Name _____

Daily Science
Big Idea 5
WEEK 3

Day 1

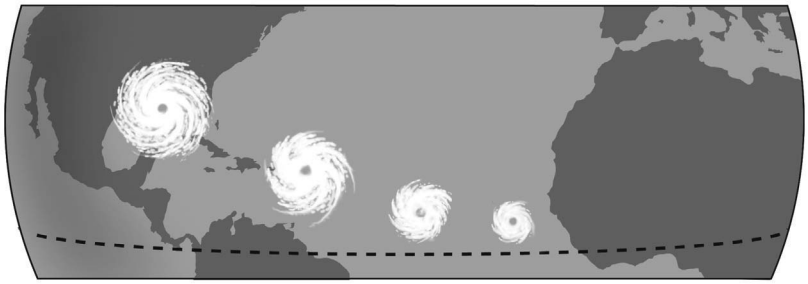
Weekly Question

What causes hurricanes?

A **hurricane**, even one viewed from a weather **satellite** hundreds of miles above Earth, is an awesome sight. Its tightly wound spiral of white clouds can be up to 600 miles wide, forming a massive, rotating storm that can travel thousands of miles and bring strong winds, heavy rains, and high seas along with it.

Hurricanes occur as a result of the sun heating Earth unevenly. The equator gets more direct sunlight, and therefore more thermal energy, than regions at the poles. Because heat flows from warmer places to cooler ones, thermal energy from the equator must eventually end up at the poles. Hurricanes are a very dramatic, sometimes violent way that heat is conveyed from the tropics to higher and cooler latitudes.

Path of a Developing Hurricane



Vocabulary

hurricane
HER-ih-kayn
a large, rotating storm system with high winds and heavy rains

satellite
SAT-uh-lite
an unmanned spacecraft that orbits Earth or the moon

A. List four characteristics of hurricanes.

1. _____ **3.** _____

2. _____ **4.** _____

B. Use the vocabulary words to complete the sentence.

Meteorologists can look at images from a _____ to predict whether a _____ will hit the United States.

C. Explain why hurricanes move from the tropics to the poles, and not the other way around.

_____

Name _____

Daily Science
Big Idea 5
WEEK 3

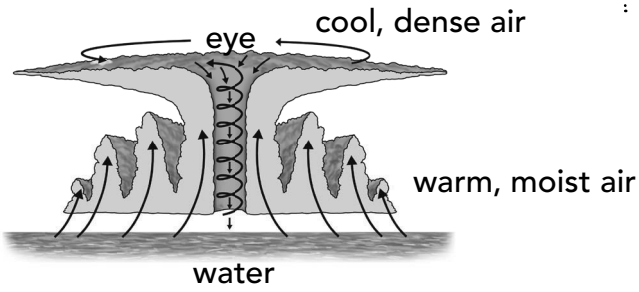
Day 2

Weekly Question

What causes hurricanes?

Hurricanes form over tropical oceans in late summer and early fall, when water temperatures are at their warmest. Heating by the sun causes the moisture-filled air to rise high into the atmosphere. The warm air is replaced by cooler, denser air that sinks back down toward the water's surface. This cooler air is then heated by the sun, picks up moisture, and rises, and the cycle continues. In this way, heat is transferred from warm waters to the atmosphere.

Heat transferred by the flow of air or water is called **convection**. Convection is one way heat is transported by hurricanes to higher latitudes. But there's a twist—literally! Earth's rotation puts a spin on the rising and sinking air. Hurricanes spin clockwise in the Southern Hemisphere and counterclockwise in the Northern Hemisphere.



Vocabulary

convection
kun-VEK-shun
the transfer of heat energy through the movement of a gas or a liquid

A. Write *true* or *false*.

1. Earth's rotation is what causes hurricanes to spin. _____
2. Hurricanes form over landmasses in August and September. _____
3. Air heated by the sun sinks toward the water's surface. _____
4. Convection transfers heat from the tropics to higher latitudes. _____

B. There are many examples of convection besides hurricanes. Which of the following is *not* an example of convection? Fill in the correct bubble.

Ⓐ Cold milk poured into coffee cools the hot drink.
Ⓑ An ice cube melts when it touches a warm glass.
Ⓒ Air blowing from an air conditioner cools a room.
Ⓓ A pot of soup heats evenly as it is stirred.

Name _____

Daily Science
Big Idea 5
WEEK 3

Day 3

Weekly Question

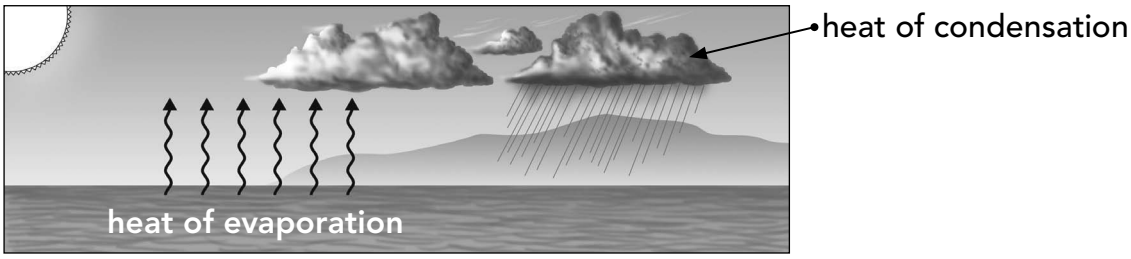
What causes hurricanes?

Hurricanes transfer thermal energy not only through the process of convection, but also through the transport of water vapor to higher elevations and new locations. The heat that water molecules absorb during evaporation travels with the gas until the molecules condense back into a liquid. As raindrops form, this heat is released into the atmosphere as **heat of condensation**. The heat released into the atmosphere equals the amount of heat that was absorbed when the water evaporated.

The condensation of water vapor can occur thousands of miles away from where the water first evaporated. Through the heat of condensation, the spinning mass of wet air associated with a hurricane transports thermal energy, and higher temperatures, to places far from the tropical oceans where hurricanes form.

Vocabulary

heat of condensation
HEET uhv KON-den-SAY-shun
the heat released when water vapor condenses



A. Next to each of the following examples of heat transfer, write whether it is occurring through *convection* or *heat of condensation*.

1. clouds forming in the sky _____

2. steam condensing on a window _____

3. hurricane winds blowing _____

B. Use the term *heat of condensation* to explain how water heated by the sun off the coast of Africa could end up putting heat back into the atmosphere in Texas.

_____

_____

Name _____

Daily Science
Big Idea 5
WEEK 3

Day 4

Weekly Question

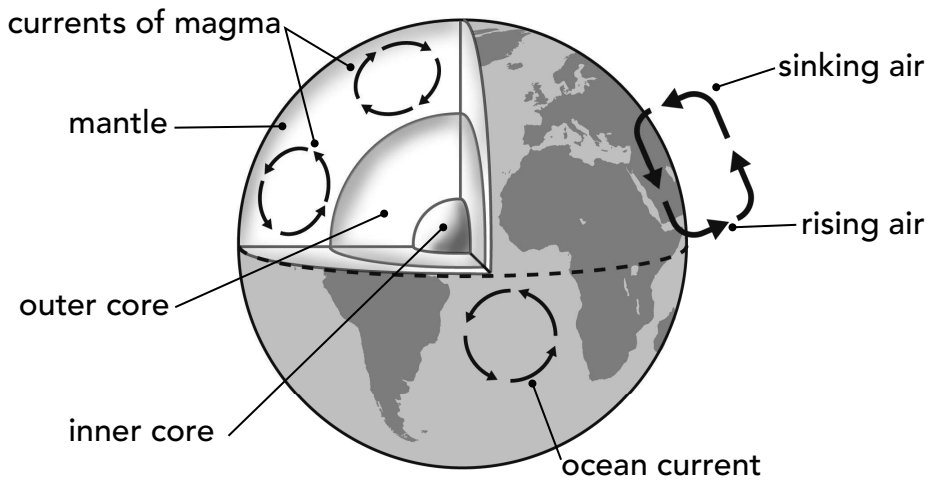
What causes hurricanes?

Earth has many natural systems in which convection plays a role in the transfer of thermal energy. Like hurricanes, tornadoes and thunderstorms move thermal energy through wind and **circulating** air.

But convection isn't limited to the air. In the ocean, water circulates in currents partly in response to the differences in water temperature that are caused by the sun. These great currents move warm water and heat around the world. And even inside Earth, heat from Earth's core results in huge convection currents of magma. These currents move heat and matter from deep within the mantle to Earth's surface.

Vocabulary

circulating
SER-kyoo-layt-ing
moving about or flowing freely



A. Name the substance in which convection occurs to complete each sentence.

1. _____ transfers thermal energy in the ocean.

2. Movement of _____ conveys heat within the mantle.

3. _____ transports thermal energy in thunderstorms.

B. Write the source of heat that drives convection in each of these systems.

The ocean: _____ **The mantle:** _____

Name _____

Daily Science
Big Idea 5
WEEK 3

Day 5

Weekly Question

What causes hurricanes?

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

convection	**hurricane**	**condensation**
circulating	**satellite**	

1. The swirling winds of a _____ result from the uneven heating of Earth.
2. Heat travels by _____ in any material that can flow.
3. A _____ can view weather patterns from above Earth.
4. When water vapor forms raindrops, it releases thermal energy back into the air in the form of heat of _____.
5. _____ currents of magma move heat from Earth's core to the surface.

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

1. The amount of heat released when water vapor freezes is equal to the amount of heat absorbed when water evaporates.
2. Convection transports heat from the tropics to the equator.
3. Hurricanes are characterized by rotating winds, high seas, and heavy snow.

C. Name the two ways that hurricanes transfer heat.

1. _____ 2. _____

Heat flows from warmer objects to cooler ones until both reach the same temperature.

Week 4

How does a thermos work?

If you have ever tried to eat an ice-cream cone before it melts all over your hand, or you've taken a sip of hot tea only to discover it has turned to iced tea, then you've been frustrated by one of the most fundamental principles of the universe: heat flows from warmer objects to cooler ones. For centuries, people have sought creative ways to circumvent this law of nature, and one of the most well-known solutions is the thermos.

This week students learn that the simple thermos bottle is designed to inhibit heat transfer by conduction, convection, and radiation. A thermos has insulators that interfere with conduction; between the walls of the thermos, there is a vacuum, which limits the flow of heat by convection; and inside the thermos, a mirror-like reflective surface blocks heat transfer through radiation. Yet this only works for a little while. The law of heat transfer dictates that eventually, even a hot or a cold beverage stored in a thermos will reach room temperature.

Day One

Materials: page 147; thermos bottle

Before students read the passage, review the three processes by which heat is transferred: *conduction*, *convection*, and *radiation*. Then allow students to examine the thermos bottle and to guess how its design might slow the transfer of heat. Have students read the passage and complete the activities. Review the answers together.

