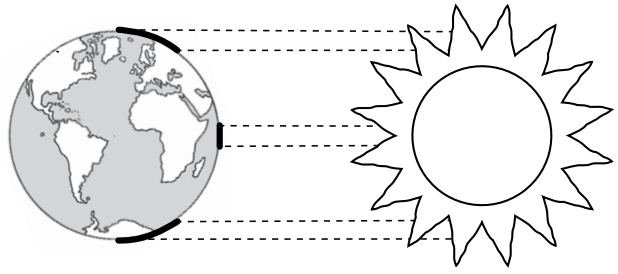
Day 2

Weekly Question

Why are the North and South Poles so cold?

Because of the **curvature** of Earth, the sun hits different places at different angles. While the sun shines almost directly overhead at the equator, it remains low on the **horizon** at the poles. Because it is at an angle, the sunlight at the poles travels farther through the atmosphere than the sunlight that hits the equator. And the atmosphere absorbs and reflects some of the sun's energy. So the sunlight that reaches the poles is weaker than the sunlight that reaches the equator.

A sunbeam that hits the ground at an angle also spreads over a greater area than a sunbeam that comes from overhead. This further reduces the amount of solar energy that the poles receive. With less solar energy, temperatures at the poles remain low.



Vocabulary

curvature
KER-vuh-chur
arching or bending

horizon
huh-RYE-zun
the line where the sky and Earth appear to meet

A. You can estimate the angle of the sun in the sky by the length of your shadow. The longer your shadow is, the greater the angle of the sun. Use this information to answer the questions.

1. If you're standing at the South Pole, will your shadow be longer or shorter than where you live? Why?

_____

2. Where is your shadow shorter, Seattle, Washington, or Miami, Florida? Why?

_____

B. A magnifying glass can use the sun's energy to burn paper. In order to ignite the paper, the magnifying glass must be held so that light from the sun forms a small, circular dot. Explain why you think this is necessary.

_____

_____

Name _____

Daily Science
Big Idea 3
WEEK 3

Day 3

Weekly Question

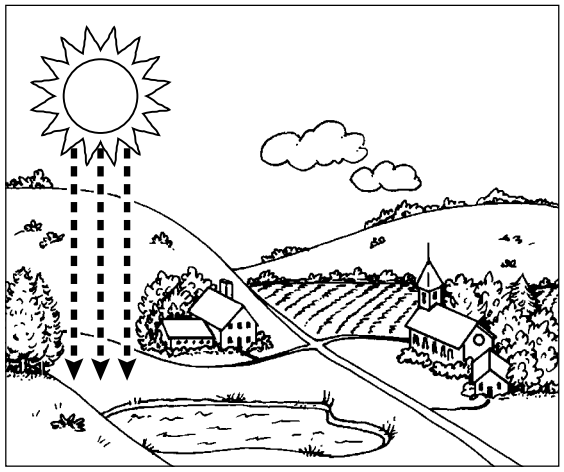
Why are the North and South Poles so cold?

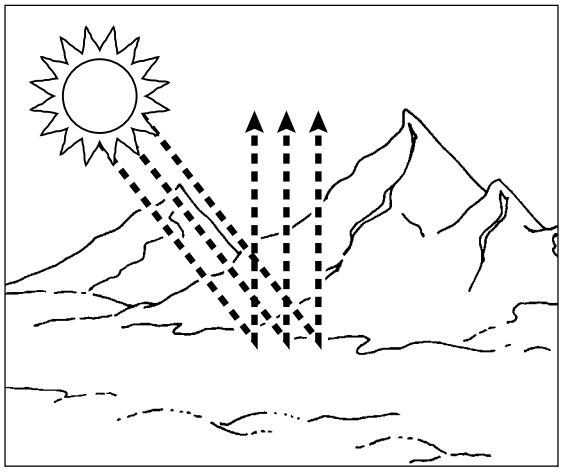
Certain features of Earth's **landscape**, such as soil, water, trees, and even towns and cities, absorb energy. This results in warmer temperatures. But snow does just the opposite. It reflects 90% of the sun's energy and sends it back into space. Snow is one more reason why the North and South Poles are so cold.

Yet another reason is the weather pattern. Clouds increase the temperature on the surface of Earth, functioning like a blanket to keep heat close to the ground. But because the climate is so dry at the poles, there are rarely any clouds in the sky. There are, however, strong winds at these latitudes, which blow most of the surface heat away.

Vocabulary

landscape
LAND-skayp
the visible features of a region





A. Use information from the passage to complete the analogies.

1. **Pavement** is to **absorb** as **snow** is to _____.
2. **Wind** is to **cold** as **cloud** is to _____.

B. Name one feature of the landscape and two features of the weather at Earth's poles. Explain how each of these features contributes to cold temperatures.

Landscape: _____

Weather: _____

_____

Name _____

Daily Science
Big Idea 3
WEEK 3

Day 4

Weekly Question

Why are the North and South Poles so cold?

At the North Pole, average temperatures range from −18°C (0°F) in summer to −37°C (−34°F) in winter. Temperatures at the South Pole are, on average, 17°C (30°F) colder. The coldest temperature ever recorded in the Arctic was −56°C (−68°F), while the coldest temperature in the Antarctic was −89°C (−128°F)! Why is the South Pole so much colder than the North Pole?

There are two reasons for this difference. One is that the North Pole is located in the middle of the Arctic Ocean. Regions near the ocean are warmer because the ocean absorbs heat. By comparison, the South Pole is on the continent of Antarctica, 800 miles from the nearest sea. The second reason is that areas of higher elevation have colder temperatures. While the North Pole is located at sea level, the South Pole sits at an elevation of nearly 10,000 feet.

A. Use the chart to answer the questions.

	Average Monthly Temperatures at the South Pole (in Fahrenheit)												
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	**Year**
Avg. high	−13°	−35°	−58°	−62°	−63°	−63°	−67°	−67°	−67°	−53°	−33°	−15°	**−49°**
Avg. low	−18°	−44°	−69°	−76°	−78°	−78°	−81°	−80°	−80°	−63°	−38°	−18°	**−60°**

1. Which three months of the year have the lowest average temperatures?

_____

2. During which month does the highest average temperature occur?

_____

B. Some areas with year-round mild climates, such as California, have snow-topped mountains. Explain how this is possible.

_____

_____

Name _____

Daily Science
Big Idea 3
WEEK 3

Day 5

Weekly Question

Why are the North and South Poles so cold?

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

climate **landscape** **horizon** **curvature**

Many factors affect the _____ of a region. Because of the _____ of Earth's surface, the sun sits low on the _____ at the North and South Poles. In addition, features of the polar _____, such as snow and ice, reflect the sun's energy, which further decreases temperatures at the poles.

B. Next to each landscape feature or weather condition, write whether it contributes to a *colder* or a *warmer* climate.

1. direct sunlight _____
2. high winds _____
3. clouds _____
4. high elevation _____
5. trees and soil _____
6. close to the ocean _____
7. sun low on horizon _____
8. snow _____
9. 12 hours of daylight _____
10. low latitudes _____

C. In your own words, explain how six months of darkness and six months of light contribute to cold temperatures at the poles.

_____

_____

_____

The tilt of Earth's axis and energy from the sun affect seasons and weather patterns.

Week 4

Are the seasons reversed on the other side of the world?

This week students gain a clearer picture of how the tilt of Earth's axis causes the four seasons. As Earth completes its annual orbit, the Northern and Southern Hemispheres change their orientations toward the sun. Thus, summer is the season when a hemisphere faces the sun, receives its maximum amount of direct sunlight, and achieves its highest temperatures. In winter, the reverse happens. However, Earth's two hemispheres never experience the same season at the same time. As one hemisphere tilts toward the sun, the other tilts away. That means that the seasons are, in fact, reversed on opposite sides of the equator. What students discover is that ultimately, seasons are defined by the planet's orientation toward the sun.

Day One

Vocabulary: *axis, hemisphere, orbit*

Materials: page 87; globe

Introduce the vocabulary and use the globe to point out Earth's axis and hemispheres. After students have read the passage, you may want to use the globe to review which continents are in each hemisphere. Then direct students to complete the activities. Review the answers together.

Day Two

Materials: page 88; globe, lamp with no shade

Instruct students to read the passage. Then, holding the globe with its axis fixed, demonstrate how Earth (the globe) orbits the sun (the lamp), and how the hemispheres receive direct and indirect sunlight. Then have students complete the activity. Review the answers together.

Day Three

Vocabulary: *equinox, solstice*

Materials: page 89

Introduce the vocabulary and have students read the passage. Explain that in the United States, the dates of the solstices and equinoxes mark the beginning of each season. Then ask whether the days get longer or shorter throughout the summer (shorter). Explain that even though summer is the warmest season, it is also when Earth begins to tilt away from the sun. Then have students complete the activities. For activity B, you may want to remind students that the vernal equinox in the Southern Hemisphere occurs on the same day as the autumnal equinox in the Northern Hemisphere.

Day Four

Materials: page 90; globe or world map

Instruct students to read the passage. When they have finished, ask students to locate the countries listed in activity A on the map. Then direct students to complete the activities on their own. Review the answers together.

Day Five

Materials: page 91

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

Name _____

Daily Science
Big Idea 3
WEEK 4

Day 1

Weekly Question

Are the seasons reversed on the other side of the world?

The imaginary line that is Earth's equator divides the planet into two halves. Each half is called a **hemisphere**. Within the Northern Hemisphere lie North America, the northern tip of South America, Europe, Asia, and two-thirds of Africa. In the Southern Hemisphere are most of South America, a third of Africa, Australia, and Antarctica.

The North and South Poles are the points in the Northern and Southern Hemispheres where Earth's **axis** meets its surface. But Earth's axis is not actually vertical. Instead, it tilts at an angle of 23.45 degrees. This means that one hemisphere is tilted toward the sun, while the other is tilted away. As Earth travels in its 12-month **orbit** around the sun, the hemispheres' positions change in relation to the sun. In other words, whichever way each hemisphere is positioned right now, it will be in the exact opposite position in relation to the sun six months from now.

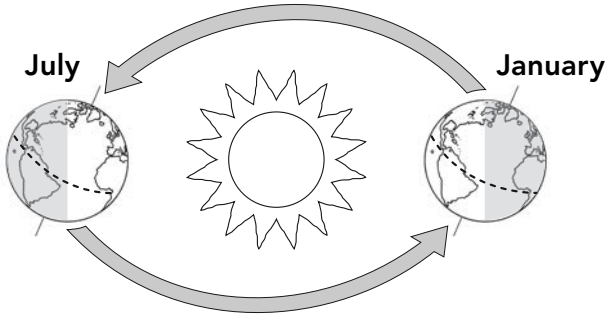
Vocabulary

axis
AK-sis
an imaginary line that passes through the center of Earth from the North Pole to the South Pole

hemisphere
HEM-ih-sfeer
the northern or southern half of Earth

orbit
OR-bit
the circular path of one object around another larger object, such as Earth's movement around the sun

A. Look at the diagram and answer the questions.



1. Does the angle of Earth's axis change during its orbit? _____
2. Which hemisphere is tilted toward the sun in January? _____
3. Name two continents that are completely tilted toward the sun in July.

   _____ and _____

B. Write a vocabulary word to complete the sentence.

Earth's equator divides the planet into two _____.

Name _____

Daily Science
Big Idea 3
WEEK 4

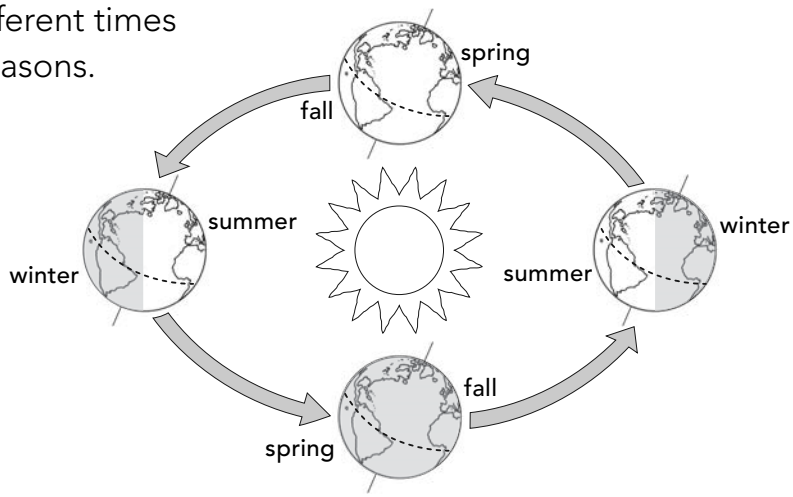
Day 2

Weekly Question

Are the seasons reversed on the other side of the world?

Because of Earth's tilt, the amount of sunlight each hemisphere gets changes throughout the year. The hemisphere that is tilted toward the sun receives direct sunlight, while the other hemisphere receives only indirect sunlight. As Earth progresses along its orbit, the hemisphere in direct sunlight begins to tilt away from the sun, and solar energy decreases. At the same time, the hemisphere that is in indirect sunlight begins to tilt toward the sun, and solar energy becomes more intense.

For any place on Earth, the varying amounts of solar energy result in different temperatures at different times of the year. This is the cause of the seasons. Summer is the season during which a hemisphere tilts toward the sun and therefore receives the most direct sunlight and reaches its highest temperatures. In winter, the same hemisphere tilts away from the sun and therefore receives the least direct sunlight and reaches its lowest temperatures.



Answer the questions.

1. During fall, does a hemisphere receive more or less solar energy than during winter? Explain your answer.

_____

2. What do you think would happen if Earth's axis were tilted in the opposite direction?

_____

_____

_____

Name _____

Daily Science
Big Idea 3
WEEK 4

Day 3

Weekly Question

Are the seasons reversed on the other side of the world?

At a certain point in Earth's orbit, on or around June 21st every year, the Northern Hemisphere reaches its maximum tilt toward the sun. At the same time, the Southern Hemisphere reaches its maximum tilt away from the sun. This is the longest day of the year in the Northern Hemisphere, known as the summer **solstice**. In the Southern Hemisphere, it is the shortest day of the year, so it is the winter solstice. On or around December 21st, the situation is reversed. In the Northern Hemisphere, it is the winter solstice. In the Southern Hemisphere, it is the summer solstice.

Twice each year, on or about March 20th and again around September 22nd, Earth's axis is tilted neither toward nor away from the sun. At these times, the sun shines directly over the equator. Day and night are of equal length all around the world, except near the poles. These two days are called the vernal **equinox** and the autumnal equinox in spring and fall, respectively.

Vocabulary

solstice
SOLE-stiss
an event that occurs twice each year when Earth's axis is tilted directly toward or away from the sun

equinox
EE-kwih-nahx
an event that occurs twice each year when Earth's axis is tilted neither toward nor away from the sun

A. Use the map to decide whether December 21st is the *summer* or *winter* solstice in each city listed below.

1. Tokyo, Japan _____

2. New York, U.S. _____

3. São Paulo, Brazil _____

4. Berlin, Germany _____

5. Auckland, New Zealand _____

6. Cape Town, South Africa _____

B. On or around which day of the year does the vernal equinox occur in the Southern Hemisphere? _____

Name _____

Daily Science
Big Idea 3
WEEK 4

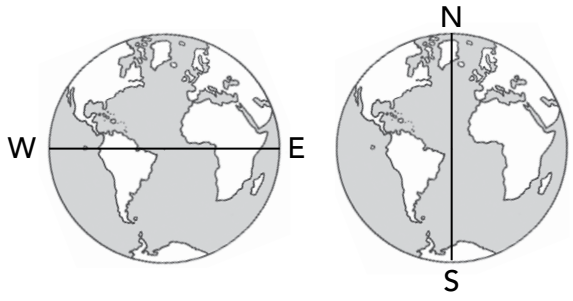
Day 4

Weekly Question

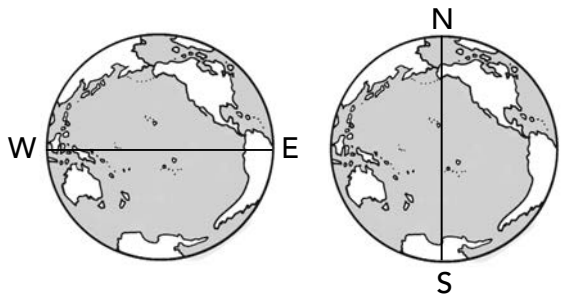
Are the seasons reversed on the other side of the world?

Yes, it's true that the seasons are reversed on the other side of the world—depending on what you mean by "the other side of the world." If you split Earth in half along a plane that goes through the North and South Poles, then China would be on the other side of the world from the United States. But China has the same seasons as the U.S. And although Argentina would be on the same side of the world as the U.S., its seasons are reversed from ours. That's because Argentina is in the Southern Hemisphere. So the seasons are only reversed when "the other side of the world" means "the opposite side of the equator."

Atlantic View



Pacific View



A. Write *true* or *false*.

1. The seasons in the United States are the reverse of the seasons in India. _____

2. The seasons are the same in the United States and Egypt. _____

3. The seasons in the United States are the reverse of the seasons in Peru. _____

4. The seasons are the same in the United States and Australia. _____

B. In your own words, explain how the answer to the question "Are the seasons reversed on the other side of the world?" could be either *yes* or *no*.

_____

_____

Name _____

Daily Science
Big Idea 3
WEEK 4

Day 5

Weekly Question

Are the seasons reversed on the other side of the world?

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

axis	equinox	Hemisphere	orbit	solstice

In the Southern _____, December 21st marks the summer _____, and the autumnal _____ occurs in March. At this time of year, because of Earth's position in its _____, Earth's _____ points neither toward nor away from the sun.

B. Rewrite the following sentences to make them true.

1. After its summer solstice, a hemisphere starts to tilt toward the sun.

_____

2. After the winter solstice, the days become shorter.

_____

3. The autumnal equinox is the longest day of the year.

_____

4. The vernal equinox follows the summer solstice.

_____

C. Explain in your own words how the tilt of Earth's axis is the reason for the seasons.

_____

_____

Name _____

Daily Science
Big Idea 3
WEEK 5

Unit Review

Comprehension

Weather or Not?

Fill in the bubble next to the correct answer.

1. If Earth's axis were not tilted, _____.

Ⓐ the North and South Poles would be warmer
Ⓑ there would be no seasons
Ⓒ Earth would not orbit the sun
Ⓓ Earth would not rotate

2. The three elements of weather are _____.

Ⓐ heat, air pressure, and humidity
Ⓑ temperature, wind, and precipitation
Ⓒ evaporation, condensation, and precipitation
Ⓓ Earth, the sun, and the atmosphere

3. All of these are different names for the same type of storm, except _____.

Ⓐ hurricane
Ⓑ typhoon
Ⓒ cyclone
Ⓓ tornado

4. The North and South Poles are the points where the _____ intersects Earth's surface.

Ⓐ axis
Ⓑ equator
Ⓒ horizon
Ⓓ diameter

5. The longest day of the year is the _____.

Ⓐ vernal equinox
Ⓑ autumnal equinox
Ⓒ winter solstice
Ⓓ summer solstice

6. The source of all weather is _____.

Ⓐ Earth
Ⓑ the atmosphere
Ⓒ solar energy
Ⓓ convection currents

Name _____

Unit Review

Vocabulary

'Tis the Season of Reason

Daily Science Big Idea 3

WEEK 5

Write the vocabulary word that matches or completes each clue.

1. to shine from within _____
2. unusual weather _____
3. an event in spring and fall _____
4. Rain is one kind. _____
5. The sun gives this off. _____
6. one half of Earth _____
7. Earth does this around the sun. _____
8. moisture in the air _____
9. where the sky and Earth meet _____
10. The air and the sky are Earth's _____.
11. a vertical wind _____
12. Earth is tilted on its _____.
13. to change from gas into liquid _____
14. roundness _____
15. a circular flow of winds _____
16. typical weather in a region _____
17. An example of this is 23°N. _____
18. the width of a circle _____
19. the scenery _____
20. to change from water into vapor _____
21. an event in summer and winter _____

atmosphere
axis
climate
condense
convection current
curvature
diameter
disturbance
equinox
evaporate
hemisphere
horizon
humidity
landscape
latitude
orbits
precipitation
radiate
solar energy
solstice
updraft

Name _____

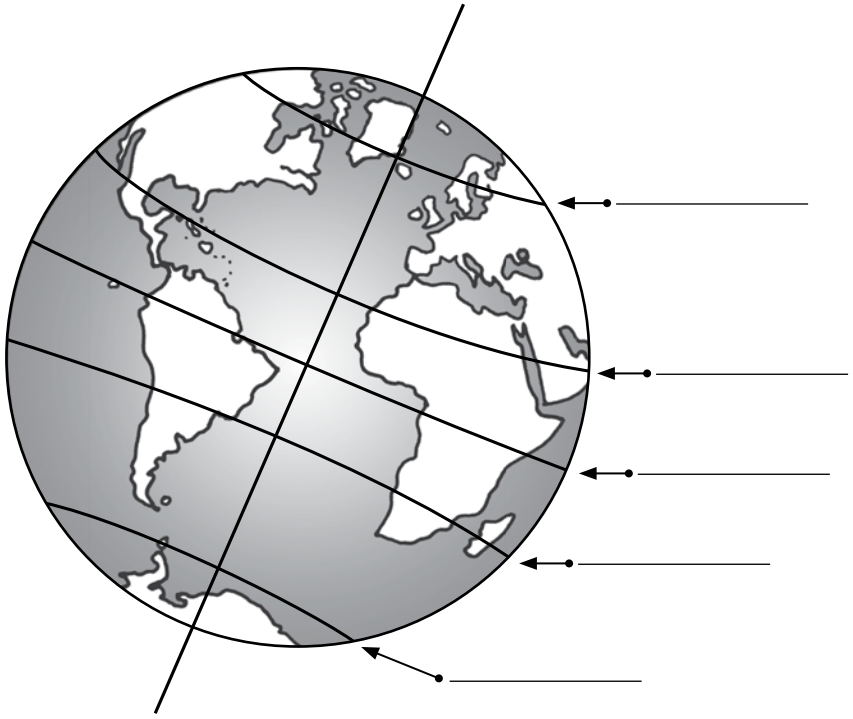
Daily Science
Big Idea 3
WEEK 5

Unit Review

Visual Literacy

Tilt-a-World

Because of the tilt of its axis, Earth is divided by five major circles of latitude. Label each latitude line with the correct latitude number from the box. Then use the diagram to write the latitude that matches each clue below.



Latitudes

0°
23.45°N
23.45°S
66.56°N
66.56°S

1. This is the southernmost latitude, at which the sun shines for 24 continuous hours at least once per year. _____
2. At this latitude, the sun shines directly overhead during the June solstice. _____
3. This latitude is halfway between the North and South Poles. _____
4. At this latitude, there is no sunlight for six months of the year, from September 21st to March 21st. _____
5. This is the latitude at which the sun shines directly overhead during the December solstice. _____

Name _____

Daily Science
Big Idea 3
WEEK 5

Unit Review

Hands-on Activity

May the Force Be With You

The effect of the Coriolis force is to shift the direction of wind on Earth, even though that wind is moving in a straight line. Perform this activity with a partner to experience the power of the Coriolis force.

What You Need

- a large piece of thick cardboard
- a sheet of 15" square paper
- scissors
- tape
- ruler
- 3 felt-tip markers of different colors
- pushpin

1. Tape the cardboard to your desk. Then cut a large circle out of the sheet of paper and lay it on the cardboard. Push the pin through the center of the circle and into the cardboard.
2. Using the ruler and one of the markers, draw a straight line from the center of the circle to the outer edge.
3. Next, have your partner slowly spin the circle at a constant speed as you use the ruler and a different marker to draw another line from the center to the edge of the circle.
4. Repeat step 3, spinning the circle in the same direction. But this time, spin the circle at a faster constant speed and use the third marker to draw the line.

What Did You Discover?

1. What happened to the lines when you spun the circle?

_____

2. How does the speed of rotation affect the shape of the lines that you drew?

_____

3. Since all lines were drawn with a ruler, what can you say about the wind's path? Does it actually change, or does it just appear to change?

_____

_____

Earth is divided into layers: crust, mantle, and core. The crust is made up of plates that move slowly around Earth's surface.

Key Concept
Plate Tectonics

National Standard
The solid Earth is layered with a lithosphere; a hot, convecting mantle; and a dense, metallic core. Lithospheric plates on the scales of continents and oceans constantly move at rates of centimeters per year in response to movements in the mantle.

This unit focuses on the movements of the continents in the past, present, and future. In addition, the unit examines the process of scientific inquiry that led to the theory of plate tectonics and our current understanding of Earth's composition and structure. In this Big Idea, students learn that:

- the outer layer of Earth is divided into plates that move slowly and continuously over Earth's surface;
- Earth is composed of a core, a mantle, and a crust—all of which are in motion;
- interactions between plates produce changes in the positions and shapes of the continents; and
- the coming together and breaking apart of the continents is an ongoing cycle that will continue for billions of years.

Teacher Background

Plate tectonics—the theory that Earth's surface is divided into plates that move constantly—is the cornerstone of modern geology. The story behind the development of this theory provides a wonderful illustration of how scientists formulate hypotheses from observations of the natural world. From initial observations that the continents looked like puzzle pieces to the discovery that Earth's crust is continually created and destroyed, scientists fine-tuned the earlier theories of continental drift and seafloor spreading to create the all-inclusive theory of plate tectonics, which forms the basis of geology today.

Through direct and indirect observations, scientists were also able to identify the composition, structure, and processes of Earth's interior. Knowing about the movements of Earth's interior and its surface helped mold scientists' understanding of not only the way our continents are formed, but the shape they took millions of years ago and will take millions of years from now.

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 the continents look like they fit together?

Connection to the Big Idea: The continents lie on plates that move over Earth's surface. Students learn that the theory of continental drift was developed to explain the similarities between continents. Separately, the theory of seafloor spreading offered an explanation as to why the ocean bottom was so young. The theory of plate tectonics combines these two theories into one and explains how the continents move.

Content Vocabulary: *cartographer, geologist, hypothesize, magma, mechanism, rift, trench*

WEEK 2: How do scientists know what is inside Earth?

Connection to the Big Idea: Earth consists of layers—the core, the mantle, and the crust—and all three layers move. Students learn that volcanic rocks, meteorites, and earthquakes offer clues to the structure and composition of Earth's interior. They also discover how the movement of the layers influence each other.

Content Vocabulary: *asthenosphere, composition, density, lithosphere, mantle, seismic waves*

WEEK 3: What happens when two continents collide?

Connection to the Big Idea: Interactions between plates shape the surface of Earth. Students learn that the tectonic plates can move toward, away from, or alongside each other. Mountains form when the continents on two converging plates collide.

Content Vocabulary: *buoyant, converge, fracture, sediment, subcontinent, subduction*

WEEK 4: What will Earth's surface look like in the future?

Connection to the Big Idea: The forces that shaped the world we know today are still at work and will continue to change Earth's surface far into the future. Students learn that Africa is colliding with Europe and, at the same time, splitting in two. They also discover that part of California is moving north. Geologists predict that the continents will merge to form another supercontinent at some point in the distant future.

Content Vocabulary: *compression, diverging, fault, tension*

WEEK 5: Unit Review

You may choose to do these activities to review the concept of plate tectonics.

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 identify the former location of today's continents within the ancient supercontinent of Pangaea.

p. 125: Hands-on Activity Students create edible models of tectonic plate boundaries to examine how the plates move and interact. Instructions and materials needed for the activity are listed on the student page.

Week 1

Why do the continents look like they fit together?

Earth is divided into layers: crust, mantle, and core. The crust is made up of plates that move slowly around Earth's surface.

This week students learn that, early in the twentieth century, the groundbreaking concept of continental drift was introduced to explain several striking similarities between the continents, including their complementary shapes. The theory asserted that the continents drifted over the surface of Earth and formed the supercontinent Pangaea before moving to their present locations.

By the mid-1900s, scientists had come to understand that the seafloor, instead of being static, was a dynamic part of Earth's crust. The seafloor was constantly "spreading out" through a process in which magma seeped up through mid-ocean rifts, forming new rock as it cooled and pushing aside older rock that eventually disappeared into trenches along the continents' edges. By the late 1960s, scientists recognized that seafloor spreading drove the movement of the continents, and the two concepts of continental drift and seafloor spreading were synthesized into the currently accepted theory of plate tectonics.

Day One

Vocabulary: *cartographer, geologist*

Materials: page 99

Tell students that this week they will follow the development of a theory that revolutionized *geology* (the study of the origin, history, and structure of Earth). Explain that the first step in developing any theory is observation. Scientists observe what is going on around them in the natural world. From their observations, they create a theory and then test their ideas. Then have students read the passage and complete the activities.

Day Two

Vocabulary: *hypothesize*

Materials: page 100

Explain to students that another word for *theory* is *hypothesis* and that when one "hypothesizes," it means that he or she formulates a theory. Have students read the passage and complete the activities independently.

Day Three

Vocabulary: *magma, rift, trench*

Materials: page 101

After introducing the vocabulary, point out that the word *rift* can be used outside of geology. (i.e., a break in friendly relations, as in, "There was a rift between the brother and sister.") Then have students read the passage and complete the activities. Review the answers together.

Day Four

Vocabulary: *mechanism*

Materials: page 102

Introduce the vocabulary word and invite students to think of other words related to it in spelling and meaning. (*mechanical, mechanics, mechanize*, etc.) When students have finished reading the passage, explain that the word *tectonics* refers to the study of processes that cause the formation and movement of Earth's surface. Instruct students to complete the activities. Review the answers together.

Day Five

Materials: page 103

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

Name _____

Daily Science
Big Idea 4
WEEK 1

Day 1

Weekly Question

Why do the continents look like they fit together?

Have you ever noticed that the west coast of Africa seems as though it would fit snugly against the east coasts of North and South America? By the 1600s, **cartographers** had recognized that these continents resembled the pieces of a jigsaw puzzle. However, no one was sure why this was the case.

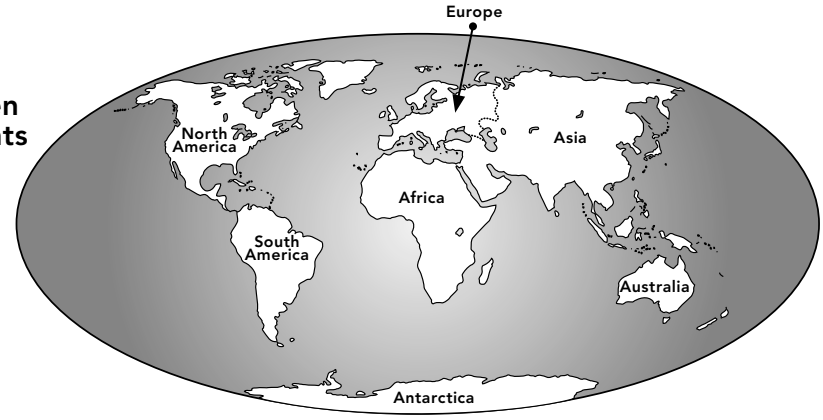
People noticed other similarities between the continents as well. **Geologists** discovered that the Appalachian (ap-uh-LAY-chun) Mountains of North America and the Caledonian (kal-eh-DOH-nee-un) Mountains of Europe were identical in form and composition. And mountains in Brazil matched those in the African Congo. Also, fossils of the same plants and animals were found on continents as far apart from each other as South America, Antarctica, and Australia. How was this possible?

Vocabulary

cartographer
kar-TAH-gruh-fur
a person who makes maps

geologist
jee-AH-loh-jist
a scientist who studies the structure and history of Earth

The Seven Continents



A. List three observations that were made about the continents by cartographers and geologists.

1. _____

2. _____

3. _____

B. Use the vocabulary words to complete the sentence.

A _____ studies only the surface features of Earth, while a _____ studies the composition of Earth as a whole.

Name _____

Daily Science
Big Idea 4
WEEK 1

Day 2

Weekly Question

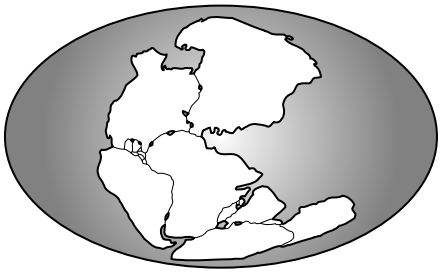
Why do the continents look like they fit together?

In 1912, German scientist Alfred Wegener proposed his theory of continental drift in order to explain the similarities between the continents. According to his theory, the continents moved slowly and continuously over the surface of Earth. Wegener went on to **hypothesize** that 250 million years ago, all of the continents were joined into one giant supercontinent called Pangaea (pan-JEE-uh).

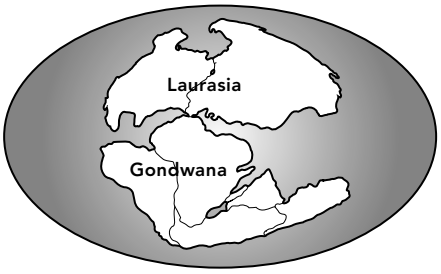
By 175 million years ago, Pangaea had split up into Laurasia (law-RAY-zhuh) and Gondwana (gahn-DWAH-nah). Laurasia consisted of what is now North America, Europe, and Asia. Gondwana was made up of South America, Africa, Antarctica, Australia, and India. The continents continued to separate until they reached the positions that they occupy today. There was a flaw in Wegener's theory, however. He couldn't explain how and why the continents moved.

Vocabulary

hypothesize
hi-PAH-thuh-size
to propose an explanation or theory



Pangaea



Laurasia and Gondwana

Modern-Day Continents

A. Write *true* or *false*.

1. Alfred Wegener hypothesized that the continents moved in short, quick bursts over Earth's surface. _____

2. Pangaea split into Laurasia and Gondwana 250 million years ago. _____

3. Wegener could not explain how the continents moved. _____

B. Complete the analogy.

North America is to **Laurasia** as **Australia** is to _____.

Name _____

Daily Science
Big Idea 4
WEEK 1

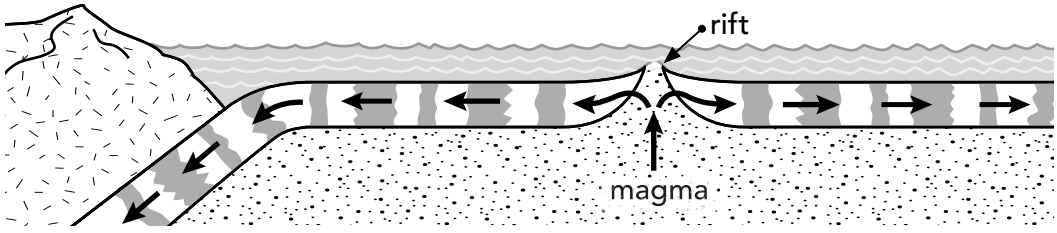
Day 3

Weekly Question

Why do the continents look like they fit together?

In the 1940s and 1950s, scientists began to closely study the bottom of the ocean. What they found surprised them. They had expected the rocks of the seafloor to be the same age as Earth—4.6 billion years old. But they were less than 200 million years old! Also, the seafloor was not flat. Instead, it had **trenches** that ran along the edges of the continents, while in the middle of each ocean ran a long mountain ridge. Within the ridges were deep **rifts**, which were the sites of earthquakes and volcanic activity. And geologists discovered matching bands of rocks on either side of each ridge.

Based on these observations, American geologist Harry Hess proposed the theory of *seafloor spreading*. Hess hypothesized that **magma** seeped out of a rift, forming matching bands of rocks on both sides of the ridge as the lava cooled. The rocks then spread away from the ridge as new lava erupted. In this way, the rocks moved across the seafloor, eventually disappearing into the deep ocean trenches along the continents.



Vocabulary

magma
MAG-muh
hot, molten, volcanic material from inside Earth, called lava once it erupts onto the surface

rift
rift
a major fault or crack in Earth's surface

trench
trench
a long, steep valley on the ocean floor

A. Write the vocabulary words to complete this sentence.

When _____ seeps up through _____ in the seafloor, older rocks are pushed into _____ at the edges of the continents.

B. Describe how Hess's theory explains why there is no ocean rock older than 200 million years.

_____

_____

Name _____

Daily Science
Big Idea 4
WEEK 1

Day 4

Weekly Question

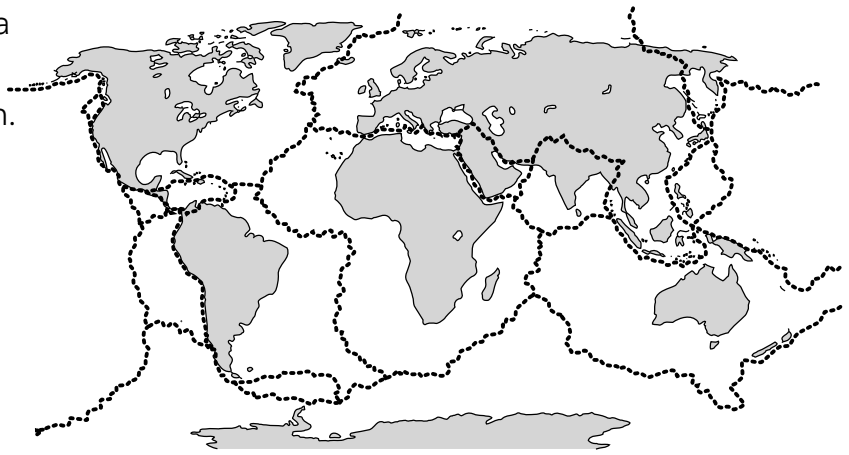
Why do the continents look like they fit together?

By the late 1960s, most geologists had accepted the idea that seafloor spreading was the underlying **mechanism** of continental drift. The two theories, continental drift and seafloor spreading, were combined into a new theory called *plate tectonics*. This theory states that Earth's surface is divided into plates composed of the continents and the seafloor. The plates are in constant slow motion, and they may move toward, away from, or against each other. Rather than "drifting" over the seafloor, the continents are embedded in the plates and therefore move with them.

The shapes and the placement of the continents are constantly changing. Movement of the plates caused the formation of Pangaea as well as its breakup. And Pangaea was not the first supercontinent. It is merely the most recent of them. Throughout the course of Earth's history, the continents have come together and split apart several times, and they will continue to do so far into the future.

Vocabulary

mechanism
MEH-kuh-NIH-zum
the process that causes an event to happen



A. What role does seafloor spreading play in plate tectonics? Use the word *mechanism* in your answer.

_____

_____

B. Explain why "continental drift" is not an accurate description of the movement of the continents.

_____

_____

Name _____

Daily Science
Big Idea 4
WEEK 1

Day 5

Weekly Question

Why do the continents look like they fit together?

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

mechanism	**cartographers**	**magma**	**rifts**
geologist	**hypothesize**	**trench**	

In the 1950s, _____ mapped the features of the ocean floor. This led a _____ named Harry Hess to _____ that the seafloor was spreading because _____ seeped out of the _____ in mid-ocean ridges. As the lava poured over the ridges and cooled, previously formed rock was pushed across the seafloor, until it finally sank into a _____. Seafloor spreading, in fact, is the _____ that causes the tectonic plates to move over the surface of Earth.

B. Of *continental drift*, *seafloor spreading*, and *plate tectonics*, write the theory that was first used to explain each statement below.

1. New crust is created along mid-ocean ridges. _____
2. Earth's surface is divided into plates composed of the continents and the seafloor. _____
3. All the continents together formed Pangaea. _____
4. Tectonic plates are in constant slow motion on the planet's surface. _____

Week 2

How do scientists know what is inside Earth?

This week students learn how geologists discovered the composition, structure, and processes of Earth's interior. From direct evidence of dense volcanic rock and meteorites, scientists learned what the inside of Earth was made of. In addition, seismic waves generated by earthquakes revealed that Earth was composed of layers.

Scientists learned that in the center of Earth is a solid inner core surrounded by a molten outer core. On top of the core lie the three layers of the mantle, including the taffy-like *asthenosphere*, which moves with Earth's tectonic plates. The outer layer of Earth, or the *lithosphere*, consists of the top layer of the mantle and the crust. Finally, scientists discovered that Earth is constantly "recycling" itself through a process by which convection currents cause heated rock to rise, liquefy, move up to the surface, cool, solidify, and sink back down again.

Earth is divided into layers: crust, mantle, and core. The crust is made up of plates that move slowly around Earth's surface.

Day One

Vocabulary:
composition, density

Materials: page 105

Ask students: **What do you think the interior, or inside, of Earth is like?** Briefly discuss their responses. Introduce the vocabulary and then instruct students to read the passage and complete the activities on their own. Review the answers as a group.

Day Two

Vocabulary:
seismic waves

Materials: page 106

After students have read the passage, discuss the diagram together. Point out how faster P waves overtake slower S waves. Ask students what happens to the P and S waves once they reach the liquid layer. (The P waves slow down and the S waves don't penetrate into the liquid.) Then ask students what happens to the P waves once they reach the solid inner layer. (The P waves speed up.) Have students complete the activity and review the answers together.

Day Three

Vocabulary:
asthenosphere, lithosphere, mantle

Materials: page 107

After introducing the vocabulary and instructing students to read the passage, have them complete the activities. You may choose to complete activity B as a group. Help students brainstorm a list of substances that are solid, yet able to be reshaped or molded. (e.g., gum, toothpaste, putty, clay)

Day Four

Materials: page 108

Help students recall the definition of *convection currents* presented in Big Idea 3. (vertical circulation due to temperature and pressure differences) Explain that convection currents occur not only in the atmosphere, but also under Earth's surface. Instruct students to read the passage and complete the activity. Then review the answers together.

Day Five

Materials: page 109

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

Name _____

Daily Science

Big Idea 4

WEEK 2

Day 1

Weekly Question

How do scientists know what is inside Earth?

For thousands of years, people have wondered what is inside Earth. At one time, there were people who claimed Earth was hollow. Some thought the interior of Earth looked like Swiss cheese, full of cavernous holes. Still others believed it was the "underworld," where spirits of the dead went! But scientists eventually discovered that rather than being open on the inside, the interior of Earth had a higher **density** than the surface. That means a rock from inside Earth could weigh more than three times as much as one of the same size on the surface.

Iron-rich volcanic rocks that have made their way to the surface from deep within Earth provided scientists with direct evidence of the **composition** of Earth's interior. As Earth was formed, the heavier elements, such as iron and nickel, sank to the center of the planet. The less dense elements, such as oxygen and silicon (SIL-ih-kahn), remained near the surface. Further proof of Earth's composition comes in the form of meteorites from space. These rocks of iron and nickel are remnants of the cores of planets and asteroids that were formed at the same time as our planet, by the same processes, and from the same materials.

meteorite

Vocabulary

composition
kom-puh-ZIH-shun
the type of material that an object is made of

density
DEN-sih-tee
the amount of matter within a given space

A. Answer the questions.

1. Which has a higher density, iron or silicon? _____
2. What two types of rock provided evidence of the composition of Earth's interior? _____ and _____

B. When you pour a cup of water and a cup of oil into the same container, the oil stays on top, while the water sinks to the bottom. Which liquid do you think is denser? Explain your answer.

_____

Name _____

Daily Science
Big Idea 4
WEEK 2

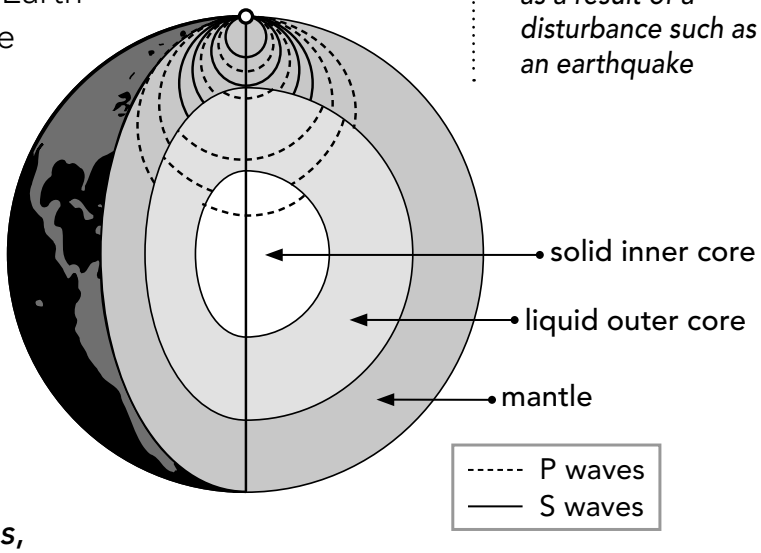
Day 2

Weekly Question

How do scientists know what is inside Earth?

While volcanic rocks offer evidence of Earth's composition, earthquakes provide information about Earth's structure. Earthquakes produce two types of **seismic waves** that travel through Earth: *primary* (P) waves and *secondary* (S) waves. P waves travel faster than S waves. And both types of waves travel faster through dense material. However, while P waves can travel through liquid, S waves cannot.

How did scientists figure this out? Following an earthquake, geologists would measure how long it took the waves to be felt at different locations around the world. Based on the time it took for the waves to arrive, they concluded that Earth consisted of different layers—some more dense than others. And because the S waves never arrived at all at some places, the scientists realized that part of Earth's interior must be liquid.



The composition and density of Earth's different layers affect the speed of seismic waves.

Vocabulary

seismic waves
SIZE-mik WAYVZ
vibrations that travel through Earth as a result of a disturbance such as an earthquake

For each clue, write whether *P waves*, *S waves*, or *both* are being described.

1. The denser the material is, the faster these seismic waves travel. _____
2. These waves can travel through liquid. _____
3. Sometimes these waves don't arrive on the other side of Earth. _____
4. These are the faster seismic waves. _____
5. These waves are produced by earthquakes. _____

Name _____

Daily Science
Big Idea 4
WEEK 2

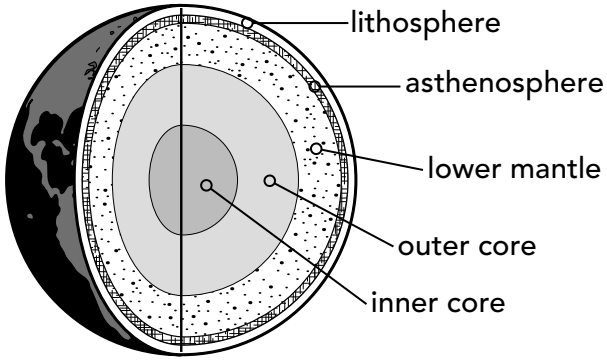
Day 3

Weekly Question

How do scientists know what is inside Earth?

Earth is divided into three main parts—the core, the **mantle**, and the crust—which vary in composition, as well as in temperature and pressure. As you move deeper and deeper into Earth, both temperature and pressure increase. The core makes up the center of Earth, where temperature and pressure are at their highest. The inner core is a solid composed almost entirely of iron, while the outer core is a liquid mixture of iron and nickel.

Directly above the core is the solid lower layer of the mantle. Above that is the **asthenosphere**. Although also a solid, this layer of the mantle can flow like taffy. On top of the asthenosphere lies the **lithosphere**. Pressure and temperature are the lowest in this layer. The lithosphere, which forms the tectonic plates of Earth's surface, includes the thin top portion of the mantle as well as the crust.



Vocabulary

asthenosphere
as-THEN-uh-sfeer
the solid middle layer of mantle that is able to move and change form

lithosphere
LIH-thoh-sfeer
the outer layer of Earth, consisting of the crust and the topmost part of the mantle

mantle
MAN-tul
the section of Earth between the crust and the core

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

1. How many layers are there in the mantle? _____

2. Which layer is made of liquid? _____

3. Which layer has the lowest temperature? _____

B. Even though it is a solid, the asthenosphere can flow like taffy. What other solids can you think of that flow? Name at least two.

_____

Name _____

Daily Science
Big Idea 4
WEEK 2

Day 4

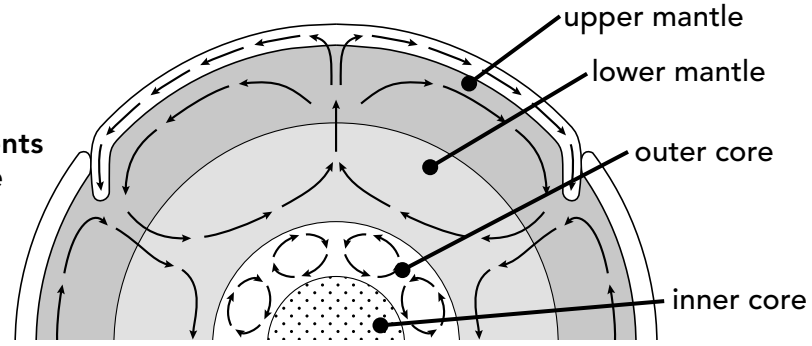
Weekly Question

How do scientists know what is inside Earth?

As scientists researched Earth's interior, they learned about the processes that go on under our planet's surface. They discovered that both the molten outer core and the mantle move in circular currents. In the outer core, these convection currents are driven by heat from the inner core. In the mantle, they are powered by the movements of the tectonic plates.

Heated rock from deep in the mantle rises because it is less dense. This creates an upward current. Near the surface, pressure is relieved and the rising rock turns to liquid magma. Once it reaches the surface through a rift, the liquid rock cools and solidifies. Over time, it becomes denser and eventually sinks into a trench and back into the mantle, pulling the surrounding rock along with it. This creates a downward current. In this way, convection currents continually recycle rocks between the crust and the mantle.

Convection Currents in the Outer Core and Mantle



Number the events in the correct order to show how convection currents work in Earth's interior. The first step in the cycle has been labeled.

____ Rising rock becomes liquid magma.

____ Dense rock sinks back into the mantle and creates a downward current.

____ Heated rock from the mantle becomes less dense and rises.

1 High temperatures from the inner core heat rock deep in the mantle.

____ Rock on the surface continues to cool and becomes denser.

____ Liquid rock cools on the surface and solidifies.

Name _____

Daily Science
Big Idea 4
WEEK 2

Day 5

Weekly Question

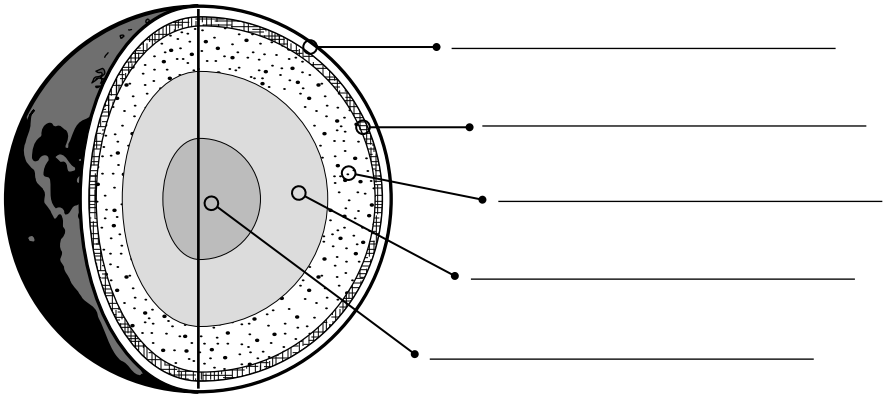
How do scientists know what is inside Earth?

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

density	seismic waves	mantle	composition

1. Volcanic rocks from deep within Earth provide evidence of the _____ and _____ of Earth's interior.
2. By studying the pattern of _____ that followed an earthquake, geologists determined that Earth's outer core was liquid.
3. The outer layer of Earth, or the lithosphere, includes the crust and the topmost layer of the _____.

B. Use the words in the box to label the layers of Earth.



lower mantle
outer core
asthenosphere
inner core
lithosphere

C. Which of these is true about Earth's core? Check the correct box.

- ❒ It has the highest temperature and pressure of any of Earth's layers.
- ❒ It has the lowest temperature and pressure of any of Earth's layers.
- ❒ The pressure is highest, but the temperature is lowest.
- ❒ The temperature is highest, but the pressure is lowest.

Week 3

What happens when two continents collide?

Earth is divided into layers: crust, mantle, and core. The crust is made up of plates that move slowly around Earth's surface.

This week students learn that our planet's surface is constantly being remodeled along the boundaries of tectonic plates. There are three types of boundaries, defined by the movement that occurs between plates. Two plates that move away from each other form a *divergent* boundary. Two plates that slide past each other form a *transform* boundary. And two that move toward each other form a *convergent* boundary. If one or both of two converging plates is composed of oceanic crust, the denser plate will sink below the more buoyant plate. This process is called *subduction*. But if both are continental plates, neither is subducted and their landmasses collide.

Students also learn that when two continents collide, mountains form along the border between them. The Himalayas were created in this manner. And because the two plates that they straddle are still converging, the Himalayas continue to grow.

Day One

Vocabulary: *converge*

Materials: page 111

After introducing the vocabulary word, have students read the passage. Then review the process of seafloor spreading so that students can understand how crust is created at divergent boundaries (lava erupts from mid-ocean ridges) and destroyed at convergent boundaries (crust sinks into oceanic trenches). Instruct students to complete the activity and review the answers as a group.

Day Two

Vocabulary: *buoyant, subduction*

Materials: page 112

After introducing the vocabulary, review the concept of *density* (the amount of matter within a given space). Ask students: **Would a pound of feathers take up more or less space than a pound of lead?** (The feathers would take up more space because they are not as dense as lead, so you need more of them to make a pound.) Then ask: **Which do you think is more buoyant and why?** (feathers, because they are less dense) Instruct students to read the passage and complete the activities.

Day Three

Vocabulary: *fracture, sediment*

Materials: page 113; world map

Before students read the passage, explain that nearly every continent on the planet is separated from the next one by a body of water. Then have students use the map to find two continents that are *not* separated by water but share the same landmass. (Europe and Asia) Have students read the passage and complete the activities independently.

Day Four

Vocabulary: *subcontinent*

Materials: page 114; world map

Help students locate the Himalayas on the map. Point out that these mountains extend for 2,400 kilometers (1,500 miles) through five countries. Have students identify the five countries. (Tibet/China, Bhutan, India, Nepal, and Pakistan) Then have students read the passage and complete the activities. Review the answers together.

Day Five

Materials: page 115

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

Name _____

Daily Science
Big Idea 4
WEEK 3

Day 1

Weekly Question

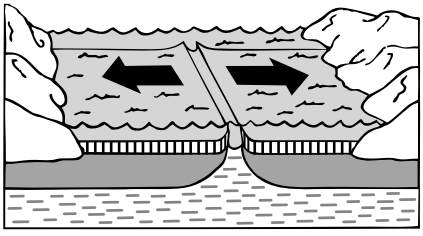
What happens when two continents collide?