Day Two

Vocabulary: *insulator*

Materials: page 148

Introduce the vocabulary word and ask students if they have ever heard of the walls of a building being lined with insulation, and what it might be used for. (to keep heat from escaping in winter and from entering in summer) Have students read the passage and complete the activities. For activity B, you may want to point out that metal is a good conductor.

Day Three

Vocabulary: *vacuum*

Materials: page 149

Introduce the vocabulary word and have students read the passage. Then explain the diagram by pointing out that the arrows represent heat, which cannot escape the thermos due to the vacuum. Instruct students to complete the activities. Review the answers together.

Day Four

Materials: page 150

Before students read the passage, have them recall why metal objects are not used inside microwave ovens. (Metal reflects microwaves, which are a kind of radiation.) After students finish reading, have them complete the activities. If students have trouble with activity B, prompt them with examples of words containing the root *therm*. (*thermostat, thermometer, thermal energy, hypothermia*, etc.)

Day Five

Materials: page 151

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

Name _____

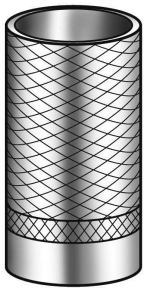
Daily Science
Big Idea 5
WEEK 4

Day 1

Weekly Question

How does a thermos work?

In 1892, a scientist named James Dewar needed a way to store extremely cold liquid oxygen without the heat from his laboratory warming up his samples. So Dewar designed a container that was able to hold liquid oxygen at −300°F. This container, which became known as the Dewar flask, is the ancestor of the modern thermos bottle. The thermos is an amazing container that can not only keep cold things cold but can keep hot things hot. It maintains temperature by slowing the transfer of heat due to conduction, convection, and radiation.



Dewar flask

modern thermos

A. Fill in the blanks to explain the direction in which heat is flowing between the hand and the container in each picture.

picture 1

picture 2

1. In picture 1, heat is flowing from the _____ to the _____.

2. In picture 2, heat is flowing from the _____ to the _____.

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

1. Heat flows from objects at room temperature to objects that are warmer.

2. James Dewar invented a special flask to keep liquid oxygen warm.

3. A thermos maintains temperature by slowing condensation, convection, and radiation.

Name _____

Daily Science
Big Idea 5
WEEK 4

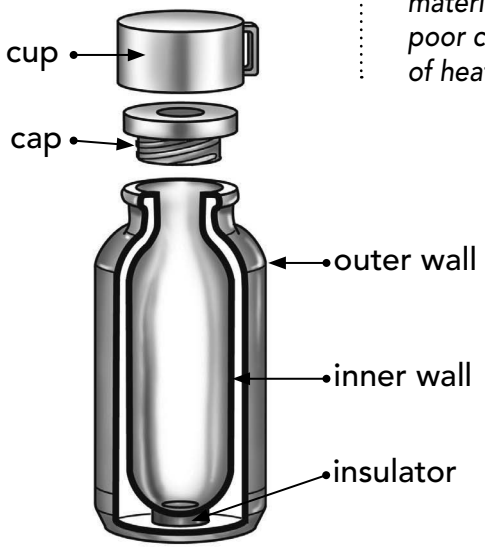
Day 2

Weekly Question

How does a thermos work?

One way to slow down the transfer of heat between objects is to keep them separated. This stops heat transfer by conduction, which requires that objects physically touch each other for heat to flow from one to the other. A second way to slow conduction is by the use of **insulators**. Materials such as plastic, wood, and fabric are poor conductors of heat and therefore make good insulators. Air can work as an insulator as well. For example, Styrofoam® cups have tiny air pockets in the foam that keep heat from moving out or in.

A thermos is basically a bottle inside a bottle that limits heat conduction in both ways—through the use of insulators and physical separation. The inner bottle, which is where you put your hot or cold drink, has little contact with the outside. The only places where heat can travel are through the thermos cap and at points where the inner and outer walls of the bottles meet. And to further reduce heat conduction, these parts of the thermos are made from insulators.



Vocabulary

insulator
IN-suh-lay-ter
material that is a poor conductor of heat

A. List the two ways a thermos bottle slows heat transfer by conduction.

1. _____

2. _____

B. If you were designing a pot to cook spaghetti in, which parts would you make from good conductors of heat? Which parts would you make from insulators? Explain your answer.

_____

_____

Name _____

Daily Science
Big Idea 5
WEEK 4

Day 3

Weekly Question

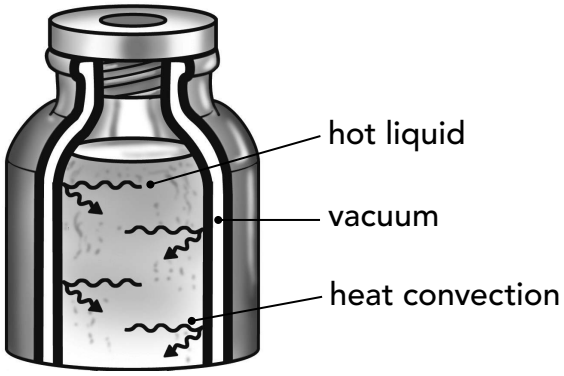
How does a thermos work?

While air is a good insulator, a **vacuum** is even better. That is because in a vacuum, heat cannot be transferred by convection. Remember that convection is the transfer of heat by movement of a gas or a liquid. Since there is no air in the space between the walls of a thermos bottle, convection of heat does not occur. In fact, another name for a thermos is *vacuum bottle*.

Many devices utilize a vacuum. For example, foods that are vacuum-packed are sealed within a vacuum in order to keep air from touching the food and spoiling it. On the other hand, despite its name, a vacuum cleaner doesn't actually contain a vacuum. But it does create one by pulling air through it when it is turned on.

Vocabulary

vacuum
VAK-yoom
a space empty of air or other material



A. Write *true* or *false*.

1. Convection cannot take place in a vacuum. _____

2. A vacuum cleaner creates conduction when it is turned on. _____

3. The space between the thermos walls contains a vacuum. _____

4. A vacuum is a good conductor. _____

B. Use words from the passage to complete the sentences.

1. Some foods are packed within a _____ to keep air out.

2. _____ requires the movement of a gas or a liquid.

Name _____

Daily Science
Big Idea 5
WEEK 4

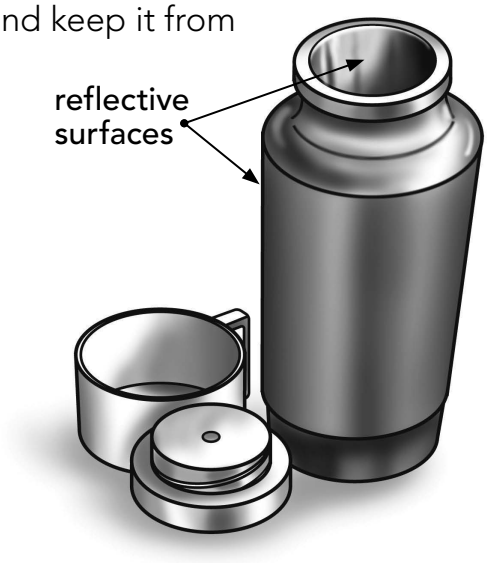
Day 4

Weekly Question

How does a thermos work?

The inside surface of the inner bottle of a thermos is shiny, like a mirror. This reflective surface is not just for looks. Shiny surfaces block the loss of heat energy through radiation, which is the movement of energy through matter and space. The shiny surface inside a thermos prevents heat from a hot drink from radiating out of the vessel. Some thermoses even have shiny outer surfaces. These surfaces reflect heat from outside the bottle and keep it from warming up cold drinks.

A thermos bottle is designed to slow the transfer of thermal energy by radiation, convection, and conduction, and it relies on reflective surfaces, a vacuum, and the use of insulators to do this. However, no container can completely stop all types of heat transfer. Even a thermos can only slow the flow of heat. Eventually, a hot or cold liquid in a thermos will reach room temperature.



A. Explain in your own words how the shiny surfaces of a thermos help keep hot drinks hot and cold drinks cold.

_____

_____

_____

B. The word *thermos* contains the Greek root *therm*, meaning "heat." List three other words that contain *therm* and write their definitions.

1. _____

2. _____

3. _____

Name _____

Daily Science
Big Idea 5
WEEK 4

Day 5

Weekly Question

How does a thermos work?

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

insulator	**room temperature**
conductors	**vacuum**

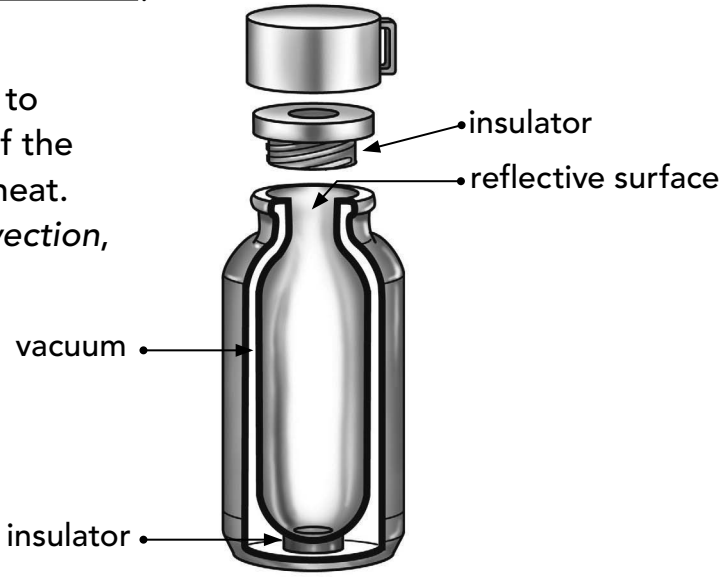
1. To keep from burning his hand on the hot pan, the chef wore an oven mitt as an _____.

2. A _____ limits the flow of heat by convection.

3. Metals are excellent _____ of heat.

4. Although a thermos limits heat transfer, eventually its contents will reach _____.

B. Write a caption for this diagram to explain how each labeled part of the thermos helps slow the flow of heat. Use the words *conduction*, *convection*, and *radiation* in your answer.



_____

_____

_____

Name _____

Unit Review

Comprehension

Take the Heat

Daily Science Big Idea 5 WEEK 5

Fill in the bubble next to the correct answer.

1. What are three ways heat can move between objects?

Ⓐ energy, wavelengths, evaporation
Ⓑ radiation, conduction, convection
Ⓒ insulators, conductors, condensers
Ⓓ absorption, microwaves, condensation

2. _____ is the measure of the kinetic energy of a substance's molecules.

Ⓐ condensation
Ⓑ radiation
Ⓒ temperature
Ⓓ latitude

3. Hurricanes transfer thermal energy by means of _____.

Ⓐ convection and heat of condensation
Ⓑ conduction and convection
Ⓒ radiation and conduction
Ⓓ heat of condensation and radiation

4. Why were the first microwave ovens sometimes referred to as "radar ranges"?

Ⓐ They could detect radio signals.
Ⓑ They were invented by James Radar.
Ⓒ They used radar to cook food.
Ⓓ Microwave ovens and radar systems both use microwaves.