The most dramatic transformations of our planet's surface happen at the boundaries of the tectonic plates. As the plates move and interact, they constantly change shape. Crust is created, destroyed, or simply reformed, depending on the type of boundary between them. There are three types of boundaries: *divergent*, *transform*, and *convergent*.

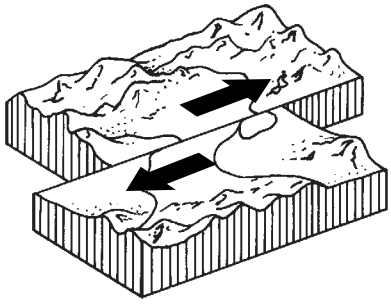
A divergent boundary occurs where two plates move away from each other. Here, new crust is created as lava seeps out of mid-ocean ridges. A transform boundary occurs where two plates slide past one another in opposite directions. Crust is neither created nor destroyed at a transform boundary. A convergent boundary occurs where two plates **converge** and one sinks under the other. Crust is destroyed along these boundaries as the sinking plate descends into the mantle. When two converging plates are carrying continents, a collision is only a matter of time.

Vocabulary

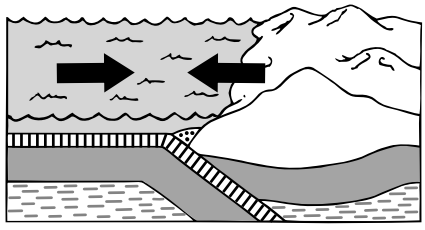
converge
kon-VERJ
to come together; to move toward one another



divergent boundary



transform boundary



convergent boundary

Write *divergent*, *transform*, or *convergent* to name the type of boundary that fits each description.

1. One plate sinks under the other along this boundary. _____
2. New crust is created along this boundary. _____
3. One plate slides past another along this boundary. _____
4. Two plates spread apart along this boundary. _____
5. Continental collisions occur along this boundary. _____

Name _____

Daily Science
Big Idea 4
WEEK 3

Day 2

Weekly Question

What happens when two continents collide?

When two plates converge, what happens next depends upon the composition of the plates. Remember that tectonic plates are made up of the lithosphere, which contains the crust. There are two types of crust: *continental* and *oceanic*. Continental crust is made of thick granite, a lightweight volcanic rock. In contrast, oceanic crust consists of thinner but heavier volcanic basalt. A plate may contain continental crust, oceanic crust, or both.

When the oceanic crust of one plate meets the continental crust of another, the oceanic plate sinks beneath the continental plate. This is because basalt is denser than granite. The process, called **subduction**, also occurs when two oceanic plates meet. In this case, however, the older plate is subducted below the younger plate because the older plate is colder, and therefore denser. When two continental plates converge, neither plate can be forced below the other because both are too **buoyant**. Instead, they collide.

Vocabulary

buoyant
BOY-ent
able to float or rise

subduction
sub-DUK-shun
a geological process in which one plate is forced below another

A. Answer the questions.

1. When two oceanic plates meet, which plate gets subducted and why?

_____

2. Why does oceanic crust get subducted below continental crust, rather than the other way around?

_____

3. When two plates with continental crust converge, why are neither of them subducted?

_____

B. Which would take up more space, a pound of granite or a pound of basalt? Explain your answer.

_____

_____

Name _____

Daily Science

Big Idea 4

WEEK 3

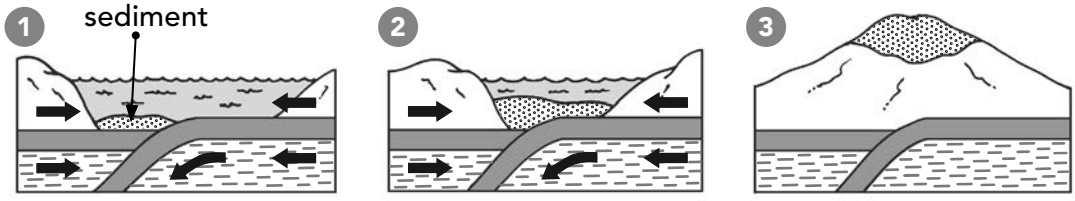
Day 3

Weekly Question

What happens when two continents collide?

Before two continents collide, the ocean between them slowly disappears. The seafloor gets subducted into a trench that runs along the boundary between the two plates. As the seafloor is subducted, the two plates scrape against each other. This causes seafloor **sediment** to collect in the trench. When the oceanic crust is completely subducted, the trench collapses, and the marine sediment is forced up onto the approaching continents.

As the continents collide, the crusts of the two plates begin to buckle and **fracture**. Much of the continental crust is thrust upward, rising into peaks that, over millions of years, form mountain ranges extending the length of the border between the continents.



Vocabulary

fracture
FRAK-chur
to break into pieces

sediment
SEH-dih-mint
sand and other small particles of rock

A. The events below describe how continental plates converge. Number the events in the correct order.

____ The seafloor slowly sinks into a trench between continents.

____ Sediment from the seafloor gets pushed onto the continents.

____ The continents collide.

____ The ocean floor is completely destroyed and the trench collapses.

____ Sediment accumulates in the trench.

____ Mountains form.

B. The fossils of marine animals and plants are often found at the tops of mountains. Explain how you think this is possible.

_____

_____

Name _____

Daily Science
Big Idea 4
WEEK 3

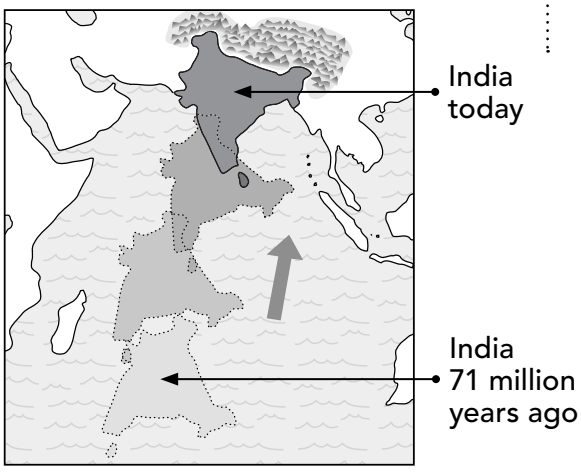
Day 4

Weekly Question

What happens when two continents collide?

The Himalayas (him-uh-LAY-uhz) are a huge mountain range that stretches between Asia and India and provides a dramatic example of colliding continents. About 70 million years ago, the Indo-Australian Plate crashed into the Eurasian Plate. For the next 20 million years, the Tethys (TEE-thiss) Sea, which lay between Asia and the **subcontinent** of India, shrank as the two landmasses moved closer together. During this time, the oceanic crust of the Indo-Australian Plate was subducted under the continental crust of the Eurasian Plate. The Tethys Sea completely disappeared approximately 50 million years ago as the two continents collided.

The Himalayas have been rising steadily ever since. Although they are among the world's youngest mountains, they are also the tallest. Mount Everest, the highest peak of the Himalayas, rises 8,850 meters (29,035 feet) above sea level. And it is still growing!



Vocabulary

subcontinent
SUB-kon-tih-nent
a large landmass smaller than a continent, or a major subdivision of a continent

A. Write *true* or *false*.

1. Today, the continents of Europe and Asia and the subcontinent of India form a single landmass. _____
2. The Tethys Sea disappeared 70 million years ago. _____
3. The Eurasian Plate was subducted under the Indo-Australian Plate. _____
4. India is a subcontinent of Asia. _____

B. Is the boundary between the Indo-Australian and Eurasian Plates a convergent, divergent, or transform boundary? Explain how you know.

_____

Name _____

Daily Science

Big Idea 4

WEEK 3

Day 5

Weekly Question

What happens when two continents collide?

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

converge	**subcontinent**	**fracture**
buoyant	**subduction**	**sediment**

When two tectonic plates _____, one plate sinks beneath another. This process is called _____. But because continental plates are _____, they cannot be subducted. When two continental plates meet, marine _____ is pushed up onto the approaching continents. As the continents collide, their crusts buckle and _____. The Himalayas were created in this manner when the _____ of India smashed into Eurasia.

B. Identify the type of boundary—*divergent*, *convergent*, or *transform*—indicated by each feature.

1. colliding continents _____
2. the Mid-Atlantic Ridge _____
3. no crust created or destroyed _____
4. plates moving toward each other _____
5. crust being destroyed _____
6. plates sliding past one another _____
7. crust being created _____
8. plates moving away from each other _____
9. subduction of one plate beneath another _____

Week 4

What will Earth's surface look like in the future?

Earth is divided into layers: crust, mantle, and core. The crust is made up of plates that move slowly around Earth's surface.

Plate tectonic activities continually shape and reshape the surface of Earth. While collisions bring continents together, rifting tears them apart. This week students will learn that the Horn of Africa is in the process of separating from the rest of the continent as the African Plate splits in two. Meanwhile, movement between the Pacific and North American Plates is causing coastal California to move north toward Alaska.

Students also learn that the area between Europe and Africa is a hotbed of tectonic activity as well. The collision of the Eurasian and African Plates, which initially produced the Alps and the Mediterranean Sea, will continue until those features are replaced by a Mediterranean mountain range. Africa will keep moving north for the next 50 million years, pushing Eurasia to the east. And Australia will merge with Asia. In 250 million years, a new supercontinent is expected to form but will break up again 50 million years later, and the cycle of continents coming together and separating will continue.

Day One

Vocabulary: *diverging*

Materials: page 117; physical map of Africa

Introduce the vocabulary and remind students that the border between two plates that are moving apart is called a *divergent boundary*. Help students locate the East African Rift Valley on the map and explain that this is an example of a divergent boundary. Then instruct students to read the passage and complete the activities. Review the answers together.

Day Two

Vocabulary: *fault, tension*

Materials: page 118; physical map of the United States

Have students locate San Francisco and Los Angeles, California, on the map. Point out that the San Andreas Fault runs between them. Explain that one of the worst earthquakes in California history occurred in 1906, devastating the city of San Francisco with an estimated magnitude of 7.8 on the Richter scale. Have students read the passage and complete the activities. Review the answers together.

Day Three

Vocabulary: *compression*

Materials: page 119; world map

Have students locate the Alps on the map and ask them to identify the countries that the Alps go through. (France, Italy, Switzerland, Liechtenstein, Germany, Austria, and Slovenia) Explain that even though we speak of Europe and Asia as separate continents, they are really one and the same—a single continent called Eurasia. Instruct students to complete the activities. Then go over the answers together.

Day Four

Materials: page 120; world map

After students have read the passage, use the map to help students visualize the movements of the continents. Then have students complete the activity and review the answers as a group.

Day Five

Materials: page 121

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

Name _____

Daily Science
Big Idea 4
WEEK 4

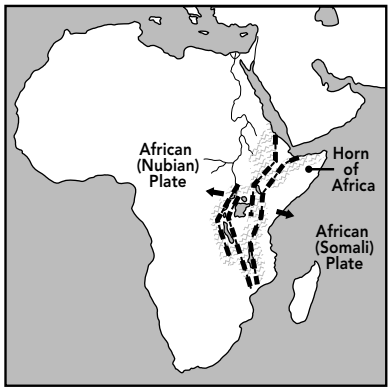
Day 1

Weekly Question

What will Earth's surface look like in the future?

Over billions of years, Earth's surface has changed a great deal, and it will keep on changing as the continents continue to shift. Not only will continents collide, but they will also be torn apart. In fact, this is happening to Africa right now. Africa lies on the African Plate, which is in the process of splitting into two separate plates, the Nubian Plate and the Somali Plate. Today, the East African Rift Valley marks the boundary between these two **diverging** plates.

The East African Rift Valley runs 6,000 kilometers (3,700 miles) through twelve countries in eastern Africa. Like undersea rifts, the Rift Valley is volcanically active. It was formed as magma welled up under the lithosphere and pushed on the continent above, causing the crust to stretch and crack. As the continent splits apart, a new ocean will form between the two landmasses. The Horn of Africa will become an island. And what was once the Rift Valley will become a mid-ocean ridge.



Vocabulary

diverging
dye-VER-jing
moving away from each other

A. Name the two plates that will form from the African Plate.

1. _____ **2.** _____

B. Answer the questions.

1. Are the plates along the East African Rift Valley diverging, converging, or both? _____

2. How is the East African Rift Valley similar to an undersea rift? What happens in both places?

_____

3. After Africa is torn apart, what will form between the two landmasses?

_____

Name _____

Daily Science Big Idea 4 WEEK 4

Day 2

Weekly Question

What will Earth's surface look like in the future?

In the United States, the region where tectonic activity is most noticeable is the state of California. California straddles the Pacific and North American Plates, which meet at a transform boundary. This type of boundary is marked by a transform **fault**, a crack in Earth's crust where two plates slide alongside each other in opposite directions. Movement of the plates along the fault is not continuous. Instead, **tension** builds between the plates over a period of time. Then, suddenly, the tension gets released in the form of an earthquake as the plates jerk past each other.

The San Andreas Fault separates the Pacific and North American Plates. The Pacific Plate is moving northwest along the North American Plate at a rate of about 5 centimeters (2 inches) per year. This means that in 10 million years, Los Angeles, which sits on the Pacific Plate, will be next to San Francisco, which sits on the North American Plate. Eventually, as the Pacific Plate moves north, it will merge with Alaska.

Vocabulary

fault
fawlt
a fracture in Earth's crust where rock is moving in different directions

tension
TEN-shun
the state of being stretched between two opposing forces

A. Use the information in the passage to complete each sentence.

1. The San Andreas Fault is called a _____ because it separates two plates that move side by side in opposite directions.
2. Earthquakes release the _____ that builds up along a fault.

B. Cross out the incorrect word in each sentence and write the correct one above it.

1. The Pacific Plate is sliding southeast along the North American Plate.
2. Millions of years from now, part of California will join up with Alabama.

Name _____

Daily Science
Big Idea 4
WEEK 4

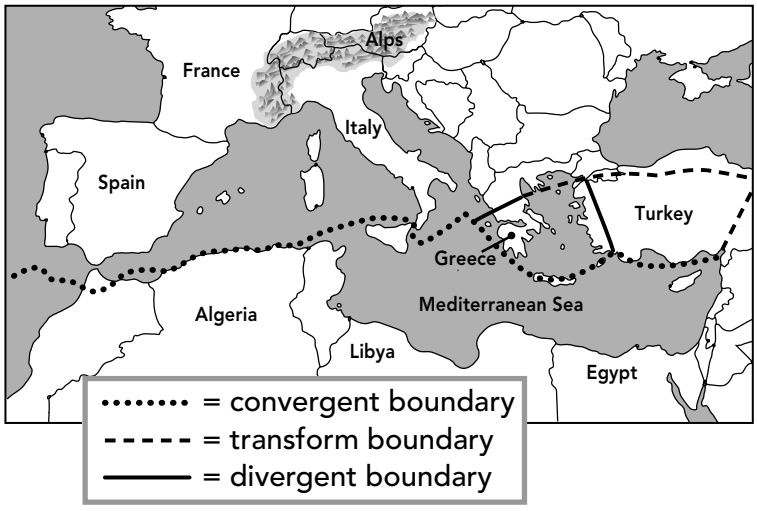
Day 3

Weekly Question

What will Earth's surface look like in the future?

Sometimes, the boundaries between plates are not clear. An area may contain fragments of plates, or *microplates*. One such area is the Mediterranean-Alpine region, which straddles the African and Eurasian Plates. When these plates began to converge 100 million years ago, the edges of both plates fractured completely, creating a complex system of convergent, divergent, and transform boundaries.

As Africa and Europe collided, the western part of the Tethys Sea disappeared. Continued **compression** of the African and Eurasian Plates caused the crust to create not only the peaks of the Alps, but also the basin of the Mediterranean Sea. Today, the African Plate is still traveling northward. Parts of this plate, including Italy and Greece, have already merged with Europe. As the African and Eurasian Plates continue to converge, the Mediterranean Sea will close. And in its place, the Mediterranean Mountains will form.



Vocabulary

compression
kum-PREH-shun
a squeezing force

A. Answer the questions.

1. How were the Alps created? Use the word *compression* in your answer.

_____

2. What do you think will happen to Africa and Europe in the future? Will they drift apart or become one big continent? Explain your answer.

_____

B. Explain in your own words why the boundary between the African and Eurasian Plates isn't clear.

_____

_____

Name _____

Daily Science
Big Idea 4
WEEK 4

Day 4

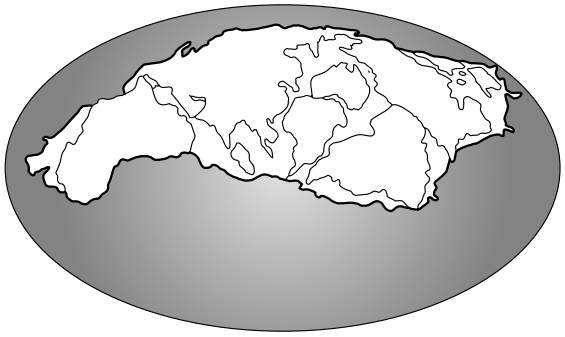
Weekly Question

What will Earth's surface look like in the future?

In 50 million years, Earth's surface will look nothing like it does today. Geologic processes happen so slowly that geologists can actually predict where the continents will be by then. It is projected that, as Africa forces its way north, Europe will rotate clockwise. Australia will move north and collide with Southeast Asia and China. And the coast of California will become the coast of southern Alaska.

Where will the continents be in 250 million years? This is not as easy to predict. Geologists now think that the continents come together to form a supercontinent about every 500 million years. There are two ways this could happen. The Atlantic Ocean may continue to widen, while the Pacific Ocean shrinks. This would cause North America to crash into Asia. The other possibility is that the Atlantic will close as the Pacific widens. In this case, North America would collide with Africa. Fifty million years after that, the supercontinent will begin to break up, and the cycle will start all over again.

How Earth Might Look in 250 Million Years



No Pacific Ocean

No Atlantic Ocean

Write *true* or *false*.

1. Geologists can predict what the positions of the continents will be in 50 million years. _____
2. According to geologists, the continents form a single supercontinent about every 250 million years. _____
3. One way the continents may form another supercontinent would be for the Atlantic Ocean to close up. _____

Name _____

Daily Science
Big Idea 4
WEEK 4

Day 5

Weekly Question

What will Earth's surface look like in the future?

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

diverging	**tension**	**fault**
tectonic	**compression**	

The _____ activity that occurs between plates involves two types of forces. The stretching that occurs between _____ plates and also between plates separated by a transform _____ is called _____. By comparison, the squeezing that occurs between converging plates is called _____.

B. Check the box next to the phrase that completes the analogy.

Converge is to **collide** as _____.

- ❒ **transform** is to **fault**
- ❒ **transform** is to **rift**
- ❒ **diverge** is to **split**
- ❒ **diverge** is to **fault**

C. Compare the East African Rift Valley to the San Andreas Fault. Name one way in which they are alike and two ways in which they are different.

Alike: _____

Different: _____

_____

Name _____

Daily Science
Big Idea 4
WEEK 5

Unit Review

Comprehension

Geologic Logic

Fill in the bubble next to the correct answer.

1. The most recent theory that explains the structure and movement of Earth's surface is called _____.

Ⓐ continental drift
Ⓑ seafloor spreading
Ⓒ seismic waves
Ⓓ plate tectonics

2. Which of these is a feature of subduction?

Ⓐ a rift
Ⓑ a trench
Ⓒ a mid-ocean ridge
Ⓓ a transform fault

3. Which geologic feature identifies a divergent boundary?

Ⓐ a rift
Ⓑ a trench
Ⓒ a mountain
Ⓓ a transform fault

4. Mountains form from the collision of _____.

Ⓐ one oceanic plate and one trench
Ⓑ one continental plate and one oceanic plate
Ⓒ two continental plates
Ⓓ two oceanic plates

5. Heat from the inner core and movement of the tectonic plates _____.

Ⓐ produce seismic waves
Ⓑ drive convection currents in the outer core and mantle
Ⓒ are proof that the outer core is liquid
Ⓓ cause the denser elements to sink to the center of Earth

6. The Tethys Sea disappeared when _____.

Ⓐ the Pacific Plate collided with the North American Plate
Ⓑ the North American Plate collided with the Eurasian Plate
Ⓒ the African and Indo-Australian Plates collided with the Eurasian Plate
Ⓓ the Nubian and Somali Plates collided with the African Plate

Name _____

Daily Science

Big Idea 4

WEEK 5

Unit Review

Vocabulary

Converge, Diverge, and Transform

Write the vocabulary word that matches or completes each clue.

1. to develop a theory _____
2. a stretching force _____
3. particles of rock _____
4. A transform boundary is a type of _____.
5. the middle section of Earth between the core and the crust _____
6. an Earth scientist _____
7. A _____ occurs within a mid-ocean ridge.
8. When plates come together, they _____.
9. the way by which something works _____
10. An earthquake produces _____.
11. The Nubian and Somali Plates are moving apart, or _____.
12. made up of crust and the top layer of the mantle _____
13. India is a _____.
14. One plate sinks beneath another in _____.
15. breaking apart _____
16. the amount of matter within a given space _____
17. a squeezing force _____
18. able to float _____
19. the taffy-like mantle layer _____
20. structure or make-up _____
21. molten rock in Earth's crust _____

asthenosphere
buoyant
composition
compression
converge
density
diverging
fault
fracturing
geologist
hypothesize
lithosphere
magma
mantle
mechanism
rift
sediment
seismic waves
subcontinent
subduction
tension

Name _____

Daily Science Big Idea 4 WEEK 5

Unit Review

Visual Literacy

Pangaea Puzzler

Use the clues to match today's continents with their previous positions within the supercontinent Pangaea. Write the numbers on the correct lines below the map.

Pangaea

____ Africa

____ Antarctica

____ Australia

____ Eurasia

____ India

____ North America

____ South America

1. When Pangaea split up, this subcontinent traveled far north to merge with Asia.
2. Today, this southern continent is not connected to any other. But in the future, it will move north to collide with Asia.
3. This is the southernmost continent today. Fossils found on this continent show that it once had a tropical climate. But now it is covered with ice.
4. A lot of tectonic activity is currently taking place on and around this continent. While its eastern part will separate to become an island, the mainland will move north and merge with Europe.
5. This continent was once connected to Africa and Antarctica. Today, it is connected to North America.
6. Today, this continent is bordered by the Atlantic Ocean on the east and the Pacific Ocean on the west.
7. Although people often think of it as two separate continents, it is really only one.

Name _____

Daily Science
Big Idea 4
WEEK 5

Unit Review

Hands-on Activity

Clean Your Plate Tectonics!

Create a tasty model to investigate plate tectonics. You can eat your model when you're done!

What You Need

- 1 large graham cracker broken into 2 squares
- 2 three-inch squares of fruit roll
- ½ cup of cake frosting
- a 12-inch square sheet of wax paper
- plastic knife
- wide-mouthed cup of water

1. Use the knife to spread a thin layer of frosting on the wax paper. Place the two fruit-roll squares side by side on the frosting. While pressing down, slowly push the fruit-roll squares about ¼" apart.
2. Remove one of the fruit-roll squares. Place a graham cracker square lightly on the frosting next to the remaining fruit-roll square. Gently push the two squares together until the graham cracker overlaps the fruit roll.
3. Remove the fruit roll. Place the second graham cracker square right next to the first. Slowly slide the squares past each other, moving them in opposite directions.
4. Remove the graham cracker squares from the frosting. Dip one edge of each square into the cup of water for just a few seconds. Place the squares back on the frosting with the wet edges next to each other. Slowly push the squares toward each other.

What Did You Discover?

1. What type of tectonic plate does the fruit roll represent? _____
2. What type of tectonic plate does the graham cracker represent? _____
3. What does the frosting represent? _____
4. Name the type of boundary you modeled in each step.

Step 1: _____ **Step 3:** _____

Step 2: _____ **Step 4:** _____

Matter is made up of tiny particles called atoms. Different arrangements of atoms compose all substances.

Key Concepts
Elements and Compounds

National Standard
There are more than 100 known elements that combine in a multitude of ways to produce compounds, which account for the living and nonliving substances that we encounter.

While students may have an abstract understanding of atoms, they may have difficulty making the connection between atoms and the visible substances that atoms compose. This Big Idea teaches students that:

- an atom is the smallest unit of an element;
- the arrangement of the periodic table reflects the properties of elements;
- elements combine to form compounds; and
- carbon compounds are essential for life.

Teacher Background

The periodic table is a tool as indispensable to chemistry as the calculator is to mathematics. Elements are arranged in the periodic table according to their atomic structure, and because an element's properties are governed by its atomic structure, its properties are reflected in the periodic table as well. Similarities in the structures and properties of the elements show up as repeating patterns in the table, which thereby reveals the underlying relationships between the elements.

The periodic table forms a bridge that links atoms to elements and compounds. By understanding the information contained in the periodic table, students can recognize and predict how elements will behave, including how they will interact with each other to form compounds. One element, carbon, behaves much differently than any of the other elements. Because of its unique ability to form complex molecules, carbon is the basic building block of all life.

For specific background information on each week's concepts, refer to the notes on pp. 128, 134, 140, and 146.

Unit Overview

WEEK 1: What do atoms look like?

Connection to the Big Idea: An atom is the smallest unit of an element. Students learn that atoms are made up of protons, neutrons, and electrons. Protons and neutrons are located within the nucleus of an atom, while electrons occupy the space outside the nucleus. Atoms are identified by the number of protons they contain.

Content Vocabulary: *atom, electron, elements, isotopes, neutron, orbital, proton*

WEEK 2: What is the periodic table?

Connection to the Big Idea: Elements are arranged in the periodic table based on their atomic structure. Students learn to read the periodic table and use it to find the number of protons and neutrons in a single atom of an element. They also use the periodic table to find the number of atomic shells and outer-shell electrons in an atom.

Content Vocabulary: *atomic number, atomic weight, chemical symbol, group, metalloid, period, periodic*

WEEK 3: What is water made of?

Connection to the Big Idea: Compounds such as water are formed by atoms of two or more elements that bond through chemical reactions. Students learn that outer-shell electrons determine how elements join together. They also discover that water is a compound made up of hydrogen and oxygen gases, which react violently when combined.

Content Vocabulary: *chemical reaction, compound, covalent bond, ion, ionic bond, molecule*

WEEK 4: How are living things different from nonliving things?

Connection to the Big Idea: Carbon is an element that exists in every compound found in living organisms. Students learn that a carbon atom's unique qualities enable it to bond to other carbon atoms in long chains, branches, and rings. These giant molecules form the basis of all life.

Content Vocabulary: *decomposition, inorganic, mineral, organic*

WEEK 5: Unit Review

You may choose to do these activities to review the concepts of the periodic table and basic chemistry.

p. 152: Comprehension Students answer multiple-choice questions to review key concepts in the unit.

p. 153: Vocabulary Students complete a crossword puzzle to review vocabulary words from the unit.

p. 154: Visual Literacy Students use the periodic table to answer questions.

p. 155: Hands-on Activity Students split water into hydrogen and oxygen. Instructions and materials needed for the activity are listed on the student page.

Matter is made up of tiny particles called atoms. Different arrangements of atoms compose all substances.

Week 1

What do atoms look like?

Matter is the "stuff" that makes up the universe. More specifically, matter is anything that is composed of particles and takes up space. This week students learn that all matter is made up of elements, and the smallest quantity of an element is an atom. But an atom is not the smallest particle of matter. Atoms can be broken down into even smaller particles: protons, which carry a positive charge; neutrons, which are electrically neutral; and electrons, which carry a negative charge. Protons and neutrons form the central nucleus of an atom. The neutrons function to insulate the protons from one another and bind the nucleus together. Electrons travel within orbitals that surround the nucleus.

Students also learn that an atom, and therefore an element, is defined by the number of protons it has. Generally, the number of neutrons in an atom is greater than or equal to the number of protons. And the number of electrons equals the number of protons. Because of this, an atom has no charge.

Day One

Vocabulary: *atom, elements*

Materials: page 129

Introduce the vocabulary and instruct students to read the passage. Then have them complete the activities. You might choose to complete activity B as a group, prompting students to think about which element we need to breathe. (oxygen) Review the answers together.

Day Two

Vocabulary: *electron, neutron, proton*

Materials: page 130

To help students distinguish between protons, neutrons, and electrons, write on the board, "Protons are positive and neutrons are neutral." Then say: **Electrons balance out protons' positive charge, so what kind of charge must electrons have?** (negative) Instruct students to read the passage and complete the activities. Review the answers together.

Day Three

Vocabulary: *orbital*

Materials: page 131

After students have read the passage, explain that *nuclei* is the plural of *nucleus*. Ask students where else nuclei are found. (in living cells) Then ask: **What is the difference between the nucleus of an atom and the nucleus of a cell?** (The nucleus of an atom is made up of protons and neutrons, while the nucleus of a cell contains DNA.) Have students complete the activities and review the answers as a group.

Day Four

Vocabulary: *isotopes*

Materials: page 132; two magnets

After students have read the passage, use the magnets to demonstrate how their like poles repel each other. Explain that this is similar to what happens with two positively charged protons. Then direct students to complete the activities. If students have trouble with activity B, suggest that they consider the number of protons in a hydrogen atom.

Day Five

Materials: page 133

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

Name _____

Daily Science
Big Idea 5
WEEK 1

Day 1

Weekly Question

What do atoms look like?

Nearly everything in the universe is made of matter. This paper is made of matter. You are made of matter. Even the air we breathe is made of matter. But what *is* matter? Matter is anything that has both mass and volume. In other words, matter is any object or substance that is composed of particles and takes up space.

The basic building blocks of matter are the **elements**. An **atom** is the smallest unit of an element that still has all the properties of that element. Oxygen is an element. Iron is an element. Gold and silver are both elements. There are 117 known elements, which means there are 117 types of atoms. More elements certainly exist, though they have yet to be discovered.

A. Write *true* or *false*.

1. We know that only 117 elements exist. _____
2. The smallest unit of an element is an atom. _____
3. Gold and silver are made of atoms. _____
4. Atoms are the basic building blocks of matter. _____

B. Even though it is invisible, air is composed of matter. In your own words, explain why this is true.

_____

_____

C. Fill in the bubble next to the phrase that completes the analogy.

Atom is to **element** as _____.

Ⓐ **matter** is to **iron**

Ⓑ **element** is to **matter**

Ⓒ **matter** is to **element**

Ⓓ **element** is to **oxygen**

Vocabulary

atom
AT-um
the smallest unit of an element that contains all the properties of that element

elements
EL-ih-mentz
basic chemical substances from which all matter is made

Name _____

Daily Science
Big Idea 5
WEEK 1

Day 2

Weekly Question

What do atoms look like?

Although an atom is the smallest particle of an element, it is not the smallest particle of matter. Atoms are composed of even smaller particles called **protons**, **neutrons**, and **electrons**. A proton has a positive electric charge. An electron has a negative electric charge. And a neutron has no electric charge. Protons and neutrons are about the same size. Electrons, however, are much smaller.

Atoms are identified by the number of protons they contain. For example, all atoms with eight protons are oxygen atoms. All atoms with 26 protons are iron atoms. Many atoms, such as oxygen, have the same number of neutrons as they do protons. Some atoms, such as iron, have more neutrons than protons. Only one kind of atom has fewer neutrons than protons. This is hydrogen, which contains one proton and no neutrons. In any atom, the number of electrons equals the number of protons, which makes the atom electrically neutral.

Vocabulary

electron
ee-LEK-trahn
a particle of matter with a charge of −1

neutron
NOO-trahn
a particle of matter with a charge of 0

proton
PRO-tahn
a particle of matter with a charge of +1

A. Use the vocabulary words and the information in the passage to complete the paragraph.

There are three basic rules for building an atom. First, the atoms of each type of element are defined by the number of _____ they have. Second, excluding hydrogen, the number of _____ is greater than or equal to the number of protons. And third, the number of _____ is the same as the number of protons.

B. Write *true* or *false*.

1. The smallest particle of matter is an atom. _____

2. Protons and electrons are roughly the same size. _____

3. An oxygen atom contains eight electrons. _____

4. Atoms are not electrically charged. _____

Name _____

Daily Science Big Idea 5

WEEK 1

Day 3

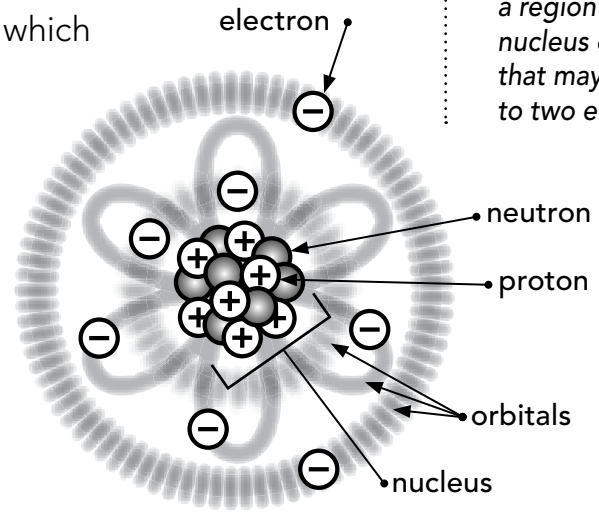
Weekly Question

What do atoms look like?

All atoms, no matter which element they are, have the same basic structure. An atom consists almost entirely of empty space. Most of the mass that does exist is concentrated in the *nucleus*, or central core, of an atom. All of an atom's protons and neutrons reside in the nucleus. Since a proton carries a positive charge and a neutron carries no charge, the charge of an atom's nucleus is equal to the number of protons it contains.

Electrons occupy the space outside the nucleus and constantly spin around it. The areas in which the electrons spin are called **orbitals**, or electron clouds. Electrons, however, do not actually orbit the nucleus in a fixed, circular path. Instead, they may move anywhere within their orbital.

An orbital may contain a maximum of two electrons. This means that an atom will have half as many orbitals as it has electrons. For example, calcium has 20 electrons that are distributed among 10 orbitals.



nitrogen atom

Vocabulary

orbital
OR-bih-tul
a region around the nucleus of an atom that may contain up to two electrons

A. Answer the questions.

1. What does an atom mostly contain? _____
2. Where is most of the mass of an atom located? _____
3. How many electrons can an orbital hold? _____

B. Check the box next to the phrase that completes the analogy.

Proton is to **nucleus** as _____.

- ❒ **neutron** is to **orbital**
- ❒ **electron** is to **orbital**
- ❒ **nucleus** is to **orbital**
- ❒ **atom** is to **element**

Name _____

Daily Science
Big Idea 5
WEEK 1

Day 4

Weekly Question

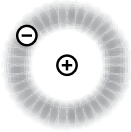
What do atoms look like?

Although they carry no charge, neutrons play an important role in the structure of an atom. Because all protons are positively charged, and because like charges repel each other, protons want to get as far away from each other as possible. But neutrons act like buffers between the protons and hold the nucleus together.

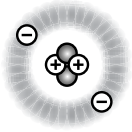
The number of protons in an atom is fixed. But the number of neutrons can vary slightly, as long as there are at least as many neutrons as there are protons. Atoms of the same element that contain different numbers of neutrons are called **isotopes**. For example, a carbon atom, which has six protons, may have six, seven, or eight neutrons. Each of these forms is an isotope of carbon.

Vocabulary

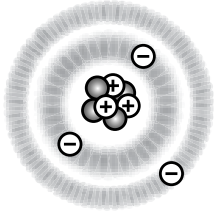
isotopes
EYE-suh-tohps
two or more forms of an atom that contain different numbers of neutrons



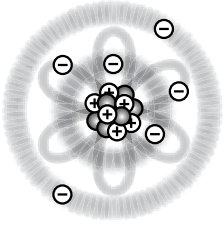
hydrogen atom



helium atom



lithium atom



carbon atom

A. For each atom shown above, count the numbers of protons, neutrons, and electrons. Write the numbers in the columns below.

	Protons	Neutrons	Electrons
1. hydrogen	_____	_____	_____
2. helium	_____	_____	_____
3. lithium	_____	_____	_____
4. carbon	_____	_____	_____

B. A hydrogen atom doesn't have any neutrons, so why do you think its nucleus does *not* come apart?

_____

_____

Name _____

Daily Science
Big Idea 5
WEEK 1

Day 5

Weekly Question

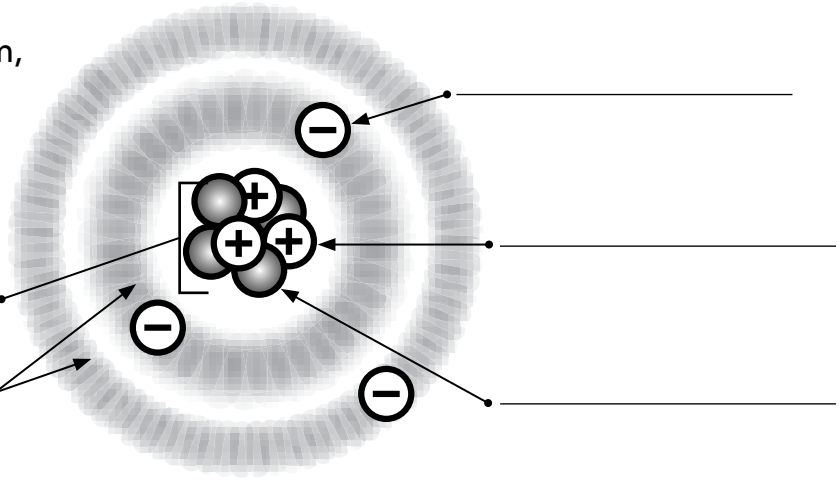
What do atoms look like?

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

electrons	**elements**	**isotopes**	**atoms**
neutrons	**orbitals**	**protons**	

Matter is made up of _____, and the smallest particles of these are called _____. In turn, the particles are made up of positively charged _____, neutral _____, and negatively charged _____. Protons and neutrons are located in the nucleus, while electrons are found in the _____. Atoms that contain the same number of protons but different numbers of neutrons are called _____.

B. Label the parts of the atom, using the words *electron*, *neutron*, *nucleus*, *orbitals,* and *proton*.



C. Write the names of four elements.

1. _____ **3.** _____

2. _____ **4.** _____

Matter is made up of tiny particles called atoms. Different arrangements of atoms compose all substances.

Week 2

What is the periodic table?

This week students learn about the importance of the periodic table, a powerful tool that reflects the repetition and regularity in the structures and properties of the elements. The periodic table provides information about the numbers of protons, neutrons, and electrons in each element, as well as the locations of the electrons in each type of atom. It also allows us to understand which elements will combine with each other.

The periodic table shows all of the 117 known elements, including 23 that are manmade. The elements range from metals on the left side to nonmetals on the right, with metalloids in between. Each square in the periodic table includes an element's chemical name, chemical symbol, atomic number, and atomic weight. Each row of squares is called a "period"; elements in the same period have the same number of atomic shells. Each column is a "group," with elements in the same group having the same number of electrons in their outer shells.

Day One

Vocabulary: *periodic*

Materials: pages 135 and 154

Have students turn to the periodic table on page 154 and scan the names of the elements to see how many they recognize. Make a list on the board, writing the names and symbols of the elements. Then help students find and circle those elements on the periodic table on page 135. Finally, direct students to read the passage and complete the activity.

Day Two

Vocabulary: *metalloid*

Materials: pages 136 and 154

After students have read the passage, have them look at the periodic table on page 154. Point out the heavy "stair step" line on the right side (properly called the *amphoteric line*). Ask students what they think the line represents. (the boundary between metals and nonmetals) Instruct students to complete the activities on page 136 and review the answers together.

Day Three

Vocabulary: *atomic number, atomic weight, chemical symbol*

Materials: pages 137 and 154

Introduce the vocabulary and instruct students to read the passage. Then use the periodic table on page 154 to point out the empty space between the elements with atomic numbers 116 and 118. Explain that even though an element with an atomic number of 117 has yet to be discovered, scientists know that it must exist, so a space has been left for it. Finally, have students complete the activity on page 137 and review the answers as a group.

Day Four

Vocabulary: *group, period*

Materials: pages 138 and 154

After students have read the passage, use the periodic table on page 154 to point out that the two bottommost rows (elements 58–71 and 90–103) actually belong to periods 6 and 7, respectively. Ask students: **Why do you think these elements have been pulled out of the periodic table?** (The rows would be too wide to fit on paper if the elements were in their proper places.) Then instruct students to complete the activities on page 138.

Day Five

Materials: page 139

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

Name _____

Daily Science

Big Idea 5

WEEK 2

Day 1

Weekly Question

What is the periodic table?

The periodic table of the elements represents one of the greatest discoveries in the history of science—that certain elements, the basic chemical substances from which all matter is made, resemble each other and behave in similar ways. These similarities in form and function repeat themselves again and again among the elements. In other words, the structures and properties of the elements are **periodic**, or recurring. So the Russian chemist Dmitri Mendeleev created the periodic table to provide a visual model of this repeating pattern.

The periodic table is the most important tool in chemistry. If you can read the periodic table, you can tell how many protons, neutrons, and electrons an element's atoms contain. You can also tell how the electrons are arranged in the orbitals surrounding the nucleus. And you can predict which elements are likely to react and combine with each other.

Vocabulary

periodic
PEER-ee-AHD-ik
occurring repeatedly or at regular intervals

Periodic Table of the Elements

1 H 1																	2 He 4
3 Li 7	4 Be 9											5 B 11	6 C 12	7 N 14	8 O 16	9 F 19	10 Ne 20
11 Na 23	12 Mg 24											13 Al 27	14 Si 28	15 P 31	16 S 32	17 Cl 35	18 Ar 40
19 K 39	20 Ca 40	21 Sc 45	22 Ti 48	23 V 51	24 Cr 52	25 Mn 55	26 Fe 56	27 Co 59	28 Ni 59	29 Cu 64	30 Zn 65	31 Ga 70	32 Ge 73	33 As 75	34 Se 79	35 Br 80	36 Kr 84
37 Rb 85	38 Sr 88	39 Y 89	40 Zr 91	41 Nb 93	42 Mo 96	43 Tc 98	44 Ru 101	45 Rh 103	46 Pd 106	47 Ag 108	48 Cd 112	49 In 115	50 Sn 119	51 Sb 122	52 Te 128	53 I 127	54 Xe 131
55 Cs 133	56 Ba 137	57 La 139	72 Hf 178	73 Ta 181	74 W 184	75 Re 186	76 Os 190	77 Ir 192	78 Pt 195	79 Au 197	80 Hg 201	81 Tl 204	82 Pb 207	83 Bi 209	84 Po 209	85 At 210	86 Rn 222
87 Fr 223	88 Ra 226	89 Ac 227	104 Rf 267	105 Db 268	106 Sg 271	107 Bh 272	108 Hs 277	109 Mt 276	110 Ds 281	111 Rg 280	112 Cn 285	113 Uut 284	114 Uuq 289	115 Uup 288	116 Uuh 291	117 Uus 294	118 Uuo 294

58 Ce 140	59 Pr 141	60 Nd 144	61 Pm 145	62 Sm 150	63 Eu 152	64 Gd 157	65 Tb 159	66 Dy 163	67 Ho 165	68 Er 167	69 Tm 169	70 Yb 173	71 Lu 175
90 Th 232	91 Pa 231	92 U 238	93 Np 237	94 Pu 244	95 Am 243	96 Cm 247	97 Bk 247	98 Cf 251	99 Es 252	100 Fm 257	101 Md 258	102 No 259	103 Lr 262

List three things the periodic table can tell you about an element.

1. _____

2. _____

3. _____

Name _____

Daily Science
Big Idea 5
WEEK 2

Day 2

Weekly Question

What is the periodic table?

Currently, the periodic table includes 117 elements. Of these, only the first 94 are naturally occurring. The remaining 23 elements are not found naturally on Earth, though they may exist elsewhere in the universe. However, scientists have been able to artificially create them. And some of these manmade elements have become very important in everyday life. For example, Americium (am-eh-RISH-ee-um) is commonly used in smoke detectors.

The elements of the periodic table can be divided from left to right into metals, metalloids, and nonmetals. The vast majority of the known elements—nearly 80%—are metals, which share certain properties. Most metals are shiny and can bend without breaking. And all of them are good conductors of heat and electricity. In contrast, nonmetals are not shiny. They are also brittle, which means they break easily. And they are poor conductors of heat and electricity. **Metalloids** lie between the metallic and nonmetallic elements in the periodic table and exhibit properties that are between the two.

Vocabulary

metalloid
MET-uh-loyd
an element with properties between a metal and a nonmetal

A. List three properties of metals.

1. _____ **3.** _____

2. _____

B. Use the periodic table on page 154 to answer the questions.

1. Which elements are metalloids? _____

_____

2. Which two elements along the stair step line are *not* metalloids?

_____

3. Which nonmetal is in the "wrong" place on the periodic table?

_____

Name _____

Daily Science Big Idea 5 WEEK 2

Day 3

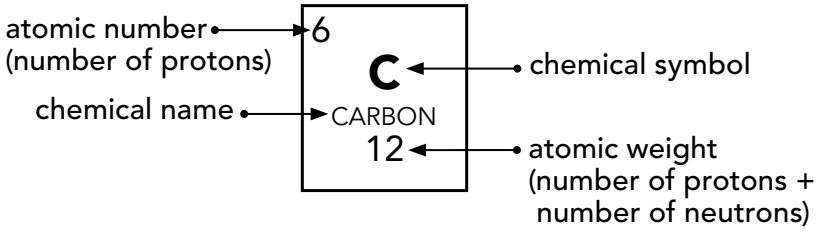
Weekly Question

What is the periodic table?

Each square in the periodic table contains information about a specific element presented in numbers and letters. Along with the element's chemical name, a square contains the element's **chemical symbol**, **atomic number**, and **atomic weight**.

The chemical symbol is the abbreviation of an element's name. Some chemical symbols are obvious. For example, the symbol "Al" stands for aluminum. But others might seem strange, such as the symbol "Au" for gold. This is because the chemical symbol for gold is based on its Latin name, *aurum*.

The number at the top of a square is an element's atomic number. This shows the number of protons in one atom of the element. Atomic numbers increase in order from left to right and from top to bottom across the periodic table. The number at the bottom of a square is the atomic weight, which is the sum of the protons and neutrons in one atom of the element. You can find the number of neutrons in an element by subtracting the atomic number from the atomic weight.



Use the periodic table on page 154 to fill in the information for each element below. Remember that the number of electrons in an element equals the number of protons.

	Symbol	Protons	Neutrons	Electrons
1. chlorine	_____	_____	_____	_____
2. calcium	_____	_____	_____	_____
3. iron	_____	_____	_____	_____
4. lead	_____	_____	_____	_____

Vocabulary

atomic number
uh-TAH-mik
NUM-ber
the number of protons in an atom of an element

atomic weight
uh-TAH-mik
WAYT
the number of protons and neutrons in an atom of an element

chemical symbol
KEM-ih-kul
SIM-bul
the abbreviation that stands for an element

Name _____

Daily Science
Big Idea 5
WEEK 2

Day 4

Weekly Question

What is the periodic table?

Not only does the periodic table help you know the number of protons and electrons in an element, but it shows the location of the electrons in that element. Remember that electrons move within orbitals that surround the nucleus of an atom. These orbitals cluster together to form *atomic shells*. The atoms of all the elements in the same row, or **period**, of the periodic table contain the same number of atomic shells. The periods are numbered from 1 to 7, indicating the number of shells that the elements in that period contain. The first shell lies closest to the nucleus, with each successive shell enclosing the previous one, like the layers of an onion.

The electrons that occupy the outermost shell in an atom are very important, because they determine how the element will combine with other elements. The atoms of all elements in the same column, or **group**, of the periodic table contain the same number of outer-shell electrons.

Vocabulary

group
groop
a column in the periodic table

period
PEER-ee-ud
a row in the periodic table

A. Use the periodic table on page 154 and the information in the passage to answer the questions.

1. How many atomic shells does a sodium (Na) atom contain? _____

2. Which other elements contain the same number of atomic shells as sodium? Use the chemical symbols to write your answer.

_____

3. Which other elements contain the same number of outer electrons as sodium? Use the chemical symbols to write your answer.

_____

B. Explain why the electrons in the outermost shell are important.

_____

_____

Name _____

Daily Science
Big Idea 5
WEEK 2

Day 5

Weekly Question

What is the periodic table?

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

atomic number	**metalloid**	**periodic**	**groups**
atomic weight	**periods**	**chemical symbol**	

1. The _____ nature of the elements' structures and properties is the reason chemists arrange the elements the way they do.
2. An element that has the properties of both a metal and a nonmetal is a _____.
3. To find the number of neutrons in an atom of an element, subtract the _____ from the _____.
4. The rows of the periodic table are called _____, and the columns are called _____.
5. The _____ is the abbreviation of an element's name.

B. Check the box next to the phrase that completes the analogy.

Group is to **outer electrons** as _____.

- ❒ **period** is to **protons**
- ❒ **period** is to **atomic weight**
- ❒ **period** is to **atomic number**
- ❒ **period** is to **atomic shells**

C. At first glance, because hydrogen is a nonmetal, it may seem like it is in the wrong place in the periodic table. But there is a good reason for putting it in that position. Why do you think hydrogen is located where it is?

_____

_____

Matter is made up of tiny particles called atoms. Different arrangements of atoms compose all substances.

Week 3

What is water made of?

For thousands of years, water was erroneously considered an element. It wasn't until the late 1700s that water was discovered to be a compound of two elements, hydrogen and oxygen. In fact, the name *hydrogen* itself means "to bring forth water." The chemical formula for water, H_2O, indicates that a water molecule contains two atoms of hydrogen and one atom of oxygen. The three atoms in a water molecule bond with each other through the sharing of electrons, which allows each atom to have enough electrons to fill its outer atomic shell and achieve stability.

This week students learn that the properties of a compound differ from those of its component elements. This is because a compound is produced by a chemical reaction, during which the initial materials are changed to create new material. Hydrogen and oxygen demonstrate this well—when the two gases combine, they react violently to produce water.

Day One

Vocabulary: *compound, molecule*

Materials: page 141

Introduce the vocabulary and have students read the passage. Then point out that, in a chemical formula, the number of atoms of each element in a molecule is indicated by a subscript, which is a small number written slightly lower than and to the side of the chemical symbol. If there is only one atom of an element, no subscript is used. Instruct students to complete the activities and review the answers together.

Day Two

Materials: pages 142 and 154

Before students read the passage, point out hydrogen's position on the periodic table on page 154 and ask students which group hydrogen is in. (Group 1A) Explain that for A-group elements (Groups 1A–8A), the group number indicates the number of outer electrons in one atom of an element. Then ask students how many outer electrons a hydrogen atom has (one) and how many outer electrons an oxygen atom has (six). Have students read the passage on page 142 and complete the activities.

Day Three

Vocabulary: *covalent bond, ion, ionic bond*

Materials: page 143

Introduce the vocabulary and have students read the passage. Then explain that when an atom has a single electron in its outer shell, it will lose that electron so that the next lower shell then becomes the outer shell. Go over the diagram with students and ask: **In which compound are electrons being shared?** (water) **In which are they being transferred?** (sodium chloride) Have students complete the activities.

Day Four

Vocabulary: *chemical reaction*

Materials: page 144

Instruct students to read the passage and complete the activities. For the oral activity, discuss the question as a group and emphasize the importance of safety when performing scientific experiments.

Day Five

Materials: page 145

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

Name _____

Daily Science
Big Idea 5
WEEK 3

Day 1

Weekly Question

What is water made of?

The ancient Greeks believed water was one of the four elements of matter, along with air, earth, and fire. It wasn't until the late 18th century that water was discovered to be a **compound** made up of the elements hydrogen and oxygen. As with all other compounds, the properties of water are different from the properties of its individual elements. Water is a liquid at room temperature, while both hydrogen and oxygen are gases. Hydrogen is highly flammable and oxygen keeps fire burning, yet water doesn't burn. It actually extinguishes flames!

Every compound has a chemical formula that shows the number of atoms of each element needed to form one **molecule** of the compound. Chemical formulas are written using the chemical symbols of the elements. The chemical formula for water is H_2O, meaning that a water molecule has two hydrogen atoms and one oxygen atom. If the quantities of the atoms change, so does the compound. For example, H_2O_2 is the formula for hydrogen peroxide, a compound that has two hydrogen atoms and two oxygen atoms.

Vocabulary

compound
KOM-pownd
a substance made up of atoms of two or more elements that are chemically combined in specific amounts

molecule
MALL-ih-kyool
an electrically neutral group of atoms that are bonded together; the smallest unit of a compound

A. Use the periodic table on page 154 and information from the passage to list the number of atoms of every element in each compound below. The first one has been done for you.

Compound Name	Chemical Formula	Atoms in a Molecule
Hydrochloric acid	HCl	1 hydrogen, 1 chlorine
Carbon dioxide	CO_2	
Ammonia	NH_3	
Calcium carbonate	$CaCO_3$	

B. Check the box next to the phrase that completes the analogy.

Molecule is to **compound** as _____.

- ❒ **element** is to **chemical formula**
- ❒ **compound** is to **chemical formula**
- ❒ **chemical symbol** is to **element**
- ❒ **atom** is to **element**

Name _____

Daily Science
Big Idea 5
WEEK 3

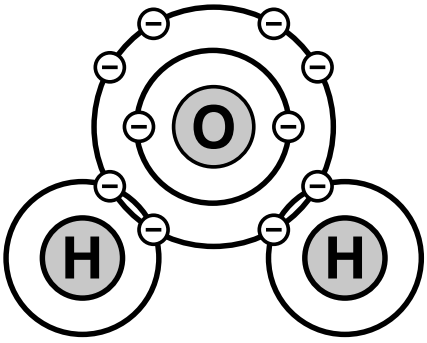
Day 2

Weekly Question

What is water made of?

What makes hydrogen and oxygen bond together to form a water molecule? The answer lies in the number of electrons in the outermost shells of the hydrogen and oxygen atoms. For any atom to be stable, its outer shell must be full, meaning that the shell contains as many electrons as it can hold. If the shell isn't full, the atom will bond to other atoms by gaining, losing, or sharing electrons.