5. Which feature of a thermos does *not* limit heat flow?

Ⓐ its insulators
Ⓑ the vacuum inside it
Ⓒ its shiny surface
Ⓓ its cup

6. The state of matter in which water molecules move the fastest is _____.

Ⓐ solid
Ⓑ ice
Ⓒ gas
Ⓓ liquid

Name _____

Unit Review

Vocabulary

You're Getting Warmer

Daily Science Big Idea 5 WEEK 5

Write the vocabulary word that matches or completes each clue.

1. the energy of motion _____
2. liquid changing into gas _____
3. the flow of thermal energy _____
4. Microwave ovens use _____ to cook food.
5. the distance between two peaks _____
6. moving about or flowing _____
7. something that slows the flow of heat _____
8. For heat transfer to occur by _____, objects must be in physical contact.
9. the measure of the kinetic energy of a substance's molecules _____
10. an artificial object orbiting Earth _____
11. typical or ordinary _____
12. a type of radiation that is absorbed by water _____
13. This is the heat that is released when raindrops form. _____
14. Hurricanes transfer heat by _____.
15. the absence of air _____

circulating
conduction
convection
conventional
heat
heat of condensation
insulator
kinetic energy
microwave
phase change
radiation
satellite
temperature
vacuum
wavelength

Name _____

Daily Science
Big Idea 5
WEEK 5

Unit Review

Visual Literacy

Conduction, Convection, and Radiation

The picture below shows examples of heat being transferred through *conduction*, *convection*, and *radiation*. Label where each of these is taking place. Then write a caption to explain how conduction, convection, and radiation are warming the objects in the picture.

_____

_____

_____

_____

Name _____

Daily Science
Big Idea 5
WEEK 5

Unit Review

Hands-on Activity

Purple Swirl

To see the effects of heat transfer in action, all you need is food coloring and water. You don't even need your hands to make the water swirl—thermal energy does all the work!

What You Need

- clear glass or plastic tray, or other rectangular container
- large Styrofoam® cup containing very hot water
- large Styrofoam® cup containing ice water
- red and blue liquid food coloring

1. Fill the tray with lukewarm water.
2. Set the tray on top of the two cups, with the hot cup under one end and the cold cup under the other.
3. Add several drops of red food coloring to the water above the hot cup, and several drops of blue food coloring to the water above the cold cup.

What Did You Discover?

1. Describe the direction(s) the water moves. Why does it move that way?

_____

_____

2. Which forms of heat transfer are you observing?

_____

3. What is the advantage to using foam cups for the hot and cold water?

_____

4. What eventually happened to the color of the water in the tray?

_____

When a new substance is made through a chemical reaction, it has properties that are different from the original substances.

Key Concepts
Chemical Reactions and Chemical Reactivity

National Standard
Substances react chemically in characteristic ways with other substances to form new substances (compounds) with different characteristic properties.

While students may understand that a substance has observable traits, they might not comprehend that substances have chemical properties that determine how they will react with other substances. In this Big Idea, students learn that:

- soda is a mixture containing different substances with different physical properties;
- in the chemical reaction that causes corrosion, iron reacts with oxygen to form rust;
- a battery produces electricity through a chemical reaction that is reversible; and
- reactants brought together on a match head combine in a combustion reaction that is not reversible.

Teacher Background

Chemical reactions happen all around us, all the time. When we light a match, a chemical reaction occurs. When a battery provides electricity or metal rusts, chemical reactions are taking place. In this unit, students gain an understanding of the basic principles governing these reactions, and learn that the reactions result in new substances with different characteristic properties.

Before students are introduced to chemical reactions, they learn that all substances have physical properties. When substances undergo a physical change, their chemical makeup does not alter. This is in contrast to a chemical change, in which a substance's chemical makeup *is* altered. Understanding the concepts of physical and chemical changes helps students understand the various types of chemical reactions, including oxidation, reduction, electrochemical reactions, and combustion, that students observe around them every day.

For specific background information on each week's concepts, refer to the notes on pp. 158, 164, 170, and 176.

Unit Overview

WEEK 1: What puts the fizz in soda?

Connection to the Big Idea: Soda is a mixture of different substances that have different physical properties. By studying the components of a soft drink solution, students learn about physical properties such as boiling point, freezing point, and solubility.

Content Vocabulary: *boiling point, carbonated, freezing point, mixture, soluble, solution*

WEEK 2: Why does metal rust?

Connection to the Big Idea: Corrosion is the result of a chemical reaction that creates rust. Students learn that when iron and oxygen react with one another, the new compound iron oxide is formed. Iron oxide has properties that are different from the original metal.

Content Vocabulary: *chemical reaction, compound, corrosion, oxidized, product, reactant, reduced*

WEEK 3: Why do batteries die?

Connection to the Big Idea: Substances have chemical properties that determine how they will react with other substances to form compounds. Students learn that the reactants in an electrochemical reaction combine to generate electrons. A battery "dies" when the chemical reactants are used up. When the battery is connected to a source of electricity, the electrochemical reaction is reversed and the battery is recharged.

Content Vocabulary: *acid, chemical properties, current, electrode*

WEEK 4: Why can't you light a match more than once?

Connection to the Big Idea: Combustion is a type of chemical reaction that creates heat and light. While learning about the invention of the match, students learn about the concepts of chemical stability, reactivity, and irreversible reactions.

Content Vocabulary: *combustion, friction, ignite, irreversible, reactive, stable*

WEEK 5: Unit Review

You may choose to do these activities to review the concept of chemical reactions.

p. 182: Comprehension Students answer multiple-choice questions about key concepts in the unit.

p. 183: Vocabulary Students write vocabulary words from the unit to match clues.

p. 184: Visual Literacy Students study diagrams of a match being lit and answer questions about the physical and chemical changes taking place.

p. 185: Hands-on Activity Students reverse the oxidation process by cleaning dirty pennies in an acid solution. Instructions and materials needed for the activity are listed on the student page.

When a new substance is made through a chemical reaction, it has properties that are different from the original substances.

Week 1

What puts the fizz in soda?

This week students are introduced to mixtures and solutions in the context of a familiar drink. Mixtures, students learn, can have physical properties that are different from those of the pure substances they are made up of. A carbonated soft drink is a mixture of sweet, flavored water and carbon dioxide gas. This gas, which is put under pressure during the bottling process, escapes into the air in the form of bubbles and fizz as soon as the soda is opened.

The example of soda provides an opportunity to learn about three physical properties of substances: boiling point, freezing point, and solubility. The fizz in soda is actually carbon dioxide gas that is boiling out of the liquid because carbon dioxide's boiling point is much lower than room temperature. However, the sugar-water solution of soda freezes at a lower temperature than pure water does because the solution has a lower freezing point. And the fact that soda contains dissolved carbon dioxide and sugar demonstrates the solubility of these substances.

Day One

Vocabulary: *carbonated, mixture*

Materials: page 159

Introduce the vocabulary and have students read the passage. Then point out that mixtures can be solids, liquids, or gases. Invite students to name solids, liquids, and gases that they think are mixtures. (e.g., sand, cake batter, iced tea, air) Have students complete the activities and review the answers together.

Day Two

Vocabulary: *boiling point, freezing point*

Materials: page 160

Introduce the vocabulary and point out that *boiling point* and *freezing point* indicate changing states of matter, from liquid to gas and from liquid to solid, respectively. After students have read the passage, explain that water is the only substance on Earth that can exist in all three states of matter under normal atmospheric conditions. Carbon dioxide, on the other hand, is a gas under normal conditions. It can only liquefy under intense pressure or turn to dry ice in extreme cold. Have students complete the activity. Review the answers as a group.

Day Three

Vocabulary: *soluble, solution*

Materials: page 161

Introduce the vocabulary. Then explain that a substance's ability to be dissolved in a liquid is called its *solubility*. Point out that the words *solution*, *soluble*, *solubility*, and *dissolve* are derived from the word root *solv*, which means "to loosen." Have students read the passage and complete the activities. Review the answers together.

Day Four

Materials: page 162

Have students read the passage and complete the activities. If students need help with activity C, remind them that the ocean contains salt water, while a pond contains fresh water.

Day Five

Materials: page 163

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

Name _____

Daily Science
Big Idea 6
WEEK 1

Day 1

Weekly Question

What puts the fizz in soda?

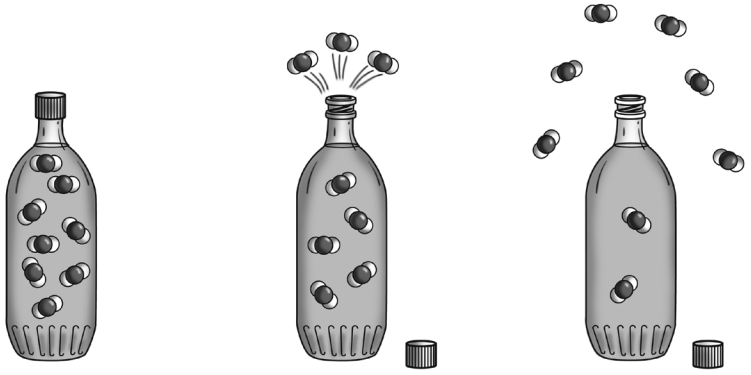
Have you ever popped open a can or bottle of soda, only to be sprayed with a wet burst of bubbles? That rush of liquid and fizz is propelled by carbon dioxide (CO_2) gas in your drink. In fact, this presence of carbon dioxide is why soft drinks are called **carbonated** beverages. Carbonation occurs during the manufacturing and bottling process, when large amounts of carbon dioxide gas are added to flavored water. The **mixture** of liquid and gas is put under pressure before the can or bottle is sealed.

As soon as you open your soda, the pressure is released and CO_2 escapes into the air. The gas will continue to leave your soda until the amount of CO_2 in the liquid is equal to the amount of CO_2 in the air. That's why, if you don't finish your soft drink right away, your drink goes "flat."

Vocabulary

carbonated
KAR-buh-nay-tid
containing carbon dioxide gas

mixture
MIKS-chur
a combination of two or more different substances



A. Use the vocabulary words to complete the sentences.

1. Club soda is a _____ beverage.
2. Chocolate milk is a _____ of chocolate syrup and milk.

B. Mixtures can usually be separated into their individual substances. Explain how, in a carbonated liquid, the gas separates from the liquid.

_____

_____

Name _____

Daily Science
Big Idea 6
WEEK 1

Day 2

Weekly Question

What puts the fizz in soda?

When you think of a boiling mixture, you probably don't picture an ice-cold soda. But, in fact, that's just what is happening when you see bubbles in your soft drink. Carbon dioxide gas is, in effect, "boiling" out of your cold soda. Unlike water, which has a **boiling point** of 100˚C (212˚F), carbon dioxide changes from liquid to gas at −57˚C (−70˚F). So even at the temperature of a chilled soda, CO_2 is still a gas, and it bubbles out of the liquid.