An atom of hydrogen has one outer electron. It needs one more electron to fill its outer shell. Oxygen has six outer electrons and needs two more to fill its outer shell. If one hydrogen atom bonds with one oxygen atom, the hydrogen atom gets to count one of the oxygen's electrons as its own, while the oxygen gets to count the hydrogen's electron as its own. At this point, the hydrogen atom has a full outer shell, but the oxygen atom is still short one electron. By bonding to a second hydrogen atom, the oxygen atom can fill its outer shell.



water molecule

A. List the three ways that atoms can bond to each other to achieve stability.

1. _____

2. _____

3. _____

B. In your own words, summarize how oxygen bonds with hydrogen to create water.

_____

_____

_____

Name _____

Daily Science Big Idea 5 WEEK 3

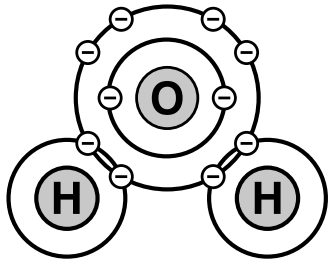
Day 3

Weekly Question

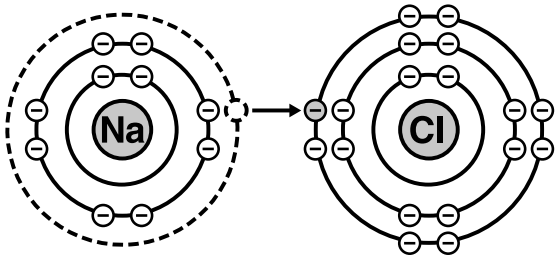
What is water made of?

The hydrogen and oxygen atoms in a water molecule share electrons, forming **covalent bonds**. In a covalent bond, two shared electrons contribute to a full outer shell for both atoms. Covalent bonds commonly form between elements that are nonmetals.

Atoms that transfer electrons rather than sharing them form **ionic bonds**. In an ionic bond, one atom gains an electron while another atom loses an electron. The atom that gains an electron becomes negatively charged, and the atom that loses an electron becomes positively charged. It is the attraction between the two opposite charges that holds the atoms, which are now called **ions**, together. Ionic bonds form between metals and nonmetals.



The atoms in water form a covalent bond.



The atoms in sodium chloride form an ionic bond.

Vocabulary

covalent bond
koh-VAY-lent bahnd
the force between two atoms that share a pair of electrons

ion
EYE-on
an electrically charged atom

ionic bond
eye-ON-ik bahnd
the attraction between two ions of opposite charge

A. Answer the questions.

1. What is the difference between a covalent bond and an ionic bond?

_____

_____

2. What is the difference between an atom and an ion?

_____

B. Explain why an atom that gains an electron becomes negatively charged, while an atom that loses an electron becomes positively charged.

_____

_____

Name _____

Daily Science
Big Idea 5
WEEK 3

Day 4

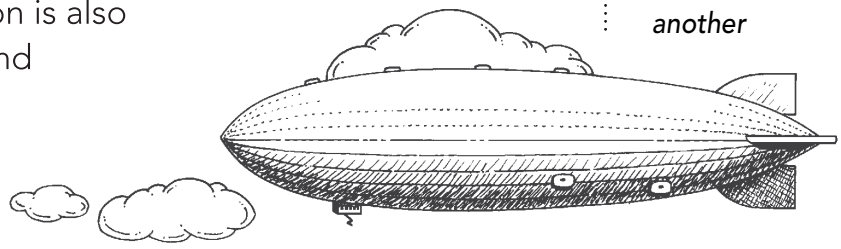
Weekly Question

What is water made of?

As a compound, water is not just a mixture of hydrogen gas and oxygen gas. Like all other compounds, water is formed by a **chemical reaction**. Every chemical reaction involves a change. The materials that begin a reaction are not the same as the materials that remain at the end of the reaction. In some cases, two elements will react as soon as they make contact with each other. In other cases, energy or a force must be applied in order for the elements to react.

In the case of hydrogen and oxygen, energy in the form of a spark is required for the two gases to react. This chemical reaction is extremely violent. If hydrogen is ignited in the presence of oxygen, the gases will explode, resulting in the production of water.

Just as a chemical reaction is required to form a compound, a chemical reaction is also required to separate a compound into its individual elements. Water can be separated into hydrogen and oxygen by passing an electric current through it.



In 1937, the famous Hindenburg airship burst into flames. One theory states that when hydrogen leaked and came into contact with the air and a spark, the ship exploded.

Vocabulary

chemical reaction
KEM-ih-kul ree-AK-shun
a process that transforms one set of chemical substances into another

Use the information in the passage to answer the questions.

1. Besides hydrogen and oxygen, what is required to produce the chemical reaction that yields water? _____

2. Besides water, what is required to produce the chemical reaction that yields hydrogen and oxygen? _____

Talk

Why do you think you should never perform a chemical experiment without proper supervision?

Name _____

Daily Science
Big Idea 5
WEEK 3

Day 5

Weekly Question

What is water made of?

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

chemical reaction	**ionic bonds**	**molecule**
covalent bonds	**compound**	**ions**

During a _____, elements can combine to form a _____. The smallest unit of a compound is a _____. If the atoms of a compound share electrons, they form _____. If the atoms of a compound transfer electrons, they are called _____, and they form _____.

B. Answer the questions.

1. Which two elements combine to form water? _____

2. How many atoms of each element are needed to form one molecule of water? _____

3. What is the chemical formula for water? _____

4. What type of bond holds the atoms in a water molecule together? _____

C. Which of these is *not* a characteristic of a compound? Check the box next to the answer.

- ❒ consists of two or more elements
- ❒ has properties different from its elements
- ❒ is always a liquid
- ❒ is created by a chemical reaction

Matter is made up of tiny particles called atoms. Different arrangements of atoms compose all substances.

Week 4

How are living things different from nonliving things?

This week students learn that carbon is the element that defines life. Because its outer atomic shell is only half full, carbon can bond with four other atoms. This allows carbon to bond to itself in long chains, branches, and rings. This unique ability of carbon is what makes possible all of the complex organic compounds found in living organisms today; namely carbohydrates, lipids, proteins, and nucleic acids. The movement of carbon between organisms and the atmosphere, soil, and oceans is an essential process in the cycle of life.

Students also learn that because carbon bonds are strong, carbon compounds are highly stable. Carbon can even form double and triple bonds, which create rigid organic molecules that provide a sturdy "skeleton" to which other elements can attach. But not all forms of carbon are organic. What distinguishes an organic carbon compound from an inorganic one is the presence of hydrogen.

Day One

Vocabulary: *inorganic, organic*

Materials: page 147

Introduce the vocabulary and point out the more familiar use of the word *organic*, as in food that is produced without chemicals. Ask students how this might be related to the definition on page 147. (Organic farming uses fertilizers derived from living organisms.) Before students read the passage, remind them that a covalent bond forms when atoms share electrons. Then direct students to read the passage and complete the activities.

Day Two

Materials: pages 148 and 154

Point out carbon and silicon on the periodic table and show students how the two elements are the same (they are in the same group) and how they are different (they are in different periods). Instruct students to read the passage on page 148 and complete the activities. Then review the answers together.

Day Three

Materials: page 149

When students have finished reading the passage, ask them how they think people and animals get carbohydrates, lipids, and proteins. (from food) You may want to make a list on the board of students' favorite foods in each category. Then instruct students to complete the activities.

Day Four

Vocabulary: *decomposition, mineral*

Materials: page 150

After students have read the passage, explain that the decomposition of organisms that lived millions of years ago produced fossil fuels such as coal, oil, and natural gas. The burning of fossil fuels has increased the amount of carbon in the atmosphere, which most scientists believe has resulted in higher temperatures and is one cause of global warming. Have students complete the activities and review the answers as a group.

Day Five

Materials: page 151

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

Name _____

Daily Science Big Idea 5 WEEK 4

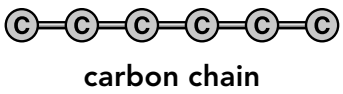
Day 1

Weekly Question

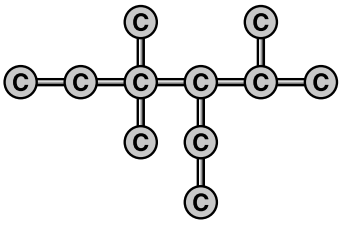
How are living things different from nonliving things?

What distinguishes living organisms from other matter? It isn't just the ability to breathe or reproduce. It is the presence of carbon. Every compound found in living organisms contains carbon. For this reason, carbon-based compounds are called **organic** compounds. There are more than ten times as many organic compounds as there are **inorganic** compounds. What makes carbon able to form so many compounds? The answer lies in its position on the periodic table.

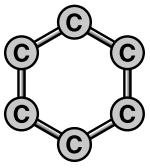
Carbon is a Group 4A element. This means it has four electrons in its outer atomic shell. This also means that it needs four more electrons to fill its outer shell. Because it has four electrons and needs four electrons, a single carbon atom can bond with four other atoms to form four covalent bonds. When a carbon atom bonds with other carbon atoms, it forms a long chain, branch, or ring that functions as a "backbone" to which other elements can attach. In this way, thousands of carbon atoms can bond to each other within a single, giant molecule. Carbon is the only element that can do this.



carbon chain



carbon branch



carbon ring

Vocabulary

organic
or-GAN-ik
relating to or derived from living organisms

inorganic
IN-or-GAN-ik
derived from a nonliving source

A. Answer the questions.

1. What must a compound contain in order to be considered organic?

_____

2. What does carbon's group number tell you about the element?

_____

B. In your own words, explain how carbon is unique among elements.

_____

Name _____

Daily Science
Big Idea 5
WEEK 4

Day 2

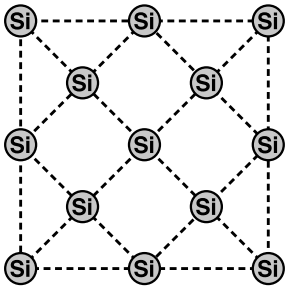
Weekly Question

How are living things different from nonliving things?

An important property of carbon is its ability to form double bonds or triple bonds. A double bond occurs when two pairs of electrons are shared between atoms. A triple bond is when three pairs are shared. Molecules held together with double or triple bonds cannot twist, and this makes carbon compounds rigid. Also, the bonds between carbon atoms are exceptionally strong. As a result, carbon compounds resist chemical change and do not normally break down. In other words, organic compounds are highly stable.

Silicon is an element that is similar to carbon. However, it cannot support life the way carbon does. Like carbon, silicon has four electrons in its outer shell and therefore can form four covalent bonds. But while carbon can form double and triple bonds, silicon forms only single bonds. Also, silicon forms diamond-shaped crystals instead of chains or rings. And though its bonds are strong, silicon is a larger atom than carbon and cannot hold on to its electrons as firmly. So silicon compounds are less stable and readily undergo chemical change.

carbon chain



silicon crystal

A. Write *true* or *false*.

1. Molecules with double or triple bonds can easily twist. _____

2. Carbon is a more stable element than silicon. _____

3. Carbon compounds are rigid and strong. _____

B. Describe one way that carbon and silicon are alike and two ways that they are different.

Alike: _____

Different: _____

_____

Name _____

Daily Science
Big Idea 5
WEEK 4

Day 3

Weekly Question

How are living things different from nonliving things?

Of the 94 elements that occur in nature, only 26 are found in living organisms. And just six of these elements account for 99% of all organic matter. In addition to carbon, most organic molecules contain hydrogen and oxygen. Nitrogen, phosphorus, and sulfur are the other elements that are common in living organisms.

These six elements combine to form the giant molecules that are the basic building blocks of life: *carbohydrates, lipids, proteins*, and *nucleic acids*. Carbohydrates include sugars and starches. They provide organisms with their main source of energy, as well as material for building cell structures. Lipids include fats and oils. They provide energy, warmth, and padding, as well as the material for building cell membranes. Proteins function as the main structural material of cells, provide chemical signaling between cells, and help fight infection. Nucleic acids, such as DNA, carry genetic information.

A. Besides carbon, which two elements are in nearly every organic molecule?

1. _____ **2.** _____

B. List the basic building blocks of life.

1. _____ **3.** _____

2. _____ **4.** _____

C. Answer the questions.

1. Which building block is the main source of energy for organisms? _____

2. Which building block is the main structural material of organisms? _____

3. Which building block carries genetic information? _____

Name _____

Daily Science

Big Idea 5

WEEK 4

Day 4

Weekly Question

How are living things different from nonliving things?

Carbon is continually being recycled, allowing life to continue on Earth. The **decomposition** of dead organisms by fungi and bacteria releases carbon into the soil, oceans, and atmosphere. Through photosynthesis, plants and algae convert carbon in the air, water, and soil into organic compounds. Animals consume plants or other animals to obtain the carbon they need. And they release carbon into the atmosphere when they exhale. Finally, when plants and animals die, they return carbon to the soil, water, and air, and the cycle of life continues.

Yet not all carbon on Earth is organic. Graphite, which is what pencil lead is made of, is a carbon **mineral**. So is a diamond. And carbon dioxide (CO_2) is a common inorganic compound. What distinguishes these substances from organic carbon compounds? They lack hydrogen. It is the presence of hydrogen and the resulting bonds that form between hydrogen and carbon that create organic compounds.

Vocabulary

decomposition
dee-KOMP-uh-ZIH-shun
the breakdown or separation into parts or elements

mineral
MIN-ur-ul
a solid, inorganic substance with a specific chemical composition

A. Explain what distinguishes an organic carbon compound from an inorganic carbon compound.

_____

_____

B. Write the vocabulary words to fill in the blanks.

1. _____ such as potassium, iron, and zinc, are an important part of a healthy diet.

2. The _____ of a whale carcass can take a long time due to its large size.

C. In your own words, describe how carbon gets recycled.

_____

_____

Name _____

Daily Science

Big Idea 5

WEEK 4

Day 5

Weekly Question

How are living things different from nonliving things?

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

decomposition	inorganic	minerals	organic

1. The _____ of _____ material releases carbon into the atmosphere.
2. Diamond and graphite are two _____ that are _____ forms of carbon.

B. Identify each substance as either *organic* or *inorganic*.

1. glass, or silicon dioxide (SiO_2) _____
2. water (H_2O) _____
3. sugar, or sucrose ($C_{12}H_{22}O_{11}$) _____
4. salt, or sodium chloride (NaCl) _____
5. olive oil, or oleic acid ($C_{18}H_{34}O_2$) _____

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

1. **Carbon** is to **organic** as _____.
   - ❒ **nucleic acid** is to **inorganic**
   - ❒ **mineral** is to **inorganic**
   - ❒ **silicon** is to **inorganic**
   - ❒ **protein** is to **inorganic**
2. **Sugar** is to **carbohydrate** as _____.
   - ❒ **oil** is to **lipid**
   - ❒ **DNA** is to **energy**
   - ❒ **protein** is to **carbon**
   - ❒ **nucleic acid** is to **infection**

Name _____

Daily Science
Big Idea 5
WEEK 5

Unit Review

Comprehension

Up and Atom!

Fill in the bubble next to the correct answer.

1. Which of these *cannot* be determined from the periodic table?

Ⓐ the number of protons, neutrons, and electrons in an element's atom
Ⓑ the abundance, or amount that exists, of an element
Ⓒ the arrangement of electrons within the orbitals of an atom
Ⓓ which elements are likely to react and combine with each other

2. The nucleus of an atom contains _____.

Ⓐ protons and electrons
Ⓑ electrons and neutrons
Ⓒ neutrons and protons
Ⓓ orbitals and electrons

3. Atoms bond to other atoms _____.

Ⓐ to change into different elements
Ⓑ to achieve stability
Ⓒ to grow bigger
Ⓓ to become ions

4. A covalent bond results when two atoms _____.

Ⓐ gain electrons
Ⓑ lose electrons
Ⓒ transfer electrons
Ⓓ share electrons

5. Every chemical reaction involves _____.

Ⓐ a change
Ⓑ an explosion
Ⓒ an electric current
Ⓓ more than two elements

6. Which phrase could *not* complete this sentence?

Carbon atoms form _____.

Ⓐ chains, branches, and rings
Ⓑ single, double, and triple bonds
Ⓒ bonds with hydrogen atoms
Ⓓ only organic compounds

Name _____

Daily Science

Big Idea 5

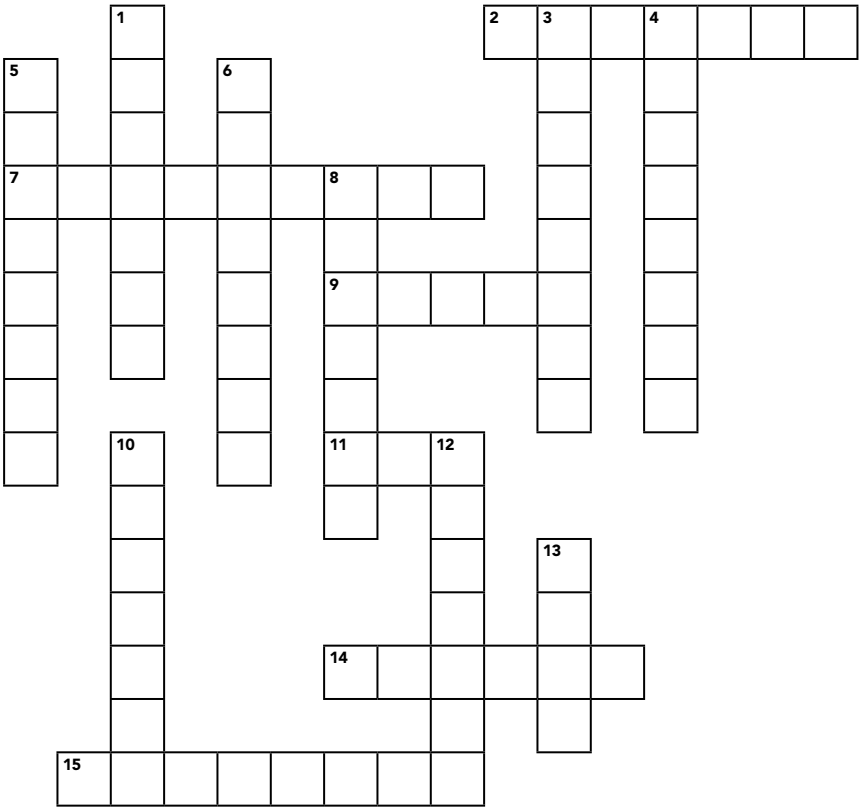
WEEK 5

Unit Review

Vocabulary

Chemistry Crossword

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



atom
compound
electron
elements
group
ion
isotopes
metalloid
mineral
molecule
neutron
orbital
organic
period
protons

ACROSS

2. a solid, inorganic substance such as graphite or gold

7. an element that resembles both a metal and a nonmetal

9. a column in the periodic table

11. an electrically charged atom

14. a row in the periodic table

15. a particle of matter with a negative charge

DOWN

1. positively charged atomic particles

3. atoms of the same element that contain different numbers of neutrons

4. the basic chemical substances from which all matter is made

5. a substance formed by the chemical reaction of two or more elements

6. the smallest unit of a compound

8. relating to living organisms

10. a region where electrons are located

12. a particle of matter with no charge

13. the smallest unit of an element

Name _____

Daily Science Big Idea 5 WEEK 5

Unit Review

Visual Literacy

Periodic Table of Elements

Use the periodic table and the key to answer the questions.

KEY

- = nonmetals
- = metals
- = metalloids

Columns 1A–8A = groups

Rows 1–7 = periods

	1A												3A	4A	5A	6A	7A	8A
1	1 H HYDROGEN 1	2A																2 He HELIUM 4
2	3 Li LITHIUM 7	4 Be BERYLLIUM 9											5 B BORON 11	6 C CARBON 12	7 N NITROGEN 14	8 O OXYGEN 16	9 F FLUORINE 19	10 Ne NEON 20
3	11 Na SODIUM 23	12 Mg MAGNESIUM 24	3B	4B	5B	6B	7B	8B			1B	2B	13 Al ALUMINUM 27	14 Si SILICON 28	15 P PHOSPHORUS 31	16 S SULFUR 32	17 Cl CHLORINE 35	18 Ar ARGON 40
4	19 K POTASSIUM 39	20 Ca CALCIUM 40	21 Sc SCANDIUM 45	22 Ti TITANIUM 48	23 V VANADIUM 51	24 Cr CHROMIUM 52	25 Mn MANGANESE 55	26 Fe IRON 56	27 Co COBALT 59	28 Ni NICKEL 59	29 Cu COPPER 64	30 Zn ZINC 65	31 Ga GALLIUM 70	32 Ge GERMANIUM 73	33 As ARSENIC 75	34 Se SELENIUM 79	35 Br BROMINE 80	36 Kr KRYPTON 84
5	37 Rb RUBIDIUM 85	38 Sr STRONTIUM 88	39 Y YTTRIUM 89	40 Zr ZIRCONIUM 91	41 Nb NIOBIUM 93	42 Mo MOLYBDENUM 96	43 Tc TECHNETIUM 98	44 Ru RUTHENIUM 101	45 Rh RHODIUM 103	46 Pd PALLADIUM 106	47 Ag SILVER 108	48 Cd CADMIUM 112	49 In INDIUM 115	50 Sn TIN 119	51 Sb ANTIMONY 122	52 Te TELLURIUM 128	53 I IODINE 127	54 Xe XENON 131
6	55 Cs CESIUM 133	56 Ba BARIUM 137	57 La LANTHANUM 139	72 Hf HAFNIUM 178	73 Ta TANTALUM 181	74 W TUNGSTEN 184	75 Re RHENIUM 186	76 Os OSMIUM 190	77 Ir IRIDIUM 192	78 Pt PLATINUM 195	79 Au GOLD 197	80 Hg MERCURY 201	81 Tl THALLIUM 204	82 Pb LEAD 207	83 Bi BISMUTH 209	84 Po POLONIUM 209	85 At ASTATINE 210	86 Rn RADON 222
7	87 Fr FRANCIUM 223	88 Ra RADIUM 226	89 Ac ACTINIUM 227	104 Rf RUTHERFORDIUM 267	105 Db DUBNIUM 268	106 Sg SEABORGIUM 271	107 Bh BOHRIUM 272	108 Hs HASSIUM 277	109 Mt MEITNERIUM 276	110 Ds DARMSTADTIUM 281	111 Rg ROENTGENIUM 280	112 Cn COPERNICIUM 285	113 Uut UNUNTRIUM 284	114 Uuq UNUNQUADIUM 289	115 Uup UNUNPENTIUM 288	116 Uuh UNUNHEXIUM 291		118 Uuo UNUNOCTIUM 294

58 Ce CERIUM 140	59 Pr PRASEODYMIUM 141	60 Nd NEODYMIUM 144	61 Pm PROMETHIUM 145	62 Sm SAMARIUM 150	63 Eu EUROPIUM 152	64 Gd GADOLINIUM 157	65 Tb TERBIUM 159	66 Dy DYSPROSIUM 163	67 Ho HOLMIUM 165	68 Er ERBIUM 167	69 Tm THULIUM 169	70 Yb YTTERBIUM 173	71 Lu LUTETIUM 175
90 Th THORIUM 232	91 Pa PROTACTINIUM 231	92 U URANIUM 238	93 Np NEPTUNIUM 237	94 Pu PLUTONIUM 244	95 Am AMERICIUM 243	96 Cm CURIUM 247	97 Bk BERKELIUM 247	98 Cf CALIFORNIUM 251	99 Es EINSTEINIUM 252	100 Fm FERMIUM 257	101 Md MENDELEVIUM 258	102 No NOBELIUM 259	103 Lr LAWRENCIUM 262

1. In which group is the metal mercury (Hg)? _____

2. In which period is the nonmetal chlorine (Cl)? _____

3. How many protons does the metalloid arsenic (As) have? _____

4. How many neutrons does the metal uranium (U) have? _____

5. How many electrons does the nonmetal xenon (Xe) have? _____

Name _____

Daily Science
Big Idea 5
WEEK 5

Unit Review

Hands-on Activity

Not Your Typical Reaction

In this experiment, you will use electricity to split water into its two elements, hydrogen and oxygen. Although the oxygen will remain dissolved, you will see evidence of the hydrogen ions.

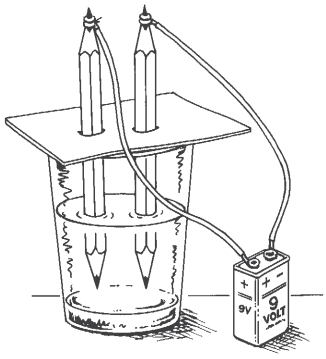
What You Need

- two No. 2 pencils with no erasers or metal bands at the ends
- scissors
- thin piece of cardboard
- 1 teaspoon salt
- small clear glass, half full of warm water
- two 9-inch pieces of electrical wire
- 9-volt battery

1. Sharpen each pencil at both ends. Use scissors to poke two holes in the cardboard, about an inch apart. Then push the pencils through the cardboard.

2. Dissolve the salt in the glass of water and set aside.

3. Wrap one end of one wire around the positive (+) terminal of the battery, and the other end around the tip of one of the pencils. Wrap the second wire around the negative (–) terminal of the battery and the tip of the second pencil.



4. Place the free ends of the pencils in the water, with the cardboard resting on top of the glass.

What Did You Discover?

1. Describe what happened when you placed the pencils in the water.

_____

2. What is the purpose of the battery in this experiment?

_____

3. What do you think is in the bubbles that formed?

_____

Energy can be mechanical, electrical, thermal, or chemical. Light, sound, and heat are often the result.

Key Concept
Energy Transfer

National Standard
Energy is a property of many substances and is associated with heat, light, electricity, mechanical motion, sound, nuclei, and the nature of a chemical. Energy is transferred in many ways.

Before studying the concept of energy transfer, students may find the definitions of the various forms of energy to be vague or contradictory. In this unit, each type of energy is clearly described with concrete examples that show how energy is converted from one form to another. This Big Idea teaches students that:

- a windmill converts mechanical energy to electrical energy;
- an increase in thermal energy within a popcorn kernel triggers the conversion of potential energy to kinetic energy;
- bioluminescence is a chemical reaction in living organisms by which chemical energy is converted to light; and
- fireworks demonstrate how the conversion of energy can produce light, sound, and heat.

Teacher Background

The law of conservation of energy states that energy cannot be created or destroyed; it can only change forms. There are many forms of energy: Mechanical energy is the energy produced by an object or body. Thermal energy is the internal energy of a substance, produced by the vibrations and attractions of its molecules. Chemical energy is the energy contained in the chemical bonds of molecules. And electrical energy is energy produced by the movement of electrons between molecules. Each of these types can be further divided into kinetic energy (the energy of motion) and potential energy (the energy of position or condition).

Energy changes forms as it moves between objects and systems. The telltale signs of energy transfer are light, sound, and heat. The sound of popcorn popping signals the release of mechanical energy. The glow of a firefly begins as chemical energy. And the sights and sounds of a fireworks display involve a series of conversions between five different forms of energy.

For specific background information on each week's concepts, refer to the notes on pp. 158, 164, 170, and 176.

Unit Overview

WEEK 1: How do windmills make electricity?

Connection to the Big Idea: Energy, the ability to cause a change in matter, exists in many forms. Students learn that energy cannot be created or destroyed; it can only be transformed. In the case of windmills, electromagnetism is used to convert mechanical energy to electrical energy.

Content Vocabulary: *electromagnetism, energy, field, kinetic energy, potential energy, turbines*

WEEK 2: What makes popcorn pop?