Boiling point and **freezing point** are physical properties of a substance. Physical properties may include color, hardness, texture, or many other characteristics of matter that can be measured or seen. The freezing point of carbon dioxide gas is −78˚C (−109˚F). At this temperature, CO_2 becomes a solid, taking the form of dry ice. But in the same way that the boiling point of a substance doesn't have to be terribly hot, the freezing point doesn't have to be very cold, either. Liquid gold, for example, "freezes" at 1,064°C (1,947°F).

Vocabulary

boiling point
BOY-ling POYNT
the temperature at which a liquid changes into a gas

freezing point
FREE-zing POYNT
the temperature at which a liquid changes into a solid

Room temperature is approximately 20°C (68°F). Use the information in the table below to answer the questions.

	Freezing Point	Boiling Point
Water	0°C	100°C
Nitrogen	−210°C	−196°C
Mercury	−39°C	357°C
Gold	1,064°C	2,856°C

1. Which substance has the highest boiling point? _____

2. Which substance has the lowest freezing point? _____

3. Which substance is a solid at room temperature? _____

4. Which two substances are liquids at room temperature? _____

Name _____

Daily Science
Big Idea 6
WEEK 1

Day 3

Weekly Question

What puts the fizz in soda?

Soda is more than just a mixture of liquid and gas. It is also a **solution**, meaning it is a liquid that contains substances that have been dissolved. Soda is made mostly of water, which can dissolve many substances. Carbon dioxide gas, for instance, is **soluble** in water. Soft drinks also contain dissolved solids, such as sugar.

Not all substances are soluble in water. For example, oil does not dissolve well in water. So when you shake a bottle of salad dressing that contains oil, water, and vinegar, the liquids mix together only temporarily. After a while, the oil separates from the vinegar and water and floats to the top of the liquid mixture.

Vocabulary

soluble
SOL-yoo-bul
able to be dissolved

solution
suh-LOO-shun
a mixture, usually liquid, in which all the components are mixed evenly

A. *Solubility* is a physical property. The table below shows the solubility of various substances in water. The higher the number, the more soluble the substance is. Use this information to answer the questions.

	Solubility (per gram of water)
Oxygen	0.0000434 gram
Carbon dioxide	0.00145 gram
Sugar	2.0 grams
Salt	0.36 gram

1. Which substance dissolves best in water? _____

2. Which gas dissolves more easily in water—oxygen or carbon dioxide? _____

3. Which substance is the least soluble in water? _____

B. If you mixed peanut butter with water, do you think it would make a solution? Explain why or why not.

_____

Name _____

Daily Science
Big Idea 6
WEEK 1

Day 4

Weekly Question

What puts the fizz in soda?

If you've ever tried to make a Popsicle® out of soda, you've probably noticed that soda doesn't freeze very well. That's because, although soft drinks are mostly water, the physical properties of water change when other ingredients are dissolved into it. In fact, most mixtures and solutions have physical properties that are different from the pure substances they are made of. Adding carbon dioxide and sugar to water lowers the freezing point of the solution as compared to that of pure water. So it takes colder temperatures to freeze soda than it does to freeze pure water.

The same thing is true when you add salt to water. Pure water freezes at 0°C, but a solution that is 20% salt freezes at −16°C. This is why salt is spread on snowy highways in winter. The salt dissolves into the ice and snow and causes it to melt. Until temperatures dip below −16°C, salt can help keep roads from icing up.

A. Answer the questions.

1. Which freezes at a warmer temperature, pure water or soda? _____

2. Which has a higher freezing point, a 20% salt solution or pure water? _____

B. A liquid called "antifreeze" is sometimes added to water to keep it from freezing. How do you think antifreeze works? Fill in the bubble next to the correct answer.

Ⓐ It lowers the boiling point of water.
Ⓑ It lowers the freezing point of water.
Ⓒ It dissolves water.
Ⓓ It carbonates the water.

C. Which do you think would freeze first, a pond or the ocean? Use the word *freezing point* in your answer.

_____

_____

Name _____

Daily Science
Big Idea 6
WEEK 1

Day 5

Weekly Question

What puts the fizz in soda?

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

boiling point	**solution**	**carbonated**
freezing point	**mixture**	

1. A soft drink is a _____ of gas, sugar, and water, but it is also a _____ because the gas and sugar are dissolved in the water.

2. Carbon dioxide's _____ is very low, which is why it is a gas at room temperature.

3. Carbon dioxide gas is what makes a soft drink _____.

4. The _____ of soda is lower than that of pure water.

B. Cross out the incorrect word in each sentence and write the correct word or words above it to make the statement true.

1. Water is a solid at room temperature.

2. Carbonation involves mixing oxygen gas into a beverage.

3. The freezing point of water increases when salt is added.

4. Oil forms a solution with the water and vinegar in salad dressing.

C. Fill in the bubble next to the words that complete the analogy.

Boiling point is to **gas** as _____.

Ⓐ **freezing point** is to **liquid**

Ⓑ **freezing point** is to **solid**

Ⓒ **liquid** is to **solid**

Ⓓ **solid** is to **liquid**

When a new substance is made through a chemical reaction, it has properties that are different from the original substances.

Week 2

Why does metal rust?

This week students learn about chemical reactions by studying one of the most commonly observed reactions occurring in nature: the rusting of metal. Unlike physical changes, which do not alter the chemical makeup of substances, a chemical reaction produces a change that transforms the substances into a brand-new material. Rust, for example, is created when iron reacts with oxygen and forms a new compound called iron oxide.

The chemical reaction that produces rust happens when electrons move from iron atoms to oxygen atoms. A substance's loss of electrons is known as *oxidation*, while a gaining of electrons is called *reduction*. In the formation of rust, iron is oxidized and oxygen is reduced. For every oxidation that occurs in a chemical reaction, a reduction must also take place.

Day One

Vocabulary: *chemical reaction, corrosion*

Materials: page 165

Invite students to recall times they have seen rust on something, such as a car, a metal fence, or a pipe, and to describe what the rust looked like. Then introduce the vocabulary and point out that *corrosion* is the result of the chemical reaction that creates rust. Have students read the passage and complete the activities. Review the answers together.

Day Two

Vocabulary: *compound, product, reactant*

Materials: page 166

Introduce the vocabulary and have students read the passage. Then explain that iron and oxygen are elements, which are pure chemical substances that cannot be separated into simpler substances. However, rust (iron oxide) is a compound consisting of the elements iron and oxygen. Instruct students to complete the activities. Then review the answers as a group.

Day Three

Vocabulary: *oxidized, reduced*

Materials: page 167; apple or avocado, plastic knife

Cut the avocado or apple into pieces and ask students to predict what will happen to them within a few minutes. (The cut surfaces will turn brown.) Then introduce the vocabulary and have students read the passage. After they have completed the activities, have students look at the cut-up fruit and note any changes. Explain that substances in the fruit react with oxygen in the air and that, like metal, fruit also oxidizes.

Day Four

Materials: page 168

Have students read the passage. Then point out that the Golden Gate Bridge in San Francisco is painted orange not only to protect it from corrosion, but to provide visibility to passing ships and airplanes as well. Have students complete the activities and review the answers together.

Day Five

Materials: page 169

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

Name _____

Daily Science
Big Idea 6
WEEK 2

Day 1

Weekly Question

Why does metal rust?

You know what rusty metal looks like, but have you ever wondered why you've never seen rust on a piece of wood or plastic? Rust is a sign of **corrosion**, which occurs when metal is exposed to air and moisture. Metal that is rusted may be crumbly, have holes in it, or have rough, reddish-brown patches on it.

Corrosion in metals arises from a **chemical reaction**, which is a process in which substances react to form new substances. A chemical reaction is different from a physical change. When you scratch metal, the chemical makeup of metal stays the same, even if its appearance changes. But when metal rusts, a chemical reaction takes place between water, oxygen, and iron that changes the metal into a whole new substance.

Vocabulary

chemical reaction
KEM-ih-kul ree-AK-shun
a change in which one or more new substances are formed

corrosion
kuh-ROH-zhun
a chemical wearing away of a material

A. Use the vocabulary words to complete the sentences.

1. One way to protect a car from _____ is to keep it inside a garage.

2. A _____ can occur when substances are exposed to air and moisture.

B. Explain in your own words how a chemical reaction is different from a physical change.

_____

_____

Name _____

Daily Science

Big Idea 6

WEEK 2

Day 2

Weekly Question

Why does metal rust?

During a chemical reaction, substances called **reactants** recombine to form new substances called **products**. In the chemical reaction that forms rust, the reactants are iron and oxygen. The product they form when they recombine is a **compound** called iron oxide. Adding water speeds up the corrosion process.

Iron oxide, like all products of a chemical reaction, has properties that are different from its original substances. One difference between pure iron and iron oxide is that iron oxide takes up more space. That means that if a metal structure starts to rust, the rusted area may push apart the areas that are not rusted. This can result in cracks in the structure. The compounds that form rust are also weaker than iron, which means they crumble more easily. So you can see why a lot of rust can be bad for structures and machinery made of metal, such as bridges and cars!

Vocabulary

compound
KOM-pownd
a substance made of two or more elements that are chemically combined

product
PRAH-dukt
a new substance that is formed during a chemical reaction

reactant
ree-AK-tent
a substance that changes during a chemical reaction

A. What are two properties of iron oxide that are different from iron?

1. _____

2. _____

B. Cross out the incorrect word or phrase in each sentence and write the correct one above it to make the statement true.

1. Rust is the product of the chemical reaction between iron and oxide.

2. A compound is made from a single element.

3. The properties of reactants are the same as the properties of products.

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

Iron is to **iron oxide** as **reactant** is to _____.

❒ **product** ❒ **rust** ❒ **oxygen** ❒ **substance**

Name _____

Daily Science
Big Idea 6
WEEK 2

Day 3

Weekly Question

Why does metal rust?

As with any chemical reaction, the formation of rust involves the transfer of electrons. When iron reacts with oxygen and forms the new compound iron oxide, the reaction occurs because electrons move from the metal atoms to the oxygen atoms. In other words, the iron that loses electrons is **oxidized**. In the same reaction, oxygen gains electrons from the iron and is **reduced**. For every electron that is lost by a substance in a chemical reaction, an electron is gained by another substance.

The oxidation and reduction process happens all around us, all the time. In fact, many cleaning products contain substances that oxidize. Household bleach, for example, removes stains by oxidizing them.

In other situations, oxidation isn't such a positive thing. For instance, air can oxidize food, causing it to spoil or go stale. This is why some foods include substances called *antioxidants*. Antioxidants give up their electrons very easily, so they satisfy the appetite of "electron-hungry" oxygen atoms and protect the food.