Connection to the Big Idea: The sound of popcorn popping signals the conversion of mechanical potential energy to mechanical kinetic energy. Students learn that any change in matter requires energy, and the energy that causes popcorn to pop is thermal energy. Thermal energy is produced by the movement and attractions of the molecules within a substance, and heat is the transfer of that energy from one place to another.

Content Vocabulary: *heat, hull, liquefy, microwave, pressure*

WEEK 3: What makes fireflies glow?

Connection to the Big Idea: Fireflies glow as a result of bioluminescence, a biochemical reaction that converts chemical energy to light. Students learn that chemicals and enzymes within a firefly's abdomen are responsible for the reaction that produces radiant energy, or light.

Content Vocabulary: *abdomen, biochemical, bioluminescent, catalyze, complex, enzyme*

WEEK 4: How do fireworks work?

Connection to the Big Idea: The detonation of fireworks involves a series of energy transformations. Students learn that a firework's chemical energy is converted to thermal energy, mechanical energy, radiant energy, and sound energy. In the process, great quantities of heat, light, and sound are produced.

Content Vocabulary: *cylindrical, electromagnetic spectrum, manifestation, mixture, shock wave*

WEEK 5: Unit Review

You may choose to do these activities to review the concept of energy transfer.

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 use the electromagnetic spectrum to answer questions.

p. 185: Hands-on Activity Students prepare popcorn kernels in four different ways before cooking them to compare how they pop. Instructions and materials needed for the activity are listed on the student page.

Energy can be mechanical, electrical, thermal, or chemical. Light, sound, and heat are often the result.

Week 1

How do windmills make electricity?

Energy, the ability to cause a change in matter, exists in many forms. Mechanical energy is the energy contained in or produced by an object. Thermal energy is the energy caused by the vibrations of molecules. We experience this type of energy as heat. Chemical energy is the energy contained in the chemical bonds that hold molecules together. And electrical energy is the energy generated by the movement of electrons between atoms. Each type of energy exists as both *potential*, or stored, energy and *kinetic*, or moving, energy.

This week students learn that windmills harness the power of the wind and convert its mechanical energy to electrical energy using electromagnetism, which is the interaction of electric and magnetic fields generated by moving electrons. Because the outer electrons of metal atoms move freely from atom to atom, metals are good conductors of electricity. This is how metal wires are able to transport electrical energy from windmills to power plants and homes.

Day One

Vocabulary: *energy, kinetic energy, potential energy*

Materials: page 159

Before students read the passage, make sure they understand the definition of *vibration*. (a rapid back-and-forth motion) Introduce the vocabulary and have students read the passage. Then instruct them to complete the activities. You may want to go over activity A together, explaining that energy contained in bonds between molecules of food is an example of chemical energy, while the energy we feel as heat is thermal energy. Also, an electrical outlet contains electrical energy, and any object that moves has mechanical energy.

Day Two

Vocabulary: *turbines*

Materials: page 160

Tell students that the *law of conservation of energy* states that energy cannot be created or destroyed. It can only change forms. Then introduce the vocabulary word and instruct students to read the passage and complete the activities. Review the answers as a group.

Day Three

Vocabulary: *electromagnetism*

Materials: page 161

When students have finished reading the passage, explain that electromagnetism works both ways: a magnetic field causes an electric current and an electric current produces a magnetic field. Turbines provide an example of how magnetism produces electricity. When students have completed the activities, go over their answers together.

Day Four

Vocabulary: *field*

Materials: page 162

Ask students how they think electricity is transported from one place to another. (through wires) Then ask what they think the wires are made of. (metal) Have students read the passage and complete the activity.

Day Five

Materials: page 163

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

Name _____

Daily Science
Big Idea 6
WEEK 1

Day 1

Weekly Question

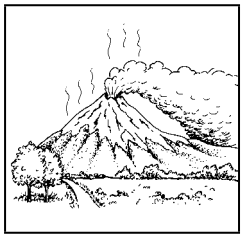
How do windmills make electricity?

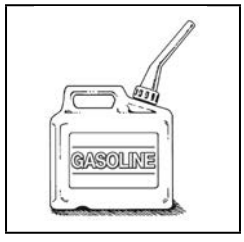
The universe runs on many types of **energy**. *Mechanical energy* is the energy of a movable object. *Thermal energy* is internal energy produced by the vibrations of a substance's molecules. *Chemical energy* is contained in the chemical bonds of molecules. And the type of energy that windmills generate is *electrical energy*, or electricity, which is produced by the movement of electrons between atoms.

Each type of energy exists in two forms: **kinetic energy** and **potential energy**. Kinetic energy is the energy of motion. Potential energy is stored energy, or the energy of "position" or "condition." A good example is a stretched rubber band. As a result of the *condition* of being stretched, energy is stored in the rubber band. When you release it, the potential energy is converted to kinetic energy as the rubber band snaps back.

Types of Energy


mechanical


thermal



chemical


electrical

Vocabulary

energy
EN-er-jee
usable power; the ability to produce a change in matter

kinetic energy
kih-NEH-tik EN-er-jee
the energy of motion

potential energy
poh-TEN-shul EN-er-jee
stored energy due to position or condition

A. Identify each type of energy as *chemical, electrical, mechanical*, or *thermal*.

1. the energy produced by a ball rolling on the floor _____
2. the energy contained in food molecules _____
3. the energy in an electrical outlet _____
4. the energy in a hot oven _____

B. Identify each example as representing *kinetic energy* or *potential energy*.

1. water held in a dam _____
2. ocean waves crashing on the shore _____

Name _____

Daily Science
Big Idea 6
WEEK 1

Day 2

Weekly Question

How do windmills make electricity?

For thousands of years, people have used windmills for a variety of purposes, such as grinding grain and pumping water. These days, most windmills are used to generate electrical energy. Windmills that produce electricity are called **turbines**.

Turbines do not create electricity out of thin air. Rather, they take energy that already exists in one form and convert it to another. The energy that is ultimately used by turbines begins as *solar energy*, or energy from the sun. Solar energy is absorbed by the surface of Earth as thermal energy, which heats the air close to the ground. When the warm air rises, cold air rushes in to fill the space. This creates wind, which is a form of mechanical energy. By harnessing the power of the wind, turbines convert mechanical energy to electrical energy.

Vocabulary

turbines
TER-bynz
windmills that produce electricity

Dutch windmill

American windmill

turbine

A. List one similarity and two differences among the windmills above.

Similarity: _____

Differences: _____

B. In order for windmills to make electricity, energy is transformed from one type into another. Write the types of energy in the correct order.

_____ → _____ → _____ → electrical energy

C. Fill in the bubble next to the word that completes the sentence.

Turbines convert _____ energy to electricity.

Ⓐ solar Ⓑ thermal Ⓒ mechanical Ⓓ electrical

Name _____

Daily Science
Big Idea 6
WEEK 1

Day 3

Weekly Question

How do windmills make electricity?

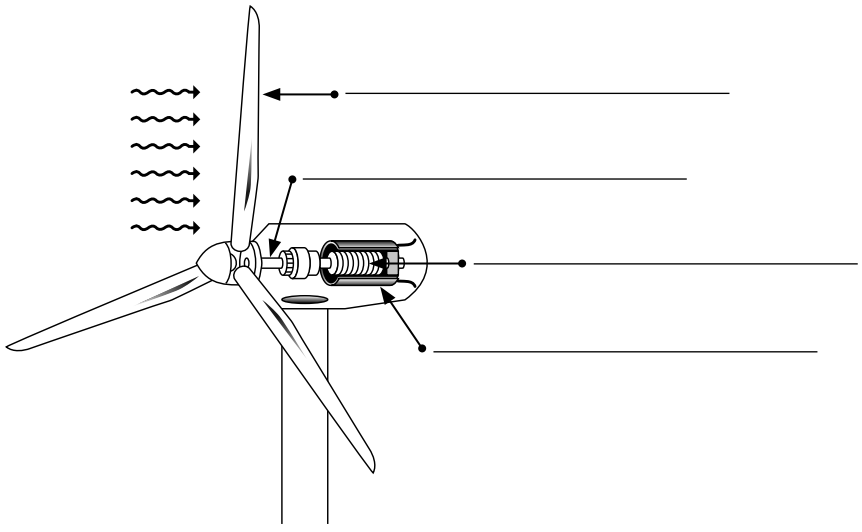
Wind blowing against the blades of a turbine produces mechanical energy. The blades are tilted at an angle to channel the air, and this causes them to rotate. Inside the turbine, a device called a drive shaft connects the blades to a generator, a machine that converts the mechanical energy created by the moving blades to electrical energy.

A generator uses **electromagnetism** to produce electricity. The generator has a huge magnet that surrounds coils of copper wire. The rotating blades of the turbine turn the drive shaft, which causes the metal coils inside the generator to spin between the positive and negative poles of the magnet. When metal such as copper moves through a magnetic field, an *electric current*, or the flow of electricity, is produced.

Vocabulary

electromagnetism
ee-LEK-troh-MAG-neh-TIH-zum
the interaction between an electric current and a magnetic field

A. Use information in the passage to label the parts of the windmill below. Use the words *blade*, *magnet*, *drive shaft*, and *metal coils*.



B. In your own words, summarize how a generator uses electromagnetism to produce electricity.

_____

_____

_____

Name _____

Daily Science
Big Idea 6
WEEK 1

Day 4

Weekly Question

How do windmills make electricity?

When the copper metal and giant magnet of a windmill's generator interact, electrons in the metal wires start to flow. Electrons generate an electric **field** as a result of their negative charge. They also generate a magnetic field as a result of their motion. The electric and magnetic fields of an electron combine, each one encouraging and strengthening the other. Thus, moving electrons are electromagnetic. Windmills use this force to produce electrical energy.

Electrical energy from a windmill is transported to power plants and homes along metal wires. Metals are good conductors of electricity due to their structure. A metal atom is big, so its nucleus has only a weak hold on the atom's outer electrons. When many metal atoms come together, their outer electrons break out of their orbitals to form a sea of electrons that move freely from atom to atom. All of the free electrons moving in the same direction produce an electric current.

Vocabulary

field
feeld
an area in which a force or influence occurs

Answer the questions.

1. Which kind of field is produced by electrons as a result of their charge? _____

2. Which kind of field is produced as a result of the motion of electrons? _____

3. What does the structure of metal atoms have to do with their ability to conduct electricity?

   _____

   _____

4. How is electricity transferred from windmills to homes?

   _____

   _____

Name _____

Daily Science
Big Idea 6
WEEK 1

Day 5

Weekly Question

How do windmills make electricity?

A. Use the words in the box to replace each underlined phrase.

potential energy	**turbines**	**electromagnetism**
kinetic energy	**energy**	**field**

1. The ability to cause a change in matter takes many different forms. _____

2. A compressed metal spring is an example of the energy of position. _____

3. A generator uses the interaction between electric and magnetic fields to produce electricity. _____

4. The energy of motion can be visible, such as when a jet flies overhead, or invisible, such as when water evaporates. _____

5. A wind farm is a group of windmills that generate electricity. _____

6. A magnetic area in which a force occurs is caused by electrons in motion. _____

B. Next to each clue, write whether it provides an example of *electrical energy*, *mechanical energy*, *chemical energy*, or *thermal energy*.

1. melting ice _____

2. a rusting nail _____

3. spinning blades of a windmill _____

4. a shock from touching a doorknob _____

Energy can be mechanical, electrical, thermal, or chemical. Light, sound, and heat are often the result.

Week 2

What makes popcorn pop?

This week students learn that the sound of popping popcorn signals more than the fact that a tasty treat will soon be ready to eat. It's also a sign that energy is being converted from mechanical *potential* energy—created by the buildup of pressure within the kernels—to mechanical *kinetic* energy as the kernels burst. The unique characteristics that allow a popcorn kernel to pop are a starchy interior, a certain amount of moisture, and a waterproof hull.

When popcorn is being cooked, the thermal energy in the kernel increases. This causes the water molecules within popcorn's starch to vibrate faster, turning the water into water vapor. The water vapor expands; however, because the hull is waterproof, the steam cannot escape. This causes pressure, and mechanical potential energy, to build within the kernel. Finally, the kernel explodes, releasing mechanical kinetic energy and expelling steam and starch in the process.

Day One

Vocabulary: *pressure*

Materials: page 165

Review the definitions of *kinetic energy* (the energy of motion) and *potential energy* (stored energy that results from position or condition). Also, remind students that mechanical energy is the energy of a movable object. Instruct students to read the passage and complete the activities independently. Then review the answers together.

Day Two

Vocabulary: *hull*

Materials: page 166

Introduce the vocabulary word and have students read the passage. Then ask students if they've ever popped a batch of popcorn and noticed that some kernels were left unpopped. Point out that those kernels probably had damaged hulls or contained the wrong amount of moisture. After students have read the passage and completed the activities, review the answers as a group.

Day Three

Vocabulary: *heat*

Materials: page 167; glass of warm water and an ice cube

After students have read the passage, drop the ice cube into the glass of water to help them visualize how thermal energy is transferred. Explain that heat always moves from warmer objects to colder ones. So even though we speak of the ice cube cooling the water, the water is really heating the ice cube. Because some of the water's thermal energy is transferred to the ice cube, the temperature of the water decreases. Have students complete the activities on their own and review the answers together.

Day Four

Vocabulary: *liquefy, microwave*

Materials: page 168

Introduce the vocabulary and explain that microwaves cook food by radiation (the transfer of radiant energy), which directly targets the molecules in liquids and foods. This is why food cooks so quickly in a microwave oven. Have students read the passage and complete the activity.

Day Five

Materials: page 169

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

Name _____

Daily Science
Big Idea 6
WEEK 2

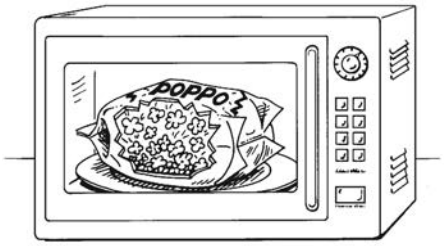
Day 1

Weekly Question

What makes popcorn pop?

To most of us, the sound of popping popcorn is a signal that snack time is near. Thousands of years ago, when Native Americans discovered how to make popcorn, they believed the sound was coming from an angry god who escaped the kernel as it popped. Today, we know that the sound produced by the exploding corn kernels is due to the release of **pressure** in the form of steam.

Popcorn jumps as it pops, producing mechanical kinetic energy, or the energy of an object's motion. Energy cannot be created; it can only be transformed, and the kinetic energy that the kernel releases as it pops comes from the mechanical potential energy stored in the unpopped kernel. This energy is the result of the buildup of pressure within the kernel.



Vocabulary

pressure
PREH-shur
the force applied to an area

A. Cross out the incorrect word or phrase in each sentence and write the correct one above it to make the statement true.

1. Popcorn was discovered by an angry god.
2. Jumping popcorn is an example of mechanical potential energy.
3. Energy can only be eliminated, not created.
4. Mechanical kinetic energy is stored in an unpopped kernel.

B. Answer the questions.

1. What creates the mechanical potential energy in a kernel of popcorn?

   _____

2. What causes the sound produced by popping popcorn?

   _____

Name _____

Daily Science
Big Idea 6
WEEK 2

Day 2

Weekly Question

What makes popcorn pop?

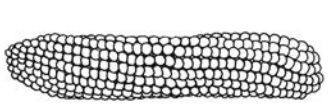
Why does pressure build up in a kernel of popcorn? The answer lies in the corn's structure. The type of corn used for popcorn is different from other types of corn. Sweet corn—the corn that you eat on the cob—is mostly sugar, with a soft outer covering on each kernel. But a popcorn kernel consists of a dense, starchy middle encased in a very hard, waterproof shell. Also, the starch contains a small amount of water.

To be exact, the water content of a popcorn kernel falls within the narrow range of 13.5% to 14%. This amount of moisture is critical to popcorn's ability to pop. If there is too little moisture, the kernels won't pop due to a lack of pressure. If there is too much moisture, the kernels pop into hard little balls that nobody wants to eat!

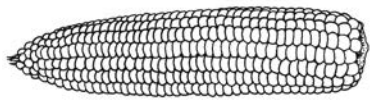
The **hull**, or outer shell, is also important. It holds the moisture in the kernel. If the hull is cracked or damaged in any way, the kernel won't pop. The combination of the hard outer shell and the moisture content of the starch allows pressure to build within the kernel when it is cooked.

Vocabulary

hull
huhl
the dry outer covering of a fruit, seed, or nut



popcorn



sweet corn

A. In your own words, describe how popcorn differs from sweet corn.

_____

_____

B. List the two features of popcorn that enable it to pop.

1. _____

2. _____

C. What are two conditions that might prevent popcorn from popping?

1. _____

2. _____

Name _____

Daily Science
Big Idea 6
WEEK 2

Day 3

Weekly Question

What makes popcorn pop?

Any change in matter requires energy. The energy that causes popcorn to change from kernels to fluffy white puffs is thermal energy. Thermal energy is the energy produced by the movement and attractions of the molecules within a substance. When it is cooked, popcorn's thermal energy increases. We sense this change in thermal energy as heat.

Although we experience thermal energy as heat, the two are distinctly different. **Heat** is the *transfer* of thermal energy. When an object feels warm to the touch, it is because the object contains more thermal energy than your fingertips do. When heat flows from the object to your fingers, you feel this gain of thermal energy as warmth. When an object feels cold, it is because the object contains less thermal energy than your fingertips. As heat flows from your fingers to the object, you feel this loss of thermal energy as coldness.

Vocabulary

heat
heet
the transfer of thermal energy

A. Answer the questions.

1. When you touch a warm object, do your fingertips gain or lose thermal energy? _____

2. If you touch a cold object, in which direction does heat flow—from the object to your fingers, or from your fingers to the object?

_____

B. Identify each clue as either *heat* or *thermal energy*.

1. the internal energy of a popcorn kernel _____

2. the flow of energy from hot oil to a popcorn kernel _____

C. Explain the difference between heat and thermal energy.

_____

_____

Name _____

Daily Science
Big Idea 6
WEEK 2

Day 4

Weekly Question

What makes popcorn pop?

In order for popcorn to pop, energy must be applied to the kernels. This energy may take the form of thermal energy, such as when popcorn is popped on the stove or in an air-popper. Or it may take the form of *radiant energy*, which is energy emitted as electromagnetic waves or particles. This is how popcorn is popped in a **microwave** oven.

When an outside source of energy is applied to a kernel of popcorn, thermal energy in the kernel increases as the molecules of water in the starch vibrate. The temperature of the kernel increases and the water molecules move faster and farther apart, until the water turns to steam. But because the hull is waterproof, the steam can't escape, and the pressure builds. The starch **liquefies**, increasing the pressure even further. Ultimately, the pressure becomes so intense that the hull gives way. The starch and steam come bursting out of the kernel, turning it inside out. As this happens, the jelly-like starch expands into bubbles that freeze upon contact with the air, forming the characteristic spongy white blobs we all know and love.

Vocabulary

liquefy
LIH-kwih-fy
to turn into a liquid

microwave
MY-kroh-wayv
a short vibration of electric and magnetic fields that can move through space

Number the events below in the correct order to explain how popcorn pops.

____ The kernel explodes.

____ Energy is applied to the popcorn kernel.

____ Pressure builds within the kernel.

____ The bubbling starch freezes.

____ Thermal energy within the kernel increases.

Name _____

Daily Science
Big Idea 6
WEEK 2

Day 5

Weekly Question

What makes popcorn pop?

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

heat	liquefy	microwaves	pressure	hull

Popcorn can be popped using radiant energy in the form of _____. As the thermal energy inside the kernel increases, _____ from the water molecules causes the starch to _____. The buildup of _____ from the starch and steam pushing against the _____ causes the kernel to burst.

B. Check the box next to the phrase that completes the analogy.

Condition is to **potential energy** as _____.

- ❒ **jumping** is to **thermal energy**
- ❒ **motion** is to **kinetic energy**
- ❒ **popping** is to **potential energy**
- ❒ **pressure** is to **kinetic energy**

C. What type of energy causes popcorn kernels to change into white puffs? Fill in the bubble next to the correct answer.

- Ⓐ mechanical energy
- Ⓑ potential energy
- Ⓒ kinetic energy
- Ⓓ thermal energy

D. In your own words, explain why ice feels cold.

_____

_____

_____

Week 3

What makes fireflies glow?

In the eastern United States, the spectacular light show produced by fireflies as they search for mates or repel predators is a familiar summer evening sight. Each of the more than 2,000 firefly species has its own pattern of blinking, which serves as a means of identification.

Energy can be mechanical, electrical, thermal, or chemical. Light, sound, and heat are often the result.

Fireflies, as students learn this week, are able to light up due to *bioluminescence*, the chemical process whereby the insects convert chemical energy, in the form of the molecule ATP, to light. This chemical reaction takes place in an abdominal organ called the lantern, where the enzyme luciferase catalyzes the process. First, ATP binds with the chemical luciferin. The resulting complex then combines with oxygen to produce oxyluciferin and light. By regulating the amount of oxygen that enters the lantern, fireflies are able to control the light and thus produce the specific blinking patterns that allow them to communicate.

Day One

Vocabulary: *abdomen, bioluminescent*

Materials: page 171

Introduce the vocabulary and explain that *bioluminescence*, which is the production and release of light by a living organism, literally means "living light process." Have students read the passage and complete the activities. Review the answers together.

Day Two

Vocabulary: *biochemical*

Materials: page 172

After students have read the passage, direct their attention to the diagram and tell them that ATP stands for *adenosine triphosphate* (uh-DEN-uh-SEEN try-FOSS-fayt), which is one adenosine molecule plus three phosphate molecules. The energy of ATP is released when the bond between two of the phosphates is broken. When students have completed the activities, review their answers together.

Day Three

Vocabulary: *catalyze, complex, enzyme*

Materials: page 173

Introduce the vocabulary and instruct students to read the passage. Then call students' attention to the diagram of the two chemical equations. Ask students what they think the arrow in a chemical equation indicates. (that something is changing into something else) Help students locate the enzyme (luciferase) and the complex (ATP-luciferin) in each equation. Have students complete the activities on their own.

Day Four

Materials: page 174

Remind students that *radiant energy* is energy emitted as electromagnetic waves or particles. Explain that other examples of radiant energy besides microwaves include x-rays, radio waves, and light. After students read the passage and complete the activities, go over the answers together.

Day Five

Materials: page 175

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

Name _____

Daily Science
Big Idea 6
WEEK 3

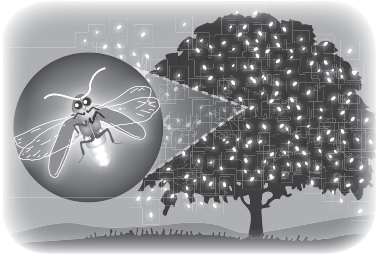
Day 1

Weekly Question

What makes fireflies glow?

Across the eastern United States, the nightly display of fireflies twinkling in the air is a welcomed sign of summer. Also known as lightning bugs, fireflies glow in order to communicate with each other. Male and female fireflies flash signals back and forth to attract mates. They also use light to lure prey and ward off predators.

Fireflies, in reality, are not flies at all. They are actually beetles with a light-producing organ called a lantern on the underside of their **abdomen**. Organisms that can produce light are said to be **bioluminescent**. There are more than 2,000 species of fireflies worldwide, each with a unique flash pattern. By varying the rhythm and intensity of the light, fireflies make themselves identifiable to other members of their species.



Vocabulary

abdomen
AB-duh-min
the last of the three body segments of an insect

bioluminescent
BY-oh-LOO-mih-NEH-sint
able to produce light

A. List three reasons why fireflies glow.

1. _____ **3.** _____

2. _____

B. Answer the questions.

1. What type of insect are fireflies? _____

2. Why do different firefly species use different patterns of flashing light?

_____

3. What distinguishes one firefly species' flash pattern from another's?

_____

C. Write the vocabulary words to complete the sentence.

A firefly is a _____ organism that has a light-producing organ on its _____.

Name _____

Daily Science Big Idea 6 WEEK 3

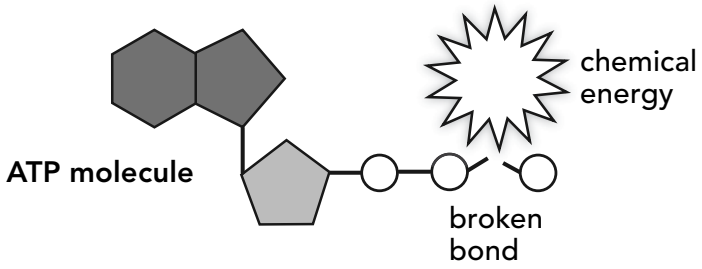
Day 2

Weekly Question

What makes fireflies glow?

Fireflies glow as a result of a **biochemical** reaction called *bioluminescence*, which converts chemical energy to radiant energy. The energy needed to make a firefly glow comes from a molecule called ATP. ATP is used by all living organisms to transfer energy.

In plants, solar energy is converted to chemical energy in the form of ATP during photosynthesis. But in animals, ATP is created from the chemical energy contained in food. In both plants and animals, ATP brings energy to wherever it is needed within a cell. When the bonds of the ATP molecule are broken, chemical energy is released.



Vocabulary

biochemical
BY-oh-KEM-ih-kul
related to or involving a chemical process in living organisms

A. Answer the questions.

1. What is the source of ATP in plants? _____

2. What is the source of ATP in animals? _____

B. ATP is called an "energy transfer molecule." Explain why this is an appropriate name for it.

_____

_____

C. Cross out the incorrect word in each sentence and write the correct one above it to make the statement true.

1. Bioluminescence is a solar reaction.

2. ATP stores mechanical energy in living organisms.

3. Energy is released when the bonds of the ATP molecule form.

Name _____

Daily Science
Big Idea 6
WEEK 3

Day 3

Weekly Question

What makes fireflies glow?

Within a firefly's lantern, special cells produce an **enzyme** that triggers the chemical reaction that transforms energy into light. This enzyme is called luciferase (loo-SIF-ur-AYSS).

Luciferase **catalyzes** the two-step reaction by first helping ATP bind with luciferin, a chemical that emits light. Then it enables the resulting ATP-luciferin **complex** to react with oxygen (O_2). This produces a new compound, oxyluciferin (OCK-see-loo-SIF-ur-in), and light. A firefly controls the light by regulating the oxygen that enters its lantern through an air tube.

Chemical Process for Firefly Bioluminescence
Step 1: luciferase + luciferin + ATP ⟶ luciferase + ATP-luciferin
Step 2: luciferase + ATP-luciferin + O_2 ⟶ oxyluciferin + light

Vocabulary

catalyze
KAT-uh-lize
to speed up the rate of a reaction

complex
KAHM-pleks
a temporary joining of two or more different molecules

enzyme
EN-zime
a protein produced by cells that speeds up the chemical reactions in living organisms

A. Answer the questions.

1. Where is luciferase produced in a firefly?

_____

2. How does a firefly control its light?

_____

B. Check the box next to the phrase that correctly completes each sentence.

1. Luciferase is _____.

❒ an enzyme ❒ a complex ❒ a form of light

2. An example of a complex is _____.

❒ oxygen ❒ oxyluciferin ❒ ATP-luciferin

3. If a reaction is catalyzed, it is _____.

❒ slowed down ❒ sped up ❒ broken

Name _____

Daily Science
Big Idea 6
WEEK 3

Day 4

Weekly Question

What makes fireflies glow?