Vocabulary

oxidized
OX-ih-dyzd
to have lost electrons

reduced
ree-DOOST
to have gained electrons

A. In each reaction described below, underline the substance that gets oxidized.

1. An apple turns brown after reacting with air.
2. Bleach removes a stain.
3. Oxygen picks up electrons found in food.
4. An iron key rusts in the rain.

B. Fill in the bubble next to the activity that slows down oxidation.

Ⓐ removing the lid from a jar of food
Ⓑ keeping a car in a dry garage
Ⓒ peeling an apple
Ⓓ adding bleach to a stain

Name _____

Daily Science
Big Idea 6
WEEK 2

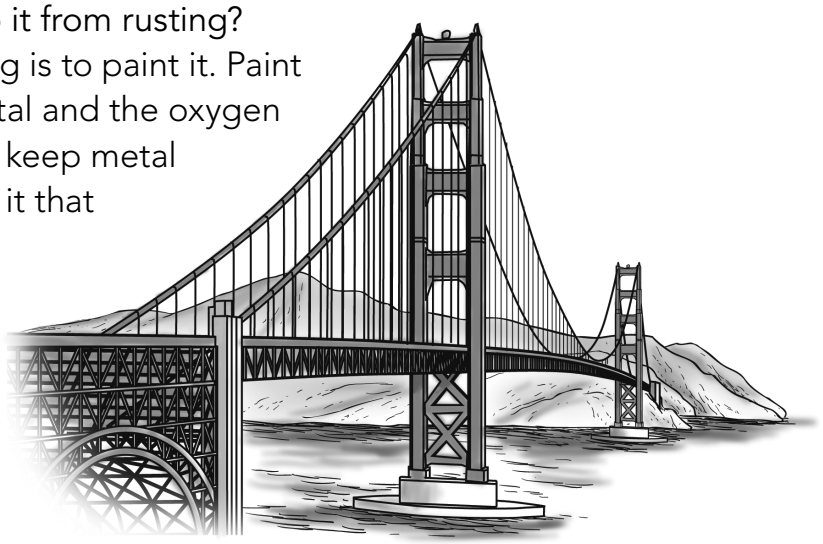
Day 4

Weekly Question

Why does metal rust?

Metal is used to build many types of structures, appliances, and other everyday items because it is strong, easy to shape, and relatively cheap and plentiful. But most metals react with water and oxygen, which is present in almost every environment on Earth. So how do people use metal and keep it from rusting?

One way to keep metal from rusting is to paint it. Paint forms a protective barrier between metal and the oxygen and moisture in the air. Another way to keep metal from oxidizing is to add a substance to it that makes the metal less able to give away its electrons. For example, stainless steel is made from iron that has carbon and chromium added to it. Stainless steel doesn't oxidize or corrode as quickly as ordinary iron. That is why knives are often made of stainless steel. Their blades stay sharp longer.



The Golden Gate Bridge in San Francisco is actually painted orange, not gold.

A. What are two ways to keep metal from rusting?

1. _____

2. _____

B. Name two ways stainless steel is different from ordinary iron.

1. _____

2. _____

C. Check the object that is the *least* likely to be made of stainless steel.

❒ **sauce pan** ❒ **plate** ❒ **scissors** ❒ **refrigerator door**

Name _____

Daily Science
Big Idea 6
WEEK 2

Day 5

Weekly Question

Why does metal rust?

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

oxidized	**reactants**	**compound**	**reduced**
product	**corrosion**	**chemical reaction**	

New substances created through a _____ have properties that are different from the starting materials, and one example of this is rust. In the reaction that creates rust, iron and oxygen are the _____, and a _____ called iron oxide is the _____. During the reaction, electrons move from the metal atoms to the oxygen atoms. When the metal atoms lose electrons, they are _____. When the oxygen atoms gain electrons, they are _____. The result of this process is the _____ of metal.

B. Write *true* or *false*.

1. One way to keep metal from rusting is to paint it. _____

2. Exposure to air and water can cause iron to break down. _____

3. Electrons can't be shared or moved between atoms. _____

4. Rust is created by the oxidation of iron. _____

5. Antioxidants cause food to spoil faster. _____

When a new substance is made through a chemical reaction, it has properties that are different from the original substances.

Week 3

Why do batteries die?

This week, by studying the chemical reactions that take place inside a battery, students learn that a substance's chemical properties determine how it reacts with other substances. When the substances in a battery undergo a reaction, they form new substances and, in the process, produce electrons. This chemical reaction, called an electrochemical reaction, converts the chemical energy available in a battery into the electrical energy needed to power our electronic devices.

A battery's "life" refers to the length of time it is able to supply electricity. When all the reactants in a battery have been used up, the battery stops producing electricity and "dies." For many batteries, however, the electrochemical reaction is reversible and batteries can be recharged.

Day One

Vocabulary: *current*

Materials: page 171; different types of batteries

Show students the different types of batteries you brought in. Allow students to examine the batteries and observe how they are distinguished according to voltage and type. Then have students read the passage. You may want to point out that many electricity-related words are derived from Count Volta's name, including *volts*, *voltage*, and *voltmeter*. Finally, have students complete the activities and review the answers together.

Day Two

Vocabulary: *acid, chemical properties*

Materials: page 172

After introducing the vocabulary, tell students that many acidic substances, such as lemon juice, have a sour taste, and that taste is an example of a *physical property*. An acid's ability to produce hydrogen when dissolved in water is an example of a *chemical property*. Have students read the passage and complete the activities. Review the answers together.

Day Three

Vocabulary: *electrode*

Materials: page 173

Point out to students that electrons are negatively charged particles. Then introduce the vocabulary word and have students read the passage and complete the activities. Review the answers together.

Day Four

Materials: page 174

Have students read the passage. Then invite them to list any devices they use that have chargers. (cell phones, MP3 players, laptops, etc.) Have students discuss the benefits of using batteries that can be recharged. (better for the environment, costs less than buying new batteries, etc.) Then instruct students to complete the activities. Go over the answers as a group.

Day Five

Materials: page 175

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

Name _____

Daily Science
Big Idea 6
WEEK 3

Day 1

Weekly Question

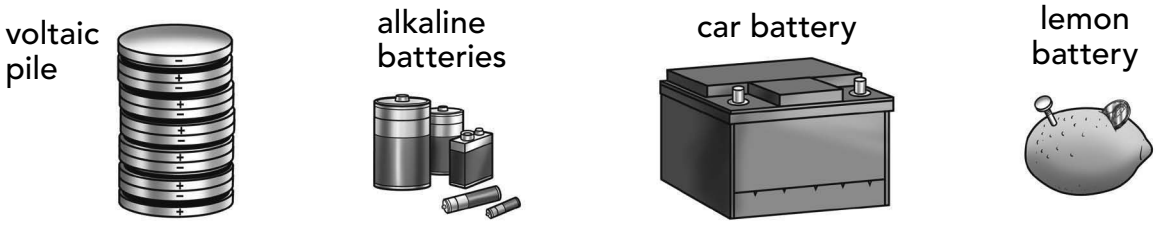
Why do batteries die?

Many materials—from potatoes and lemons to stacks of metal coins—can be used to make a battery. All you need is a material that has the ability to produce a flow of electrons. The first battery, demonstrated by Count Alessandro Volta in 1800, was a stack of discs made of alternating kinds of metal separated by paper soaked with salt water. It was that simple.

Today, batteries come in a variety of materials with different properties. Batteries can be disposable or rechargeable, and they can be made of various compounds such as lithium ion, nickel cadmium, or metal hydride. The different materials used to construct batteries result in differences in the amount of electric **current** produced, the size and cost of the battery, and the lifetime of the battery. But no matter what material is used, eventually every battery "dies" and stops producing electricity.

Vocabulary

current
KUR-int
the flow of electricity through a conductor



Different Kinds of Batteries

A. Write *true* or *false*.

1. Only metals can be used to make a battery. _____

2. Eventually, a battery stops producing electricity. _____

3. Batteries have the ability to generate a flow of electrons. _____

B. Name four ways that batteries can differ from one another, depending on the different materials used to construct them.

1. _____ **3.** _____

2. _____ **4.** _____

Name _____

Daily Science
Big Idea 6
WEEK 3

Day 2

Weekly Question

Why do batteries die?

Batteries generate electricity through a type of chemical reaction called an *electrochemical* reaction. During this particular kind of reaction, the reactants combine to create new substances and, in the process, produce electrons.

Whether or not a reaction produces electrons depends on the **chemical properties** of the reactants. Chemical properties are determined by the chemical composition of a substance and, in turn, control a substance's ability to undergo a particular chemical change. For example, a substance might have the tendency to rust, to catch on fire, to form an **acid**, or to explode. Unlike a physical property, which can be observed without changing a substance's composition or structure, a chemical property can be observed or measured only when a substance undergoes a chemical change.

A. Next to each example of a substance's property, write whether the property is *physical* or *chemical*.

1. Hydrogen explodes when ignited. _____
2. Copper is a reddish-orange, shiny metal. _____
3. Silver reacts with moisture to form tarnish. _____
4. Metal corrodes when exposed to air. _____
5. Water freezes at 32˚F. _____

B. Explain in your own words the difference between physical and chemical properties.

_____

_____

Vocabulary

acid
AS-sid
a chemical compound that, when dissolved in water, produces hydrogen that is missing its electron

chemical properties
KEM-ih-kul PRAH-per-teez
characteristics that determine the chemical changes that a substance can undergo

Name _____

Daily Science
Big Idea 6
WEEK 3

Day 3

Weekly Question

Why do batteries die?

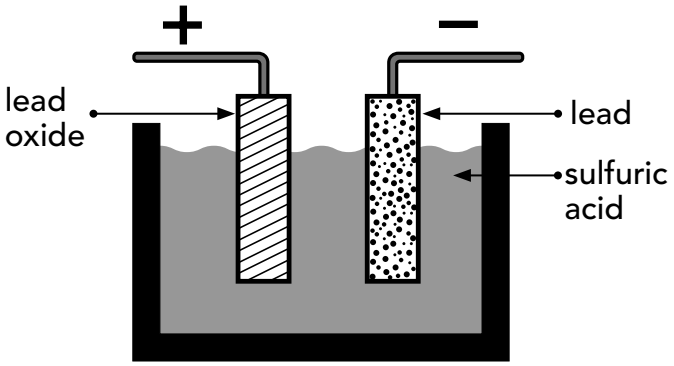
Think of a battery as a reaction chamber filled with chemicals. For example, a typical car battery consists of a series of compartments, each containing a pair of **electrodes** immersed in a kind of acid called sulfuric acid. One electrode is made of lead, and the other electrode is made of lead oxide. Electrodes are where a battery's electrochemical reactions take place, and different reactions take place on different electrodes.

On the lead electrode of a car battery, the lead reacts with sulfuric acid to form a new compound called lead sulfate. This reaction produces electrons, and negative charges build up on the lead electrode.