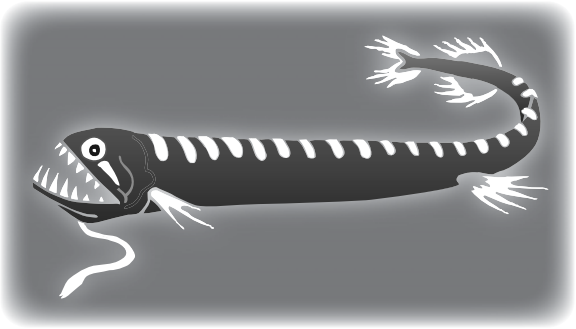
Fireflies are extremely efficient at turning chemical energy into light, a form of radiant energy. In fact, 98% of the energy used in bioluminescence is converted to light, with only 2% lost as heat.

There are many other bioluminescent organisms on Earth besides fireflies. Numerous bacteria, algae, fish, squid, jellyfish, and more than 60 species of fungi are known to produce light. Most bioluminescent creatures live in the deep sea, where there is little natural light. There, the ability to produce one's own light is more than just a spectacular sight—it's a critical adaptation.

Bioluminescent Organisms

crystal jelly

night-light mushroom



blackdragon fish

A. Answer the questions.

1. How much of the chemical energy that goes into the bioluminescent reaction of a firefly is transformed into light? _____

2. What form of energy is light? _____

B. Explain why bioluminescence is an important adaptation for deep-sea creatures.

_____

_____

Name _____

Daily Science
Big Idea 6
WEEK 3

Day 5

Weekly Question

What makes fireflies glow?

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

abdomen	**complex**	**bioluminescent**
catalyze	**enzyme**	**biochemical**

Fireflies are a type of _____ beetle. The _____ reaction that converts chemical energy to radiant energy occurs in a firefly's lantern, which is located on its _____. The _____ luciferase is needed to _____ the reaction. It then enables the resulting ATP-luciferin _____ to react with oxygen and produce light.

B. Write each ingredient of a firefly's bioluminescent reaction next to its clue.

luciferin **ATP** **luciferase** **oxygen**

1. emits light _____

2. regulated to control the amount of light _____

3. supplies energy _____

4. an enzyme produced in the lantern _____

C. Check the box next to the pair of words that complete the sentence.

In bioluminescence, _____ energy is transformed into _____ energy.

- ❒ mechanical, radiant
- ❒ chemical, radiant
- ❒ radiant, thermal
- ❒ mechanical, chemical

Energy can be mechanical, electrical, thermal, or chemical. Light, sound, and heat are often the result.

Week 4

How do fireworks work?

The vibrant colors and sounds of fireworks exploding in midair are more than just a celebratory tradition. They also provide a vivid model of energy changing forms. This week students learn that when a firework is detonated, its chemical energy is transformed into thermal energy, mechanical energy, radiant energy, and sound energy.

The black powder in the bottom of a firework shell starts the energy transformation process. When ignited, the powder's chemical energy is converted to thermal energy and then to mechanical energy as the firework is launched. At the highest point in its aerial path, the firework bursts, discharging a shower of pellets known as stars. As they burn, metallic elements within the stars release different amounts of radiant energy, which correspond to particular colors of light. The chemical energy in stars is also transformed into thermal and sound energy. The latter, a form of mechanical energy, travels as waves of vibration through the air, producing thunderous booms of fireworks. However, we often see the explosion before we hear it because light travels faster than sound.

Day One

Vocabulary: *manifestation*

Materials: page 177

Invite students to describe fireworks displays they have seen and to name occasions on which they have seen them. Instruct students to read the passage and complete the activities. Review the answers together.

Day Two

Vocabulary: *cylindrical, mixture*

Materials: page 178

Introduce the vocabulary. Then compare *mixture* to *compound* by reminding students that a compound is a substance made up of the atoms of two or more elements chemically bound together, and that the properties of a compound are different from the properties of its elements. In contrast, the elements in a mixture retain their original properties. Have students read the passage and complete the activities.

Day Three

Vocabulary: *electromagnetic spectrum*

Materials: page 179

Introduce the vocabulary word and ask students if they have ever heard of Roy G. Biv. If not, explain that Roy G. Biv is not a person! It's a way to remember the order of colors of visible light in the electromagnetic spectrum. (**r**ed, **o**range, **y**ellow, **g**reen, **b**lue, **i**ndigo, and **v**iolet) After students have read the passage, instruct them to complete the activities. Then review the answers together.

Day Four

Vocabulary: *shock wave*

Materials: page 180

After students have read the passage, demonstrate how a sound wave travels by having students create a human wave, such as those performed by spectators at sporting events. Point out that, like molecules of air in a sound wave, the students don't change their positions. Rather, it is the wave itself that "travels" as each person responds to the movement of his or her neighbor. Then have students complete the activities.

Day Five

Materials: page 181

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

Name _____

Daily Science
Big Idea 6
WEEK 4

Day 1

Weekly Question

How do fireworks work?

KABOOM! No Fourth of July celebration in America would be complete without flashes of fireworks rocketing skyward and bursting into a shower of colors. Invented by the Chinese a thousand years ago, fireworks were first used in ceremonies to frighten away evil spirits. They are now used to celebrate special occasions around the world.

The dazzling display of color, light, and sound produced by fireworks is a **manifestation** of an incredible amount of energy. Specifically, it is the end result of a series of energy transformations. When fireworks explode, chemical energy is transformed into thermal energy, mechanical energy, radiant energy, and sound energy.

Vocabulary

manifestation
MAN-ih-fess-TAY-shun
the visible or noticeable expression of something

Washington, D.C.

Sydney, Australia

Guiyang, China

A. Write *true* or *false*.

1. Fireworks were invented on July 4, 1776. _____
2. Color, light, and sound are manifestations of different forms of energy. _____
3. Fireworks explode when sound is transformed into chemical energy. _____

B. List the five forms of energy involved in a fireworks explosion.

1. _____
2. _____
3. _____
4. _____
5. _____

Name _____

Daily Science
Big Idea 6
WEEK 4

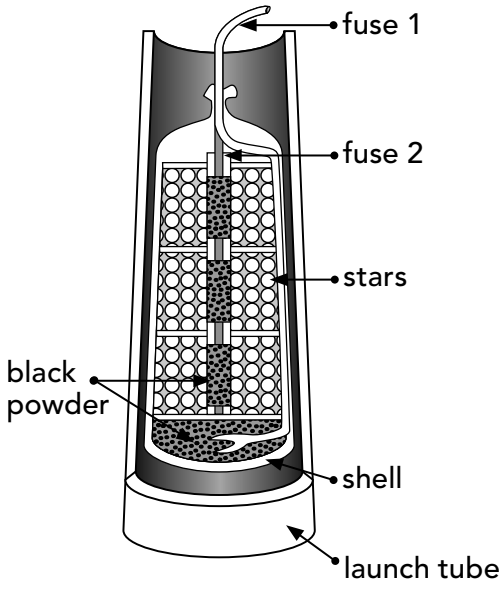
Day 2

Weekly Question

How do fireworks work?

Most fireworks are made up of a shell that contains two fuses and pellets of chemicals, which is loaded into a **cylindrical** launch tube. The most important ingredient in the shell is black powder, a **mixture** of potassium nitrate, carbon, and sulfur. When one of the fuses is lit and comes into contact with the mixture, the powder burns. The chemical energy of the black powder is converted to thermal energy, and great quantities of gas and heat are generated.

The gas then becomes trapped within the launch tube and expands, causing pressure to build. Ultimately, the pressure becomes too intense and the gas explodes, causing thermal energy to be converted to mechanical energy that propels the firework into the sky. There, more black powder and the second fuse produce another explosion, which spews out the remaining contents of the shell.



Vocabulary

cylindrical
suh-LIN-drih-kul
tube-shaped

mixture
MIKS-chur
a blend of different substances that are not chemically bound together

A. Answer the questions.

1. What is inside the cylindrical launch tube of a firework?

_____

2. What is the most important ingredient in fireworks? _____

3. What becomes trapped in the launch tube? _____

B. Write the correct forms of energy to show the order in which energy is transformed when the black powder is ignited.

chemical energy → _____ → _____

Name _____

Daily Science Big Idea 6 WEEK 4

Day 3

Weekly Question

How do fireworks work?

The chemical pellets that produce the sparks of light and color in a firework are called *stars*. Metallic elements within the stars each emit a specific color of light as they burn, due to differences in their atomic structures. When a metallic element burns, its atoms absorb thermal energy, which temporarily moves the atoms' outer electrons up to a higher energy level. The electrons then return to their original energy level, releasing radiant energy as light in the process.

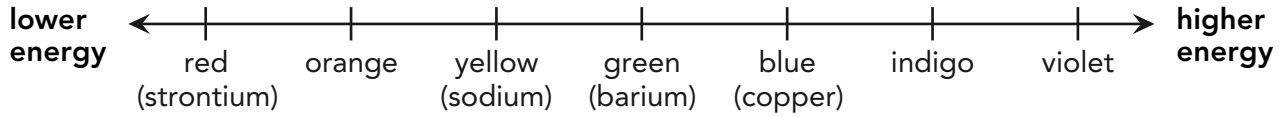
The amount of radiant energy emitted, which is unique to each element, determines the color of the light. Light is the only visible form of radiant energy on the **electromagnetic spectrum**. The colors of light include red, orange, yellow, green, blue, indigo, and violet. Energy increases from red to violet along the spectrum.

Vocabulary

electromagnetic spectrum
ee-LEK-troh-mag-NEH-tik SPEK-trum
the complete range of radiant energy types, including microwaves, x-rays, and light

A. The diagram below shows the colors of light. Four metallic elements are given in parentheses under the colors they emit. Use the diagram and information in the passage to answer the questions.

Colors of Light



1. Which metallic elements would you mix to create an orange firework?

_____

2. Which metals would you mix to create a purple firework?

_____

3. Which element, sodium or copper, releases a higher level of energy when it burns? _____

B. Explain why different metals emit different colors of light.

_____

Name _____

Daily Science
Big Idea 6
WEEK 4

Day 4

Weekly Question

How do fireworks work?

Firework stars produce not only light and color, but also heat and sound. In addition to metals, stars contain carbon and potassium perchlorate (per-KLOR-ayt). When the stars are ignited, the chemicals react with each other. The bonds between their atoms break apart, and the atoms rearrange to form new chemicals. Chemical energy in the stars is released as radiant energy in the form of colored light, as thermal energy in the form of heat, and as sound energy in the form of a **shock wave**.

Although it travels in waves like light, sound is not a form of radiant energy. Lightwaves are radiation that can move through empty space, whereas sound waves are vibrations that travel only through the molecules of matter—usually air. So sound energy is actually a form of mechanical energy. Just like an ocean wave, it is the sound wave that travels, not the molecules of matter. The molecules merely vibrate in place, stimulating the molecules next to them.

So the next time you hear the thunderous boom of fireworks exploding into a spectacular burst of lights and colors, remember that you are witnessing firsthand the transformation of energy.

Vocabulary

shock wave
SHAHK wayv
a pulse of high pressure traveling through matter and caused by an explosion or an object moving faster than sound

A. Write what is produced by each form of energy in a fireworks explosion.

Radiant energy: _____ **Sound energy:** _____

Thermal energy: _____

B. Describe two differences between a lightwave and a sound wave.

_____

_____

Name _____

Daily Science
Big Idea 6
WEEK 4

Day 5

Weekly Question

How do fireworks work?

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

cylindrical	**spectrum**	**manifestations**
mixture	**shock wave**	

1. The _____ generated by a jet plane is heard as a sonic boom.
2. The visible portion of the electromagnetic _____ matches the order of the colors of the rainbow.
3. Sneezing and coughing are _____ of a cold.
4. A firework shell is launched from a _____ tube.
5. Air is a _____ of nitrogen, oxygen, water, carbon dioxide, and argon.

B. Answer the questions.

1. What type of energy does an unlit firework contain? _____
2. What type of energy is sound energy? _____

C. Summarize how fireworks demonstrate the transformation of energy.

_____

_____

_____

_____

Name _____

Daily Science
Big Idea 6
WEEK 5

Unit Review

Comprehension

Conservation of Energy

Fill in the bubble next to the correct answer.

1. Sound is to mechanical energy as _____.

Ⓐ electromagnetic spectrum is to chemical energy
Ⓑ electricity is to mechanical energy
Ⓒ light is to radiant energy
Ⓓ thermal energy is to heat

2. Which of these does *not* define potential energy?

Ⓐ the energy of motion
Ⓑ stored energy
Ⓒ the energy of position
Ⓓ the energy of condition

3. Which of these is an energy transfer molecule?

Ⓐ luciferin
Ⓑ luciferase
Ⓒ black powder
Ⓓ ATP

4. We experience thermal energy as _____.

Ⓐ light
Ⓑ heat
Ⓒ sound
Ⓓ bioluminescence

5. A moving electron produces an electric field as a result of its _____, and a magnetic field as a result of its _____.

Ⓐ motion, charge
Ⓑ charge, motion
Ⓒ size, shape
Ⓓ shape, size

6. When the bonds between the atoms of a molecule break, what form of energy is released?

Ⓐ mechanical energy
Ⓑ electrical energy
Ⓒ chemical energy
Ⓓ thermal energy

Name _____

Daily Science Big Idea 6 WEEK 5

Unit Review

Vocabulary

Energy Transformations

Write the vocabulary word that matches or completes each clue.

1. a blend of substances _____
2. A rolling ball is an example of this type of energy. _____
3. force applied to an area _____
4. the transfer of thermal energy _____
5. an insect's body part _____
6. Fireworks produce sound energy in the form of a _____.
7. Fireflies and some jellyfish are _____.
8. A closed jack-in-the-box is an example of this type of energy. _____
9. two or more different molecules temporarily joined _____
10. an area affected by a force _____
11. to trigger or speed up _____
12. the shape of a tube _____
13. a catalyzing protein _____
14. chemical reactions in living organisms _____
15. the combination of electric and magnetic fields _____
16. Exploding kernels of corn are the _____ of increased thermal energy.

abdomen
biochemical
bioluminescent
catalyze
complex
cylindrical
electromagnetism
enzyme
field
heat
kinetic energy
manifestation
mixture
potential energy
pressure
shock wave

Name _____

Unit Review

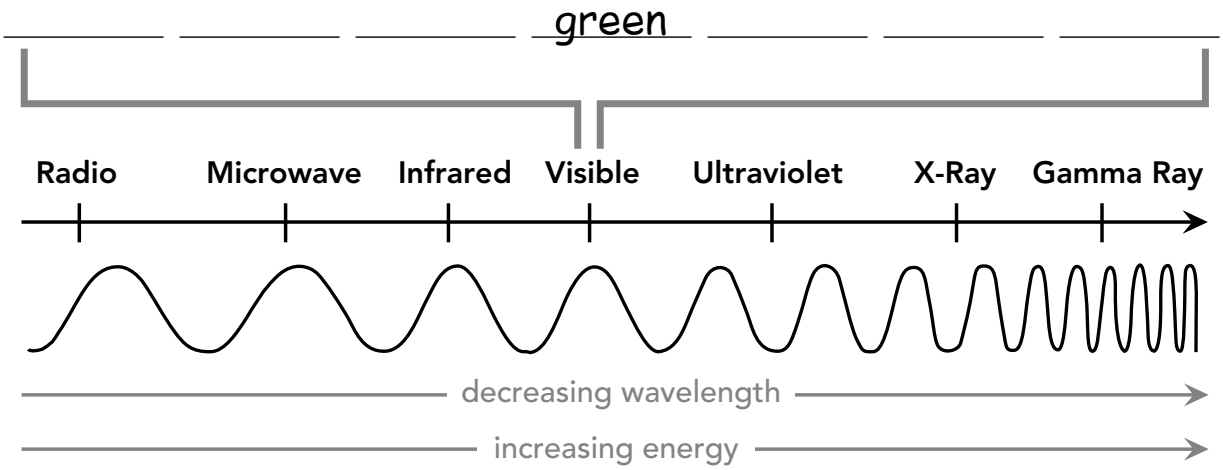
Visual Literacy

Electromagnetic Spectrum

Daily Science Big Idea 6

WEEK 5

Use the electromagnetic spectrum to answer the questions.



1. Which type of electromagnetic wave has the highest energy?

_____

2. Which type of electromagnetic wave has the longest wavelength?

_____

3. *Infrared* means "below red." *Ultraviolet* means "beyond violet." Based on these definitions, is the color red to the left or the right of the color violet in the visible portion of the spectrum?

_____

4. What are the colors of the visible portion of the electromagnetic spectrum? Write them above the spectrum using the words in the box below. (Green has already been filled in for you.)

blue	**red**	**yellow**
orange	**violet**	**indigo**

Name _____

Daily Science
Big Idea 6
WEEK 5

Unit Review

Hands-on Activity

Test Your Hy-POP!-thesis

You can have your popcorn—and eat it too—with this edible experiment!

What You Need

- 1⅓ cups of regular popcorn kernels
- kitchen knife
- air-popper
- small bowl of water
- paper towels

1. Divide the kernels into four batches of ⅓ cup each.
2. Warm one batch of kernels in a conventional oven at 220°F for two hours.
3. At the same time, soak another batch of kernels in water for two hours. Then remove the kernels and pat them dry.
4. Scratch the kernels of the third batch with a knife. Leave the fourth batch untouched.
5. Before you begin the experiment, answer question 1 below.
6. Pop each batch of popcorn separately and for the same amount of time. Then count the number of unpopped kernels in each batch. Record your results.

What Did You Discover?

1. Make a prediction. Which batch of popcorn will have the fewest number of unpopped kernels? Which batch will have the most?

_____

2. Which batch of popped popcorn actually had the fewest number of unpopped kernels? Which had the most?

_____

3. Evaluate the results. Why did the batch with the most unpopped kernels fail to pop? Why did the batch with the fewest unpopped kernels pop so well?

_____

_____

Answer Key

Big Idea 1: Week 1 • Day 1

A. 1. physical
2. behavioral
3. behavioral
4. physical
5. physical

B. Answers will vary.

Big Idea 1: Week 1 • Day 2

A. 1. true
2. false
3. false

B. Organisms in the same genus have many traits in common, but not as many as those in the same species. Organisms in the same species can produce fertile offspring, while those in the same genus cannot.

C. Answers will vary—e.g., a tiger, because it walks on all fours and has paws with claws, whiskers on its face, and fur like a lion

Big Idea 1: Week 1 • Day 3

A. A zebroid is a hybrid of a horse and a zebra, so it has a combination of both species' traits.

B. *Zebra traits:* stripes, spiky mane, resistance to disease
Horse traits: body shape, size, tame

Big Idea 1: Week 1 • Day 4

A. 1. Hybrids don't exist in nature.
2. Hybrids are sterile.
3. Hybrids' inherited traits are unpredictable.

B. 1. clean, free from germs
2. unable to reproduce
3. boring, dry

TALK: Answers will vary—e.g., Yes, they should create hybrids because you can combine the best traits of two species OR No, because hybrids don't occur in nature, and people shouldn't create animals that wouldn't exist otherwise.

Big Idea 1: Week 1 • Day 5

A. Inherited traits, genus, species, fertile, hybrid, sterile

B. Answers will vary—e.g.,
Horse: tame, agile
Zebra: stripes, strong
Both: mane, hooves

C. Answers will vary—e.g., Someone might want to breed a zebroid to use as a pack animal. Zebroids should not be bred because horses and zebras are different species and don't normally mate.

Big Idea 1: Week 2 • Day 1

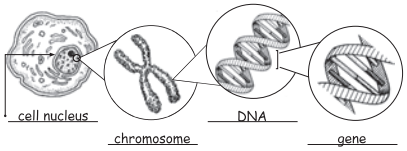
A. Answers will vary.

B. If doctors can figure out which genes carry which diseases, they may be able to find a way to prevent those diseases.

C. genes, heredity

Big Idea 1: Week 2 • Day 2

A.



B. 1. true
2. false
3. false
4. true

Big Idea 1: Week 2 • Day 3

1. two recessive genes
2. two dominant genes or one dominant and one recessive
3. three: two dominant, two recessive, or a dominant and a recessive
4. No, because he or she will always contribute a dominant gene for brown eyes to his or her offspring.

Big Idea 1: Week 2 • Day 4

A. Answers will vary—e.g.,
Advantage: There are fewer left-handed people, so your competitors might not know how to beat you.
Disadvantage: It's harder to find sports gear for left-handed people.

B. 1. blue eyes
2. recessive

C. Answers will vary.

Big Idea 1: Week 2 • Day 5

A. 1. f 2. a 3. d 4. e 5. c 6. b

B. Yes, the baby could be left-handed if both the mom and dad pass down a recessive gene.

C. 1. 2, 50% 2. 2, 50%

Big Idea 1: Week 3 • Day 1

A. 1. *egg* is to *chicken*
2. *blue* is to *kernel*

B. No, the corn plants will not share all the same traits, because each kernel has its own unique set of genes.

Big Idea 1: Week 3 • Day 2

A. 1. Genes can mutate into new genes.
2. Genes can form new combinations of genes.
3. New genes can get introduced into a population.

B. 1. false
2. true
3. true
4. false

Big Idea 1: Week 3 • Day 3

A. 1. ~~minor~~ major
2. ~~unaffected~~ affected
3. ~~on~~ off
4. ~~kernels~~ DNA

B. C

Big Idea 1: Week 3 • Day 4

A. You can breed only organisms with desirable traits and prevent organisms that don't have desirable traits from reproducing. Over time, the undesirable traits will occur less frequently.

B. Because potatoes and tomatoes are different species, a tomato plant could never naturally produce potatoes, and a potato plant couldn't produce tomatoes.

TALK: Answers will vary—e.g., Farmers might want to selectively breed corn that is more resistant to disease or drought, corn plants that produce more ears, or corn that can be used to feed livestock.

Big Idea 1: Week 3 • Day 5

A. genetic variation, mutate, selective breeding

B. Answers will vary—e.g., Early dog ancestors must have shown a lot of genetic variation.

C. The cultivated flower was selectively bred to be taller and to have more petals and a bigger center.

Big Idea 1: Week 4 • Day 1

A. Answers will vary—e.g., Identical and fraternal twins both develop and are born at the same time. Identical twins are formed from one fertilized egg and fraternal twins are formed from two fertilized eggs.
B. because they form from a single egg

Big Idea 1: Week 4 • Day 2

1. true
2. false
3. true
4. false
5. false

Big Idea 1: Week 4 • Day 3

A. Answers will vary—e.g., The amount of nutrients a fetus gets from the placenta can impact its size. A person's upbringing or education can impact his or her interests.
B. Answers will vary—e.g., One twin could cut her hair, while the other leaves it long. One twin could dress differently from the other twin.

Big Idea 1: Week 4 • Day 4

A. As identical twins get older, their epigenomes become less and less alike. Copy errors during early development can change the DNA of identical twins.
B. Answers will vary—e.g., Identical twins are not identical. They are unique because of environmental and slight genetic differences.

TALK: Answers will vary—e.g., Nature, because people from the same family with similar genes are often very alike; OR Nurture, because people from the same family who go to different schools or move to different parts of the world can end up being very different from one another.

Big Idea 1: Week 4 • Day 5

A. 1. c 2. d 3. b 4. a
B. Answers will vary—e.g., Their environment can influence some of their traits, changes to their epigenomes might result in genetic differences as they age, and copy errors during early development can result in differences in their DNA.
C. *Fraternal Twins:* formed from two separate fertilized eggs, can be the same sex or different sexes, share about 50% of the same genetic material
Identical Twins: formed from one fertilized egg that divides, will always be the same sex, share the same DNA
Both: develop in the womb together, are born at the same time

Big Idea 1: Week 5 • Unit Review 1

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

Big Idea 1: Week 5 • Unit Review 2

1. o
2. k
3. p
4. n
5. j
6. m
7. a
8. b
9. g
10. s
11. l
12. e
13. r
14. d
15. h
16. i
17. f
18. c
19. q

Big Idea 1: Week 5 • Unit Review 3

A.

	D	d
D	DD	Dd
D	DD	Dd

1. 4:4
2. DD or Dd

B.

	B	b
B	BB	Bb
b	Bb	bb

1. 1:4
2. brown

Big Idea 1: Week 5 • Unit Review 4

1. Answers will vary—e.g., like cotton candy, like threads, etc.
2. so that the DNA doesn't dissolve and we can see it

Big Idea 2: Week 1 • Day 1

A. 1. 250 million years ago
2. about 65 million years ago
3. 5
B. It gets filled by one or more new species.

Big Idea 2: Week 1 • Day 2

A. 1. c 2. e 3. d 4. a 5. b
B. The pandas will become extinct as well.

Big Idea 2: Week 1 • Day 3

A. 1. Mass extinction happens over a short period of time.
2. Mass extinction affects many organisms.
B. 1. one-time natural disasters
2. global climate change
C. gradual change, because the species will have more time to adapt

Big Idea 2: Week 1 • Day 4

1. true
2. false
3. false
4. true

Big Idea 2: Week 1 • Day 5

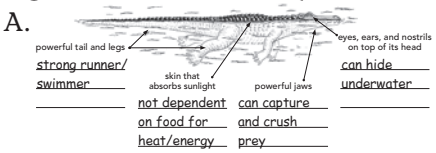
A. niche, ecosystem, extinction, predation, uninhabitable
B. *Background extinction:* predation, competition, small population size
Mass extinction: volcanic eruption, asteroid, climate change
Both: humans, habitat loss

Big Idea 2: Week 2 • Day 1

A. 1. false
2. true
3. true
4. false
B. When the climate changes and produces harsh conditions on land, the animal can just live in the water. And if conditions are bad in the water, the animal can move onto land.

Big Idea 2: Week 2 • Day 2

A.



B. Areas that have very cold climates; crocodiles wouldn't absorb enough heat energy there.

Big Idea 2: Week 2 • Day 3

A. *Salt water:* salt glands that remove ingested salt from their system
Desert: the ability to enter a state of dormancy and conserve energy
B. Scaly skin is tougher than soft skin and helps crocodiles survive in harsh conditions.

Big Idea 2: Week 2 • Day 4

1. generalized 3. generalized
2. specialized

TALK: Answers will vary—e.g., People who fear crocodiles might hunt them down and kill them. People who like crocodiles will want to help in conservation efforts.

Big Idea 2: Week 2 • Day 5

A. exploit, ectothermic, dormancy, endangered, conservation
B. Generalized adaptations allow a species to live in many habitats. Specialized adaptations are evolved for one particular habitat.
C. 1. An ectothermic system allows crocodiles to go for a long time without food.
2. Staying underwater for up to two hours allows crocodiles to hide from danger or hunt prey.