On the lead oxide electrode, the material also reacts with sulfuric acid to produce lead sulfate. However, this reaction removes electrons from the electrode. As a result, positive charges collect on the lead oxide electrode. When the two electrodes are connected in an electrical circuit, electrons flow from the negatively charged electrode to the positively charged electrode, and electricity is produced.

Vocabulary

electrode
ee-LEK-trohd
a metal rod or plate that can conduct electricity into or out of a battery



lead-acid battery

A. Complete the analogy.

Sulfuric acid is to **reactant** as **lead sulfate** is to _____.

B. Use words from the passage to complete the paragraph.

The lead electrode in a car battery reacts with the acid solution to form _____, and this reaction _____ electrons. The lead oxide electrode reacts with the solution to form the same compound, but this reaction _____ electrons.

Name _____

Daily Science
Big Idea 6
WEEK 3

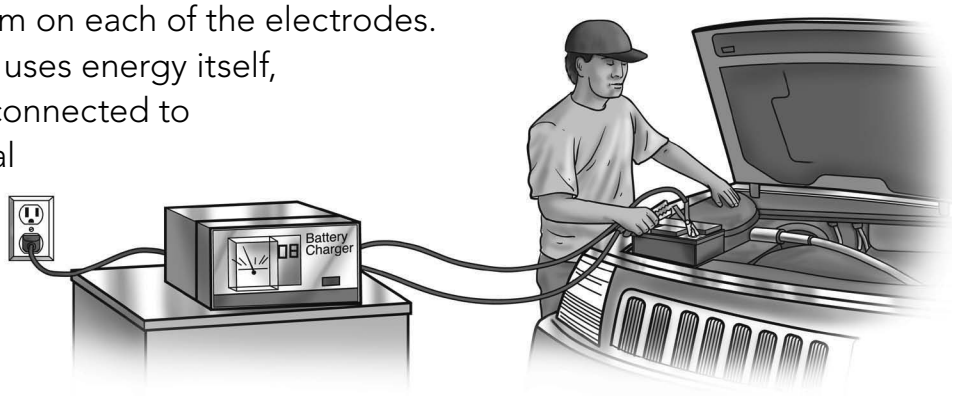
Day 4

Weekly Question

Why do batteries die?

A battery contains only a fixed amount of reactants, so as soon as these reactants have been used up, the reaction stops and the battery goes dead. A dead battery produces no more electrons and no more electricity.

However, some batteries can be recharged by connecting them to a source of electricity such as a wall outlet. This is possible because the electrochemical reactions that create electricity are reversible. When a battery is recharging, electricity flows in the opposite direction. In a car battery, this allows the lead sulfate that coats both of the electrodes to dissolve back into the acid solution. Lead and lead oxide re-form on each of the electrodes. This process of recharging uses energy itself, but when the battery is reconnected to the car, the electrochemical reaction that produces electricity can start all over again.



A. Number the steps in the correct order to show how a battery is recharged.

____ Lead sulfate dissolves into the acid solution.

____ The battery is connected to a source of electricity.

____ Lead and lead oxide re-form on the electrodes.

____ The battery produces electrons.

B. Name two devices you have used or seen that have rechargeable batteries. Then name the source of the energy that you would use to recharge them.

1. _____

2. _____

Name _____

Daily Science
Big Idea 6
WEEK 3

Day 5

Weekly Question

Why do batteries die?

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

chemical properties	**electrodes**	**acid**
electrochemical	**current**	

1. Batteries generate electricity through _____ reactions that take place on _____.

2. An _____ is a substance that generates a form of hydrogen when it dissolves in water.

3. The way a substance reacts or combines with other substances to create new substances is determined by its _____.

4. Different kinds of materials used in batteries result in different amounts of electric _____ produced.

B. Write *true* or *false*.

1. The chemical properties of a substance are determined by its chemical composition. _____

2. The chemical reactions that power a car battery are irreversible. _____

3. All batteries have the ability to produce a flow of electrons. _____

4. When a battery's reactants are used up, it no longer produces electricity. _____

5. All electrochemical reactions produce light. _____

When a new substance is made through a chemical reaction, it has properties that are different from the original substances.

Week 4

Why can't you light a match more than once?

This week students explore the chemistry of how a match burns. They learn that when a match is lit, it undergoes the chemical reaction of combustion and produces energy in the form of heat and light. Inventors of the first matches had to contend with chemical mixtures that tended to spontaneously combust or explode upon lighting. Finding the balance between the stability of substances and chemical reactivity proved to be challenging.

The modern match is a testimony to experimentation and persistence. Inventors finally discovered the proper reactants to produce the desired chemical reaction. Thus, the flash of light and heat that accompanies the strike of a match is a one-time event: the reactants that initiate combustion are limited, and the products of the reaction don't burn again. No matter how hard you rub a burned match against a striking surface, it will not relight.

Day One

Vocabulary: *combustion, ignite*

Materials: page 177

Before students read the passage, explain that people once relied on fire as their only source of heat and light. Then ask: **Why do you think fire was so important? What happened if a person couldn't light a fire?** (He or she might freeze, couldn't see in the dark, couldn't cook food, etc.) Introduce the vocabulary and have students read the passage. Then have them complete the activities and review the answers together.

Day Two

Vocabulary: *friction, stable*

Materials: page 178

Introduce the vocabulary and invite students to list situations in which friction occurs. (e.g., using an eraser or sandpaper, sliding down a slide, dragging a box across the floor) Then have students read the passage and complete the activities. If students need help with the oral activity, prompt them with examples of how friction can be helpful (walking without slipping) or harmful (skinning your knee).

Day Three

Vocabulary: *reactive*

Materials: page 179

Introduce the vocabulary word and have students read the passage. Point out to students that a chemical reaction doesn't start until the reactants are physically brought together. Direct them to complete the activities. Then go over the answers as a group.

Day Four

Vocabulary: *irreversible*

Materials: page 180

Before students read the passage, have them describe what a burned match looks like. (black, misshapen, crumbly, etc.) Then ask students why they think a match can be lit only once. Revisit their hypotheses after they have read the passage. Then instruct students to complete the activities.

Day Five

Materials: page 181

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

Name _____

Daily Science
Big Idea 6
WEEK 4

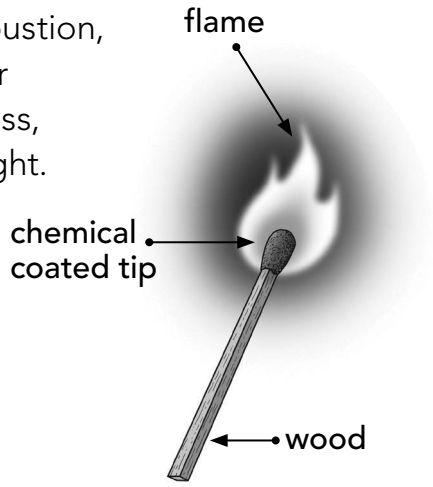
Day 1

Weekly Question

Why can't you light a match more than once?

Imagine trying to start a campfire without a match—it's very hard to do! In fact, before matches were invented, it was often difficult to get a fire going or even light a candle. But by the 1800s, people knew that mixing certain substances together could produce a flame. They applied these chemicals to the ends of sticks to create some of the first matches.

A match produces a flame through a chemical reaction called **combustion**. During combustion, substances combine with oxygen in the air to make new substances and, in the process, produce energy in the form of heat and light.



The first matches that were made could produce a flame, but they had one problem. The chemicals that were put on the match tips sometimes reacted too easily! Early matches could unexpectedly **ignite**, bursting into flames or exploding.

Vocabulary

combustion
kum-BUSS-chun
the oxidation or burning of a substance

ignite
ig-NYT
to catch on fire

A. Use the vocabulary words to complete the sentences.

1. Chemical substances applied to the ends of sticks cause them to _____.

2. A kind of reaction called _____ results in the oxidation of a substance.

B. The first matches were stored in airtight boxes to keep them from igniting suddenly on their own. Why do you think this worked?

_____

_____

Name _____

Daily Science
Big Idea 6
WEEK 4

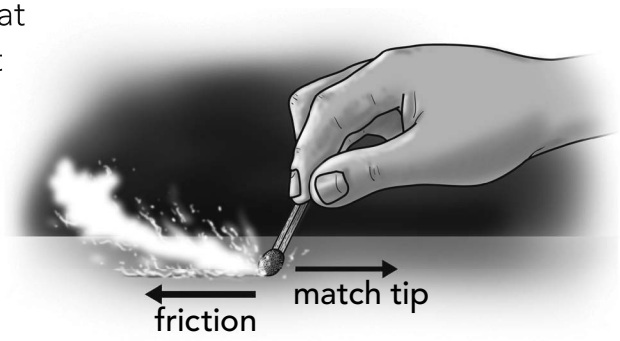
Day 2

Weekly Question

Why can't you light a match more than once?

In 1826, the English chemist John Walker developed a new kind of match. He realized that, in order for a match to work safely, its reactants had to react less easily. In other words, the match had to be a little hard to light. Walker came up with the idea of creating a match that would ignite only when it was rubbed against a surface. He put two substances—potassium chlorate and antimony sulfide—on a match tip. He knew that these substances were relatively **stable** and wouldn't accidentally ignite like some other chemicals. However, he also knew that heat would cause the two substances to react. And this heat could be generated by **friction**.

Friction is a force that resists movement between objects that touch. In the same way that rubbing your hands together causes them to get warm, heat is produced when a match tip is struck against a surface. The heat lasts only a second, but it provides enough energy to start the reaction between chemicals on the match.



Vocabulary

friction
FRIK-shun
a force between two surfaces that resists movement and produces heat

stable
STAY-bul
having the ability to resist a chemical change

Check the boxes next to the statements that are true.

- ❒ John Walker did not think a chemical reaction was required to light a match.
- ❒ Potassium chlorate and antimony sulfide are relatively stable substances.
- ❒ Friction is a force that resists chemical change.
- ❒ Rubbing your hands together is an example of friction.

Talk

In some situations friction is helpful, and in other situations it can hurt. Discuss with a partner two ways friction can be helpful and two ways it may not be.

Name _____

Daily Science
Big Idea 6
WEEK 4

Day 3

Weekly Question

Why can't you light a match more than once?

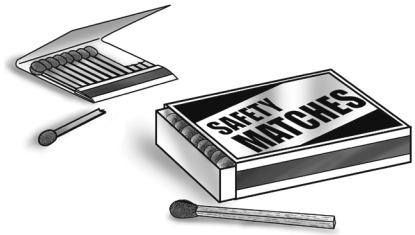
The friction match invented by John Walker was a kind of "strike-anywhere" match. It was called this because the match would ignite after being struck on almost any surface. But the match had a bad smell, so a few years later a new type of match was developed by a chemist who put an odorless chemical called phosphorus into the reaction mix. These matches became popular, but they were dangerous because the phosphorus was very **reactive**.

Finally, in 1844, the "safety match" was created by Swedish inventors. They put a chemical called potassium chlorate on the tip of the match and moved the phosphorus to a strip alongside the matchbox. In this way, the reactants didn't come together until the match was struck against the strip. And the match didn't smell as bad.