Big Idea 2: Week 3 • Day 1

A. 1. sea ice 3. land
2. water
B. Global warming has reduced areas of arctic conditions.
C. *sea ice* is to *ocean*

Big Idea 2: Week 3 • Day 2

A. 1. because the ice cap melts, so the polar bears don't have as much of a platform from which to hunt the seals
2. They sit near a breathing hole and wait for a seal to come out. They also stalk seals that are resting on the edges of the ice.
B. carnivorous

Big Idea 2: Week 3 • Day 3

1. ~~ice~~ land OR ~~return to~~ leave
2. ~~cubs~~ mothers OR ~~fat reserves~~ mother's milk
3. ~~well fed~~ malnourished
4. ~~later~~ sooner

Big Idea 2: Week 3 • Day 4

A. 1. camouflage 2. foraging
B. The polar bear's diet will change faster, because it is not a physical adaptation as blubber is. Physical adaptations take many generations to develop.
C. Answers will vary—e.g., disagree, because the polar bears are only being seen on land because their original habitat, the sea ice, is disappearing

Big Idea 2: Week 3 • Day 5

A. 1. carnivorous 4. foraging
2. tundra 5. camouflage
3. malnourished, threatened
B. C
C. because there are no plants in the tundra where they live

Big Idea 2: Week 4 • Day 1

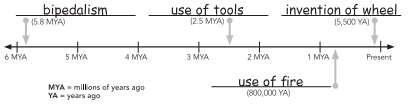
A. Answers will vary—e.g.,
1. height
2. shape of face/size of head
3. arm length/body hair
B. climates that aren't too warm or too cold, because they are easier for us to adapt to

Big Idea 2: Week 4 • Day 2

A. 1. climate change
2. competition
B. because they don't depend on one type of food and aren't restricted to live in one area to find food

Big Idea 2: Week 4 • Day 3

A.



B. Weapons keep us safe from predators; shelter, fire, and clothing keep us warm; and fire and utensils help us cook and cut our food.

Big Idea 2: Week 4 • Day 4

1. Numerous glaciations happened during this time, but in between them, temperatures actually got much warmer.
2. 250,000 years ago
3. 8°F warmer, around 125,000 years ago

Big Idea 2: Week 4 • Day 5

A. hominids, omnivores, glaciations, bipedalism, technology, distribution
B. Our species was able to adapt to climate change better than other hominids, and we outcompeted them.
C. Technology allowed otherwise weak humans to protect themselves against predators, stay warm and sheltered, find better ways to get food, and migrate to new places.

Big Idea 2: Week 5 • Unit Review 1

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

Big Idea 2: Week 5 • Unit Review 2

ACROSS	DOWN
3. niche	1. tundra
5. omnivores	2. malnourished
9. endangered	4. foraging
12. extinction	6. predation
13. conservation	7. glaciations
	8. dormancy
	10. technology
	11. hominids

Big Idea 2: Week 5 • Unit Review 3

1. Barbary lion 4. bigger
2. smaller 5. dodo
3. human, American alligator

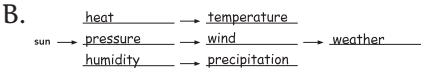
Big Idea 2: Week 5 • Unit Review 4

1. could not feel the coldness of the water as much with the hand in the glove
2. no
3. The polar bear would get hot very quickly.

Big Idea 3: Week 1 • Day 1

A. 1. During the summer months, humidity increases.
2. Without solar energy, there would be no life on Earth.
3. Rainforests receive a lot of precipitation.

B.



Big Idea 3: Week 1 • Day 2

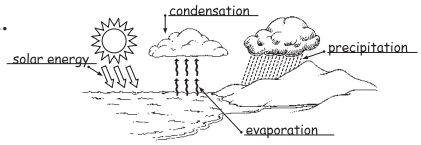
solar energy, absorbed, reflected, radiated

Big Idea 3: Week 1 • Day 3

A. Cold air is heavier and exerts more pressure, so it sinks. Warm air is lighter and is under less pressure, so it rises.
B. The wind reverses direction because the warm air over the ocean rises, and the cooler air from the land flows in to take its place.

Big Idea 3: Week 1 • Day 4

A.



B. dramatic weather events such as tornadoes

Big Idea 3: Week 1 • Day 5

A. 1. f 3. h 5. e 7. b
2. a 4. c 6. g 8. d
B. *condensation* is to *precipitation*
C. Answers will vary—e.g., The sun controls weather because the amount of solar energy determines the amount of heat, which controls temperature. The sun also causes changes in pressure, which creates wind. And the sun evaporates water vapor, so it determines the amount of humidity in the air, which results in precipitation.

Big Idea 3: Week 2 • Day 1

A. 1. false 3. true
2. false 4. true
B. 1. diameter 3. storm surge
2. eye

Big Idea 3: Week 2 • Day 2

A. 1. latitude
2. wind
3. ocean's surface temperature
4. moisture in the atmosphere
B. 1. disturbance 2. updraft

Big Idea 3: Week 2 • Day 3

A. 1. 4 2. 5 3. 4
B. because the surface waters aren't warm enough at higher latitudes for hurricanes to form

Big Idea 3: Week 2 • Day 4

A. 1. right 2. left
B. Without the Coriolis force, the air wouldn't spin, so a storm would not be able to form.

Big Idea 3: Week 2 • Day 5

A. disturbance, latitudes, diameter, updrafts
B. 1. This is when surface waters reach their highest temperatures.
2. Without warm waters and moisture, the hurricanes lose strength.
3. The Coriolis force is strongest at the poles.
4. They don't happen at the equator because the Coriolis force is absent there.
C. Solar energy heats up ocean surface waters, causes high humidity, and creates wind—all factors that contribute to the formation of a hurricane.

Big Idea 3: Week 3 • Day 1

Barrow, Alaska
St. Petersburg, Russia
Shanghai, China
Bogota, Colombia

Big Idea 3: Week 3 • Day 2

A. 1. Your shadow will be longer, because the angle of the sun is greater at the poles.
2. Miami, Florida, because the sun hits there at less of an angle.
B. In order to burn the paper, you need the sun's light to be as intense as possible. It is more intense in a small dot than it is when spread out.

Big Idea 3: Week 3 • Day 3

A. 1. reflect 2. warm
B. *Landscape:* Snow reflects the sun's energy.
Weather: A dry climate means there are few clouds to keep heat close to the ground. Winds blow away surface heat.

Big Idea 3: Week 3 • Day 4

A. 1. July, August, September
2. January
B. Mountains are at higher elevations, and areas of high elevation have colder temperatures.

Big Idea 3: Week 3 • Day 5

A. climate, curvature, horizon, landscape
B. 1. warmer 6. warmer
2. colder 7. colder
3. warmer 8. colder
4. colder 9. warmer
5. warmer 10. warmer
C. With six months of darkness, temperatures drop very low to the point where six months of sunlight is not enough to warm them up.

Big Idea 3: Week 4 • Day 1

A. 1. no
2. Southern
3. Any two of the following: North America, Europe, or Asia
B. hemispheres

Big Idea 3: Week 4 • Day 2

1. more, because that hemisphere is tilted more toward the sun than it is during winter
2. If Earth's axis were tilted in the opposite direction, then the seasons would be reversed. The Northern Hemisphere would have summer during January and winter during July. In the Southern Hemisphere it would be the opposite.

Big Idea 3: Week 4 • Day 3

A. *Tokyo:* winter; *New York:* winter; *São Paulo:* summer; *Berlin:* winter; *Auckland:* summer; *Cape Town:* summer
B. September 22

Big Idea 3: Week 4 • Day 4

A. 1. false 3. true
2. true 4. false
B. The seasons are reversed on the other side of the equator, but they are not reversed on opposite sides of the same hemisphere.

Big Idea 3: Week 4 • Day 5

A. Hemisphere, solstice, equinox, orbit, axis
B. 1. After its winter solstice, a hemisphere starts to tilt toward the sun. OR After its summer solstice, a hemisphere starts to tilt away from the sun.
2. After the winter solstice, the days become longer. OR After the summer

solstice, the days become shorter.
3. The summer solstice is the longest day of the year.
4. The autumnal equinox follows the summer solstice. OR The vernal equinox follows the winter solstice.

C. Because of Earth's tilt, the amount of light each hemisphere gets changes throughout the year. When the hemisphere is tilted toward the sun, it is summer. When the hemisphere is tilted away from the sun, it is winter.

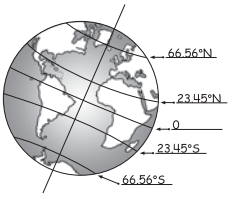
***Big Idea 3:** Week 5 • Unit Review 1*

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

***Big Idea 3:** Week 5 • Unit Review 2*

1. radiate
2. disturbance
3. equinox
4. precipitation
5. solar energy
6. hemisphere
7. orbits
8. humidity
9. horizon
10. atmosphere
11. updraft
12. axis
13. condense
14. curvature
15. convection current
16. climate
17. latitude
18. diameter
19. landscape
20. evaporate
21. solstice

***Big Idea 3:** Week 5 • Unit Review 3*



1. 66.56°S
2. 23.45°N
3. 0°
4. 66.56°N
5. 23.45°S

***Big Idea 3:** Week 5 • Unit Review 4*

1. They curved.
2. The faster you spin the circle, the more the line curves.
3. The wind's path is straight, but it appears to curve.

***Big Idea 4:** Week 1 • Day 1*

A. 1. Some of the continents looked like they fit together.
2. Mountains on different continents were identical in form and composition.
3. Fossils of the same plants and animals were found on different continents.

B. cartographer, geologist

***Big Idea 4:** Week 1 • Day 2*

A. 1. false
2. false
3. true

B. Gondwana

***Big Idea 4:** Week 1 • Day 3*

A. magma, rifts, trenches

B. The old rock sinks into ocean trenches and is replaced by lava that cools and forms newer rock.

***Big Idea 4:** Week 1 • Day 4*

A. Answers will vary—e.g., According to the theory of plate tectonics, seafloor spreading is the mechanism that drives the movement of the continents.

B. Because the continents don't drift over the surface, they are embedded in the plates and move with them.

***Big Idea 4:** Week 1 • Day 5*

A. cartographers, geologist, hypothesize, magma, rifts, trench, mechanism

B. 1. seafloor spreading
2. plate tectonics
3. continental drift
4. plate tectonics

***Big Idea 4:** Week 2 • Day 1*

A. 1. iron
2. volcanic rocks, meteorites

B. water is more dense, because it sinks below the oil

***Big Idea 4:** Week 2 • Day 2*

1. both
2. P waves
3. S waves
4. P waves
5. both

***Big Idea 4:** Week 2 • Day 3*

A. 1. three
2. outer core
3. lithosphere

B. Answers will vary—e.g., toothpaste, silly putty, gum, clay

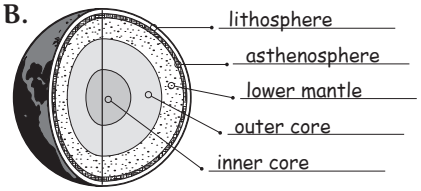
***Big Idea 4:** Week 2 • Day 4*

3, 6, 2, 1, 5, 4

***Big Idea 4:** Week 2 • Day 5*

A. 1. density, composition
2. seismic waves
3. mantle

B.



C. It has the highest temperature and pressure of any of Earth's layers.

***Big Idea 4:** Week 3 • Day 1*

1. convergent
2. divergent
3. transform
4. divergent
5. convergent

***Big Idea 4:** Week 3 • Day 2*

A. 1. The older plate is subducted because it's more dense.
2. Oceanic crust is more dense than continental crust.
3. because both plates are buoyant

B. a pound of granite, because it is lighter and thicker

***Big Idea 4:** Week 3 • Day 3*

A. 1, 4, 5, 3, 2, 6

B. Marine fossils from the seafloor get forced onto continents when they collide and end up on the mountains.

***Big Idea 4:** Week 3 • Day 4*

A. 1. true
2. false
3. false
4. true

B. convergent, because a mountain range runs the length of it

***Big Idea 4:** Week 3 • Day 5*

A. converge, subduction, buoyant, sediment, fracture, subcontinent

B. 1. convergent
2. divergent
3. transform
4. convergent
5. convergent
6. transform
7. divergent
8. divergent
9. convergent

***Big Idea 4:** Week 4 • Day 1*

A. 1. Nubian Plate 2. Somali Plate

B. 1. diverging
2. They are both volcanically active. Magma wells up under the lithosphere and pushes the crust apart.
3. a new ocean

Big Idea 4: Week 4 • Day 2

A. 1. transform boundary
2. tension
B. 1. ~~southeast~~ northwest
2. ~~Alabama~~ Alaska

Big Idea 4: Week 4 • Day 3

A. 1. by compression caused by Africa and Europe colliding
2. They will form one big continent, because Africa is moving north into Europe.
B. Answers will vary—e.g., There are many microplates that are fractured at the edges, causing convergent, divergent, and transform boundaries to form.

Big Idea 4: Week 4 • Day 4

1. true 2. false 3. true

Big Idea 4: Week 4 • Day 5

A. tectonic, diverging, fault, tension, compression
B. *diverge* is to *split*
C. Answers will vary—e.g.,
Alike: Both are plate boundaries that involve tension.
Different: The San Andreas Fault is a transform boundary, while Rift Valley is divergent. Earthquakes occur on the San Andreas Fault, and volcanoes happen at Rift Valley.

Big Idea 4: Week 5 • Unit Review 1

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

Big Idea 4: Week 5 • Unit Review 2

1. hypothesize
2. tension
3. sediment
4. fault
5. mantle
6. geologist
7. rift
8. converge
9. mechanism
10. seismic waves
11. diverging
12. lithosphere
13. subcontinent
14. subduction
15. fracturing
16. density
17. compression
18. buoyant
19. asthenosphere
20. composition
21. magma

Big Idea 4: Week 5 • Unit Review 3

4, 3, 2, 7, 1, 6, 5

Big Idea 4: Week 5 • Unit Review 4

1. oceanic plate
2. continental plate
3. asthenosphere
4. Step 1: divergent
Step 2: convergent
Step 3: transform
Step 4: convergent

Big Idea 5: Week 1 • Day 1

A. 1. false 3. true
2. true 4. false
B. Air is made up of particles and takes up space. There is oxygen in air, and oxygen is an element, which means it must be made of matter.
C. B

Big Idea 5: Week 1 • Day 2

A. protons, neutrons, electrons
B. 1. false 3. true
2. false 4. true

Big Idea 5: Week 1 • Day 3

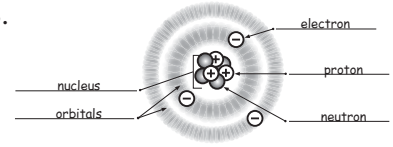
A. 1. empty space
2. in the nucleus
3. a maximum of two
B. *electron* is to *orbital*

Big Idea 5: Week 1 • Day 4

A. 1. 1, 0, 1 3. 3, 4, 3
2. 2, 2, 2 4. 6, 6, 6
B. It only has one proton, so there are no other positive charges to repel it.

Big Idea 5: Week 1 • Day 5

A. elements, atoms, protons, neutrons, electrons, orbitals, isotopes
B.



C. Answers may vary—e.g.,
1. hydrogen 3. oxygen
2. helium 4. carbon

Big Idea 5: Week 2 • Day 1

1. the number of protons, neutrons, and electrons in an atom of an element
2. how electrons are arranged in orbitals
3. which elements are likely to react and combine with each other

Big Idea 5: Week 2 • Day 2

A. 1. shiny
2. can bend without breaking
3. good conductors of electricity
B. 1. boron, silicon, germanium, arsenic, antimony, tellurium, polonium
2. aluminum and astatine
3. hydrogen

Big Idea 5: Week 2 • Day 3

1. Cl, 17, 18, 17
2. Ca, 20, 20, 20
3. Fe, 26, 30, 26
4. Pb, 82, 125, 82

Big Idea 5: Week 2 • Day 4

A. 1. 3
2. Mg, Al, Si, P, S, Cl, Ar
3. H, Li, K, Rb, Cs, Fr
B. The number of outer-shell electrons determines how an element will combine with other elements.

Big Idea 5: Week 2 • Day 5

A. 1. periodic
2. metalloid
3. atomic number, atomic weight
4. periods, groups
5. chemical symbol
B. *period* is to *atomic shells*
C. Hydrogen is on the far left of the periodic table because it contains one outer-shell electron like the other elements in its group.

Big Idea 5: Week 3 • Day 1

A. 1 carbon, 2 oxygen
1 nitrogen, 3 hydrogen
1 calcium, 1 carbon, 3 oxygen
B. *atom* is to *element*

Big Idea 5: Week 3 • Day 2

A. 1. by sharing electrons
2. by losing electrons
3. by gaining electrons
B. Oxygen needs two electrons to fill its outer shells, so it binds to two hydrogen atoms. The two hydrogen atoms fill their outer shells by each counting one of the oxygen atoms as their own.

Big Idea 5: Week 3 • Day 3

A. 1. In a covalent bond, atoms share electrons. In an ionic bond, atoms transfer electrons so that one gains an electron and one loses an electron.
2. An atom has no charge, while an ion has a charge.
B. Electrons have negative charges and protons have positive charges. If an atom gains an electron, it will have

more electrons than protons and be negatively charged. If it loses an electron, it will have more protons and be positively charged.

Big Idea 5: Week 3 • Day 4

1. a spark
2. an electric current

TALK: Answers will vary—e.g., because chemical reactions can be extremely violent

Big Idea 5: Week 3 • Day 5

A. chemical reaction, compound, molecule, covalent bonds, ions, ionic bonds

B. 1. hydrogen and oxygen
2. 2 hydrogen, 1 oxygen
3. H_2O
4. covalent

C. is always a liquid

Big Idea 5: Week 4 • Day 1

A. 1. carbon
2. It has four electrons in its outer shell.

B. Carbon can bond to itself to form long chains, branches, and rings.

Big Idea 5: Week 4 • Day 2

A. 1. false 2. true 3. true

B. Answers will vary—e.g.,
Alike: both have four outer-shell electrons
Different: carbon can form double or triple bonds, silicon can form only single bonds; carbon forms chains and rings, silicon forms crystals

Big Idea 5: Week 4 • Day 3

A. 1. hydrogen 2. oxygen

B. 1. carbohydrates
2. lipids
3. proteins
4. nucleic acids

C. 1. carbohydrates
2. proteins
3. nucleic acids

Big Idea 5: Week 4 • Day 4

A. The presence of hydrogen and the resulting bond that forms between hydrogen and carbon distinguishes organic compounds.

B. 1. Minerals 2. decomposition

C. Decomposition of dead organisms releases carbon. Plants convert carbon to organic material. Animals eat plants or other animals for carbon and when they die, the cycle continues.

Big Idea 5: Week 4 • Day 5

A. 1. decomposition, organic
2. minerals, inorganic

B. 1. inorganic
2. inorganic
3. organic
4. inorganic
5. organic

C. 1. *silicon* is to *inorganic*
2. *oil* is to *lipid*

Big Idea 5: Week 5 • Unit Review 1

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

Big Idea 5: Week 5 • Unit Review 2

ACROSS
2. mineral
7. metalloid
9. group
11. ion
14. period
15. electron

DOWN
1. protons
3. isotopes
4. elements
5. compound
6. molecule
8. organic
10. orbital
12. neutron
13. atom

Big Idea 5: Week 5 • Unit Review 3

1. group 2B 3. 33 5. 54
2. period 3 4. 146

Big Idea 5: Week 5 • Unit Review 4

1. Bubbles formed around the tips of the pencils.
2. The battery supplies the electric current needed to split water into its elements.
3. hydrogen gas

Big Idea 6: Week 1 • Day 1

A. 1. mechanical energy
2. chemical energy
3. electrical energy
4. thermal energy

B. 1. potential energy
2. kinetic energy

Big Idea 6: Week 1 • Day 2

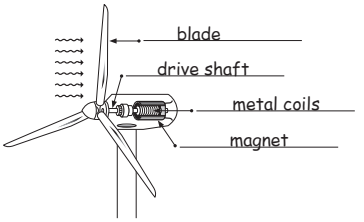
A. *Similarity:* They all have blades.
Differences: Answers will vary—e.g., They have different numbers of blades and they are shaped differently.

B. solar energy, thermal energy, mechanical energy

C. C

Big Idea 6: Week 1 • Day 3

A.



B. The metal coils within the generator spin between the two poles of a magnet. When metal moves through a magnetic field, electricity is produced.

Big Idea 6: Week 1 • Day 4

1. electric field
2. magnetic field
3. Because they are so big, metal atoms can't hold on to their outer electrons, which move freely between atoms. When the free electrons move in the same direction, they conduct electricity.
4. along metal wires

Big Idea 6: Week 1 • Day 5

A. 1. energy
2. potential energy
3. electromagnetism
4. kinetic energy
5. turbines
6. field

B. 1. thermal energy
2. chemical energy
3. mechanical energy
4. electrical energy

Big Idea 6: Week 2 • Day 1

A. 1. ~~an angry god~~ Native Americans
2. ~~potential~~ kinetic
3. ~~eliminated~~ transformed
4. ~~kinetic~~ potential

B. 1. the buildup of pressure within the kernel
2. the release of pressure from the steam

Big Idea 6: Week 2 • Day 2

A. Popcorn has a starchy middle with a hard outer shell. Sweet corn has a sugary middle with a soft outer covering.

B. 1. a certain amount of moisture
2. a hard, waterproof hull

C. 1. too little moisture
2. a cracked or damaged hull

Big Idea 6: Week 2 • Day 5

A. microwaves, heat, liquefy, pressure, hull
B. *motion* is to *kinetic energy*
C. D
D. Ice feels cold because it has less thermal energy than your fingers, so when you touch it, heat flows from your fingers to the ice. You feel the loss of thermal energy as coldness.

Big Idea 6: Week 3 • Day 1

A. 1. to attract mates
2. to lure prey
3. to ward off predators
B. 1. beetles
2. to identify other members of their species
3. the rhythm and intensity of the light
C. bioluminescent, abdomen

Big Idea 6: Week 3 • Day 2

A. 1. solar energy 2. food
B. because ATP stores energy and brings it to wherever it is needed within a cell
C. 1. ~~solar~~ biochemical
2. ~~mechanical~~ chemical
3. ~~form~~ break

Big Idea 6: Week 3 • Day 3

A. 1. within the lantern
2. by regulating the amount of oxygen that enters the lantern
B. 1. an enzyme
2. ATP-luciferin
3. sped up

Big Idea 6: Week 3 • Day 4

A. 1. 98%
2. radiant energy
B. Because there is so little natural light in the deep sea, being able to produce one's own light gives bioluminescent organisms an advantage over others.

Big Idea 6: Week 3 • Day 5

A. bioluminescent, biochemical, abdomen, enzyme, catalyze, complex
B. 1. luciferin 3. ATP
2. oxygen 4. luciferase
C. chemical, radiant

Big Idea 6: Week 4 • Day 1

A. 1. false 2. true 3. false
B. 1. chemical energy
2. thermal energy
3. mechanical energy
4. radiant energy
5. sound energy

Big Idea 6: Week 4 • Day 2

A. 1. a shell containing two fuses and chemical pellets
2. black powder
3. gas
B. thermal energy, mechanical energy

Big Idea 6: Week 4 • Day 3

A. 1. strontium and sodium
2. strontium and copper
3. copper
B. Due to differences in their atomic structures, each metal emits a different amount of radiant energy when it burns.

Big Idea 6: Week 4 • Day 4

A. **radiant energy:** colored light
thermal energy: heat
sound energy: shock wave
B. A lightwave moves through empty space, and a sound wave moves only through matter. Lightwaves are electromagnetic radiation, and sound waves are vibrations.

Big Idea 6: Week 4 • Day 5

A. 1. shock wave 4. cylindrical
2. spectrum 5. mixture
3. manifestations
B. 1. chemical energy
2. mechanical energy
C. When a firework is lit, its chemical energy is transformed into thermal energy, which converts to mechanical energy to launch the firework. The chemical energy in the pellets then transforms into radiant energy as colored light, and sound energy in the form of a shock wave.

Big Idea 6: Week 5 • Unit Review 1

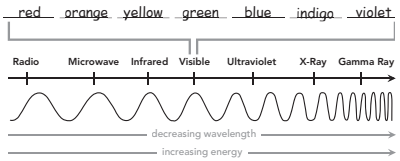
1. C 4. B
2. A 5. B
3. D 6. C

Big Idea 6: Week 5 • Unit Review 2

1. mixture 9. complex
2. kinetic energy 10. field
3. pressure 11. catalyze
4. heat 12. cylindrical
5. abdomen 13. enzyme
6. shock wave 14. biochemical
7. bioluminescent 15. electro-magnetism
8. potential energy 16. manifestation

Big Idea 6: Week 5 • Unit Review 3

red, orange, yellow, green, blue, indigo, violet

1. gamma ray
2. radio
3. red is to the left of violet
4. 

Big Idea 6: Week 5 • Unit Review 4

1. Answers will vary.
2. Answers will vary—e.g., The soaked or the untouched had the fewest. The scratched or the baked had the most.
3. The scratched kernels had cracked hulls, so pressure couldn't build. The baked kernels had too little moisture, so pressure couldn't build. The soaked kernels had the right amount of moisture, as did the untouched.

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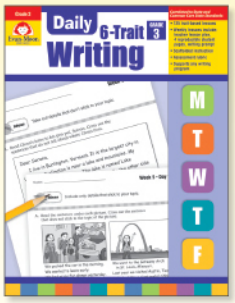

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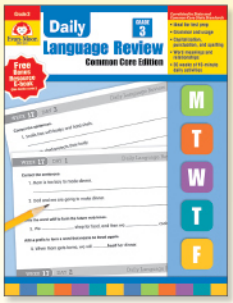

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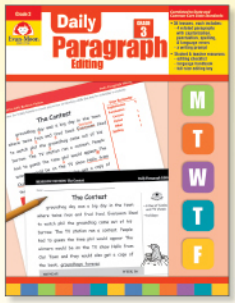

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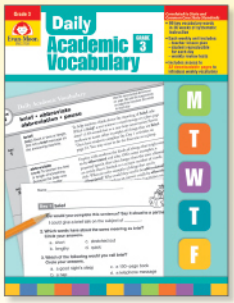

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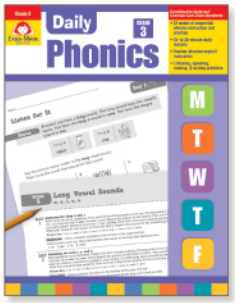

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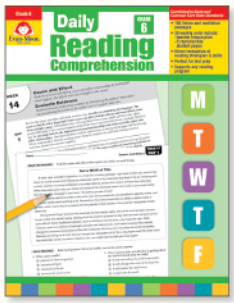

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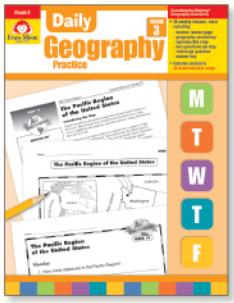

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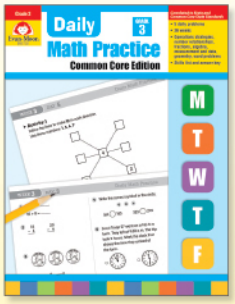

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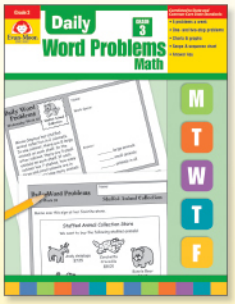

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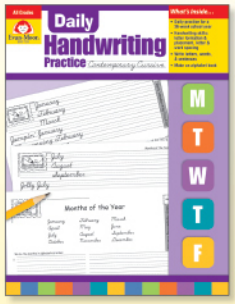

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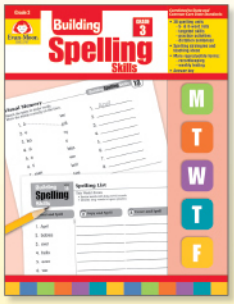

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