Vocabulary

reactive
ree-AK-tiv
able to easily enter into a chemical reaction

Strike-anywhere matches have a white tip.



Safety matches can be made of either wood or cardboard.

A. Explain the difference between a strike-anywhere match and a safety match.

_____

_____

B. Complete the analogy.

Match tip is to **potassium chlorate** as **matchbox strip** is to _____.

C. Cross out the incorrect word and write the correct one above it to make the statement true.

Phosphorus matches were popular, but they were too stable.

Name _____

Daily Science
Big Idea 6
WEEK 4

Day 4

Weekly Question

Why can't you light a match more than once?

A lit match looks very different from an unused match. Fire, smoke, and soot are the most obvious signs of combustion. There are, however, other substances produced from the reaction that are not visible to the eye. These include potassium chloride and compounds called phosphorus oxides. These new substances have properties that are different from the original substances. Most importantly, the new compounds are not very reactive. This is a good thing if you don't want a match to relight accidentally after you have blown it out!

Furthermore, a match contains only a limited amount of reactive material. So after all the reactants have been used up, no amount of friction will cause the match to relight. And unlike a battery that can be recharged, the chemical reaction that ignites a match is **irreversible**.

Vocabulary

irreversible
eer-ih-VERS-ih-bul
unable to go in the opposite direction

unused match | lit match | burned match

A. Give three reasons why a match lights only once.

1. _____

2. _____

3. _____

B. What are two obvious products of combustion? What are two products that are *not* obvious?

Obvious: _____

Not obvious: _____

Name _____

Daily Science
Big Idea 6
WEEK 4

Day 5

Weekly Question

Why can't you light a match more than once?

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

combustion	**friction**	**ignites**
irreversible	**reactive**	**stable**

A match _____ when substances on the match tip combine with oxygen in the air. Early matches used substances that were too _____, which resulted in sudden, unexpected _____ of the matches. In order to create a safe and effective match, inventors needed to find reactants that were more _____. But these reactants didn't light as easily, so one inventor had the idea of using _____ to momentarily heat the substances and start the reaction. To this day, however, no one has invented a match that can be used more than once. This is because the reaction is _____. Once all of the reactants on a match have been used up, it can't light again.

B. Name two ways that people tried to make matches safer.

1. _____

2. _____

Name _____

Daily Science
Big Idea 6
WEEK 5

Unit Review

Comprehension

Ignite Your Curiosity

Fill in the bubble next to the correct answer.

1. Which of these is a chemical property of metal?

Ⓐ It reacts with oxygen to form rust.
Ⓑ It is hard and shiny.
Ⓒ It can conduct electricity.
Ⓓ It has a very high boiling point.

2. Which of these is *not* a way to keep food from oxidizing?

Ⓐ storing it in an airtight container
Ⓑ adding antioxidants
Ⓒ adding carbonation
Ⓓ sealing it securely in plastic wrap

3. In a chemical reaction, _____.

Ⓐ reactants form mixtures
Ⓑ CO_2 gas dissolves
Ⓒ new substances are formed
Ⓓ the freezing point is lowered

4. Which of these is *not* a product of combustion?

Ⓐ heat
Ⓑ light
Ⓒ smoke
Ⓓ wood

5. The electrochemical reaction in a car battery _____.

Ⓐ produces rust
Ⓑ is reversible
Ⓒ stops electric current
Ⓓ is irreversible

6. Which of these is *not* true about soda?

Ⓐ It is a compound.
Ⓑ It has a lower freezing point than water.
Ⓒ It is a sugar-water solution.
Ⓓ It is carbonated.

Name _____

Daily Science
Big Idea 6
WEEK 5

Unit Review

Vocabulary

React to This!

Write the vocabulary word that matches or completes each clue.

1. When a material is _____, it enters easily into a chemical reaction.

2. able to be dissolved _____

3. cannot be reversed _____

4. to catch on fire _____

5. end material in a chemical reaction _____

6. qualities that determine how a substance reacts with other substances _____

7. This chemical reaction produces a flame. _____

8. This generates heat by rubbing. _____

9. a mixture that is a liquid _____

10. The temperature at which liquid changes into a gas is a substance's _____.

11. Substances in a _____ can be separated.

12. not very reactive _____

13. The temperature at which liquid changes into a solid is a substance's _____.

14. starting material in a chemical reaction _____

15. Rusting metal is a sign of this. _____

boiling point
chemical properties
combustion
corrosion
freezing point
friction
ignite
irreversible
mixture
product
reactant
reactive
soluble
solution
stable

Name _____

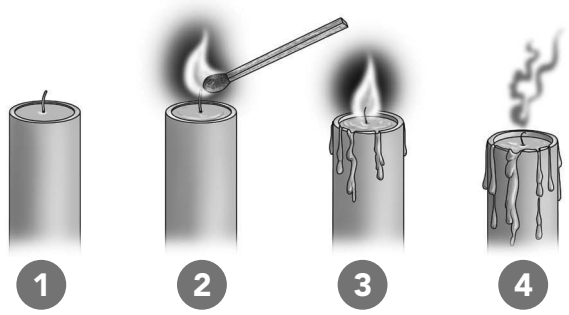
Daily Science
Big Idea 6
WEEK 5

Unit Review

Visual Literacy

Illuminating Discussion

A. Look at the pictures showing a candle as it is lit and after it has been blown out. Then answers the questions below.



1. Name a physical property of the unlit candle in picture 1.

_____

2. Name a physical property of the candle that has been blown out in picture 4.

_____

3. What starts the chemical reaction of the wick burning in picture 2?

_____

4. Which product of combustion is visible in picture 3?

_____

B. Write whether each statement below describes a *physical* or a *chemical* change.

1. The solid wax melts into liquid. _____

2. Chemicals on the match tip ignite. _____

3. Substances in the wax combine with oxygen in the air. _____

Name _____

Daily Science
Big Idea 6
WEEK 5

Unit Review

Hands-on Activity

Penny for Your Thoughts

When copper pennies are first made, they look shiny and new. But after a while, the copper becomes oxidized. Complete the experiment to see what happens when an oxidized penny is placed in an acidic solution. The results are priceless!

What You Need

- ½ cup white vinegar
- 2 teaspoons salt
- 1 shallow clear glass or plastic bowl
- 1 spoon (not metal)
- 20 dull pennies
- 1 clean steel nail
- paper towels

1. Pour the salt and vinegar into the bowl and stir until the salt dissolves.
2. Dump 15 of the copper pennies into the bowl so that they are fully covered in solution.
3. After 10 minutes, remove five pennies from the solution. Rinse them in water and put them on the paper towels to dry.
4. While the rest of the pennies are reacting with the vinegar and salt solution, place the nail halfway into the solution.
5. After 30 minutes, remove the pennies and the nail from the solution. Rinse them and place them on the paper towels to dry.

What Did You Discover?

1. What did you observe when you placed the pennies in the solution?

_____

2. What did the first batch of pennies look like when you removed them from the solution and dried them off? How did they compare to the untreated pennies?

_____

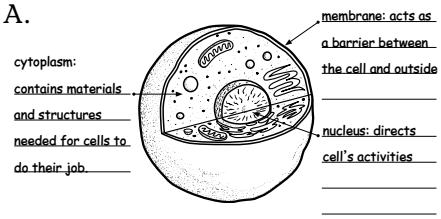
3. What did the nail look like when you removed it from the solution?

_____

Answer Key

***Big Idea 1:** Week 1 • Day 1*

A.



B. Muscle cells help you move, and bone cells give your body its shape.

***Big Idea 1:** Week 1 • Day 2*

1. connective tissue
2. connective tissue
3. muscle tissue
4. connective tissue
5. muscle tissue
6. muscle tissue

***Big Idea 1:** Week 1 • Day 3*

A. 1. The muscle tissue attached to your skeleton is made from long, thin cells.
2. Skeletal muscle cells have more than one nucleus and a cell membrane.
3. When you flex your arm, the muscle tissue becomes shorter and thicker.

B. Answers will vary—e.g., *Voluntary*: hand, neck, tongue *Involuntary*: heart, digestive muscles, lungs

***Big Idea 1:** Week 1 • Day 4*

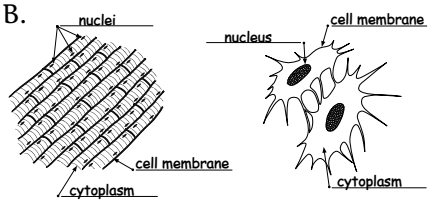
A. *Alike*: Both have cytoplasm and both perform special functions. *Different*: Bone cells are star-shaped and surrounded by calcium, while muscle cells are long and thin and have more than one nucleus.

B. Answers will vary—e.g., As your bones grow, calcium makes them hard, which also makes them stronger.

***Big Idea 1:** Week 1 • Day 5*

A. cell, nucleus, membrane, cytoplasm, tissue, Connective tissue, Muscle tissue

B.



***Big Idea 1:** Week 2 • Day 1*

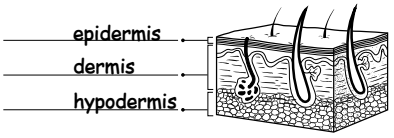
A. 1. epithelial tissue
2. connective tissue

B. It protects the body from the outside world, moves materials in and out of the body, and secretes sweat.

C. *cell* is to *tissue*

***Big Idea 1:** Week 2 • Day 2*

A.



B. 1. dermis
2. epidermis
3. hypodermis

C. the dermis, because this is the layer where hair roots are located and where sensations of temperature are registered

***Big Idea 1:** Week 2 • Day 3*

1. callus
2. sebum
3. sebum
4. callus

TALK: Answers will vary—e.g., Water and soap wash off sebum, which can clog your pores.

***Big Idea 1:** Week 2 • Day 4*

A. 1. The fingers have the most callus cells.
2. because you aren't soaking in water for more than 20 minutes
3. because there aren't many callus cells on your stomach

B. The substance is like sebum because it acts like a waterproof seal. It is different because it comes from a gland near the tail, and ducks have to spread it themselves.

***Big Idea 1:** Week 2 • Day 5*

A. organ, epithelial, hypodermis, dermis, epidermis, sebum, callus

B. 1. false 2. true 3. true

C. First degree burns happen in the epidermis, second degree in the dermis, and third degree in the hypodermis. The more serious the burn, the deeper layer it affects.

***Big Idea 1:** Week 3 • Day 1*

1. esophagus
2. small intestine
3. break down food, absorb nutrients, expel waste

***Big Idea 1:** Week 3 • Day 2*

A. When food is in your mouth, your salivary glands secrete saliva, which, along with chewing, helps break down nutrients for your body to absorb.

B. 1. Both help break down food. Chewing breaks food into smaller pieces but enzymes break down food's nutrients.
2. Answers will vary—e.g., You might choke on food pieces that are too big; you might not break down food enough to get all its nutrients.

***Big Idea 1:** Week 3 • Day 3*

A. 1. acids
2. villi
3. small intestine

B. Strong muscles in the stomach contract to force out spoiled food.

***Big Idea 1:** Week 3 • Day 4*

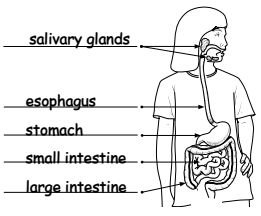
A. 1. absorb water from waste
2. compact the waste
3. expel waste from the body

B. digestive, excretory

***Big Idea 1:** Week 3 • Day 5*

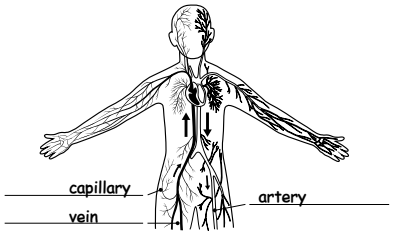
A. digestive system, salivary glands, enzymes, esophagus, intestine, villi

B.



Big Idea 1: Week 4 • Day 1

A.



B. 1. Blood moves oxygen and nutrients throughout the body.
2. Blood carries waste away so it can be eliminated.

Big Idea 1: Week 4 • Day 2

1. plasma
2. white blood cells
3. platelets
4. from red blood cells
5. If that person got a cut, the blood would not clot. He or she would not stop bleeding.

Big Idea 1: Week 4 • Day 3

A. 1. false 2. false 3. true
B. 4.2 billion
C. marrow, stem, blood

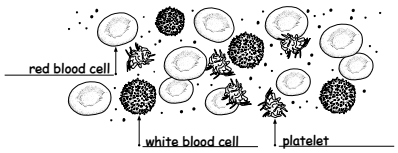
Big Idea 1: Week 4 • Day 4

1. red blood cells
2. accident
3. 40–95 units
4. 5 units

Big Idea 1: Week 4 • Day 5

A. circulatory system, blood vessels, plasma, platelets, marrow, stem cells

B.



C. Answers will vary—e.g., People should donate blood to help those who need it after an accident, during surgery, or when fighting a disease.

Big Idea 1: Week 5 • Unit Review 1

1. A 5. B
2. C 6. C
3. D 7. D
4. B

Big Idea 1: Week 5 • Unit Review 2

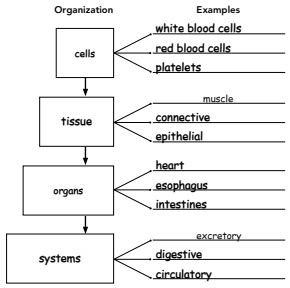
ACROSS

1. cytoplasm
5. tissue
7. marrow
9. esophagus
12. villi
14. enzymes

DOWN

2. plasma
3. dermis
4. hypodermis
6. organ
8. membrane
10. platelets
11. nucleus
13. cell

Big Idea 1: Week 5 • Unit Review 3



Big Idea 1: Week 5 • Unit Review 4

1. The bread broke down into a wet, mushy substance.
2. The gum remained as a wad.
3. The bread is digestible but the gum is not.

Big Idea 2: Week 1 • Day 1

A. *habitat* is to *ecosystem*
B. microorganisms, habitat, ecosystem, decomposers

Big Idea 2: Week 1 • Day 2

A. 1. contains earthworms' food
2. shields earthworms from exposure
3. helps earthworms stay cool and hydrated

B. Earthworms burrow into soil to avoid exposure to the sun and to remain hydrated.

Big Idea 2: Week 1 • Day 3

A. 1. false 2. true 3. false
B. 1. They add nutrients and minerals to the soil with their castings.
2. They aerate soil when they burrow.
3. They help water drain through the soil.

Big Idea 2: Week 1 • Day 4

A. 3, 2, 1, 5, 4
B. Answers will vary—e.g., Soil wouldn't have as many nutrients, so plants might not grow and provide food for animals.

Big Idea 2: Week 1 • Day 5

A. ecosystem, decomposers, castings, aerate, exposure, hydrated
B. 1. As decomposers, earthworms break down kitchen waste and add nutrients to the soil.
2. Not all trash is organic. Some of it is plastic, glass, or other things that don't decay.

Big Idea 2: Week 2 • Day 1

A. *Pandas*: live in China, eat bamboo
Polar Bears: live in the Arctic Circle, eat seals
Both: members of the bear family, consumers, have special adaptations

B. 1. allows a dolphin to breathe underwater
2. keeps sand out of a camel's eyes
3. allows a monkey to grab branches and balance itself

Big Idea 2: Week 2 • Day 2

A. 1. Pandas have flat teeth to help them grind their food.
2. Pandas have a bone that extends from their wrist to help them grasp bamboo.

B. 1. Most bears are omnivores.
2. Pandas cannot easily digest bamboo.
3. A panda's habitat is mild.

Big Idea 2: Week 2 • Day 3

A. 1. helps polar bear swim
2. helps polar bear grip ice and catch prey
3. helps polar bear walk on ice

B. 1. because no plants grow where they live
2. Fur and fat keep the polar bear warm in the cold climate.

***Big Idea 2:** Week 2 • Day 4*

1. false 3. true
2. false 4. true

TALK: Answers will vary—e.g., fight climate change, set aside land for animals, breed them in captivity, stop hunting them, etc.

***Big Idea 2:** Week 2 • Day 5*

A. consumers, omnivores, herbivores, carnivores, adaptations, habitats
B. A polar bear would not survive in a panda's habitat because the polar bear would not have the right food, and the climate would be too warm.
C. Answers will vary—e.g., *Panda ecosystem*: bamboo, rain, cool weather, mountains
Polar bear ecosystem: ice, seals, ocean, frigid temperatures

***Big Idea 2:** Week 3 • Day 1*

A. predator, prey
B. 1. powerful legs
2. sharp teeth
3 strong jaw
4. sharp claws
C. 1. false 2. true 3. true

***Big Idea 2:** Week 3 • Day 2*

A. Answers will vary—e.g., In the savanna food chain, grasses are eaten by gazelles, which in turn are eaten by lions.
B. 1. wide grasslands
2. warm and usually dry
3. scattered shrubs and trees

***Big Idea 2:** Week 3 • Day 3*

A. Answers will vary—e.g.,
1. impala/giraffe
2. acacia tree/grass, giraffe/zebra
3. grass, aardvark, hyena
B. Cheetahs are fast and can outrun prey and lions.

***Big Idea 2:** Week 3 • Day 4*

A. Answers will vary—e.g.,
1. plankton/fish, salmon, grizzly bear/wolf
2. plants, elk/rabbits, wolf/grizzly bear
B. Answers will vary—e.g., The rabbits spread without being eaten. The rabbits hurt the vegetation by eating too much of it.

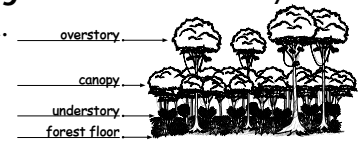
***Big Idea 2:** Week 3 • Day 5*

A. savanna, predators, prey, competition, food chain, food web
B. A food chain is a sequence of organisms in which each member feeds on the one below it. A food web includes many overlapping food chains.
C. 1. *hyena* is to *gazelle*
2. *Alaska* is to *grizzly bear*

***Big Idea 2:** Week 4 • Day 1*

A. Answers will vary—e.g.,
1. warm, humid
2. rainy
3. thousands of plants
B. monkey

***Big Idea 2:** Week 4 • Day 2*

A. 

B. the canopy, because it traps humidity and captures most of the sunlight, which makes it easy for plants to grow

***Big Idea 2:** Week 4 • Day 3*

A. 1. false 3. true
2. false 4. true
B. 1. from dead organic matter that falls from above
2. from the soil

***Big Idea 2:** Week 4 • Day 4*

A. Answers will vary—e.g., The rainforest is home to a wide diversity of life, including insects, frogs, and many types of plants.
B. 1. pollinate flowers
2. help scatter seeds
3. provide nutrients

***Big Idea 2:** Week 4 • Day 5*

A. rainforest, diversity, producers, overstory, understory, canopy, epiphytes
B. 1. forest floor
2. canopy
3. overstory

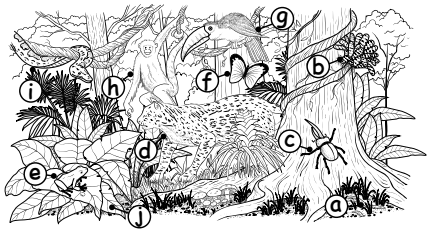
***Big Idea 2:** Week 5 • Unit Review 1*

A. 1. C 3. A 5. B
2. B 4. D 6. C
B. 1. They aerate it.
2. They provide nutrients with their castings.

***Big Idea 2:** Week 5 • Unit Review 2*

1. diversity
2. castings
3. decomposer
4. adaptation
5. savanna
6. hydrated
7. canopy
8. omnivore
9. carnivore
10. epiphyte
11. aerate
12. exposure
13. consumer
14. food web
15. producer
16. predator
17. competition
18. herbivore

***Big Idea 2:** Week 5 • Unit Review 3*



***Big Idea 2:** Week 5 • Unit Review 4*

1. Earthworms ate the lettuce and mixed it into the soil; the other lettuce rotted and didn't move.
2. Earthworms mixed the layers; the other layers stayed in place.
3. Earthworms burrow and bring nutrients deep into the soil, mixing the soil around.

***Big Idea 3:** Week 1 • Day 1*

A. 

B. 1. true 3. true
2. false 4. false
C. 3 milliliters

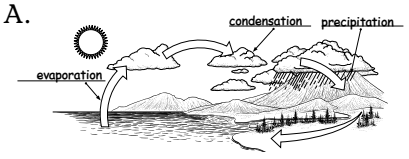
***Big Idea 3:** Week 1 • Day 2*

A. 4, 2, 1, 3
B. 1. evaporate
2. water vapor, humidity

***Big Idea 3:** Week 1 • Day 3*

A. Condensation is when water vapor condenses into a liquid, and precipitation is when that liquid falls to the ground as droplets or ice.
B. boiling water

***Big Idea 3:** Week 1 • Day 4*

A. 

B. Answers will vary—e.g., Because fresh water returns to the ocean through precipitation or by rivers and balances out the salt.

Big Idea 3: Week 1 • Day 5

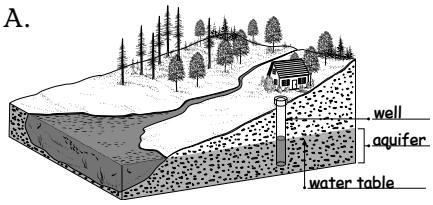
A. water cycle, evaporate, water vapor, humidity, condensation, precipitation
B. Answers will vary—e.g., Yes, because water can be blown to a different location on Earth by the wind. It has also been constantly recycled over millions of years in the water cycle.

Big Idea 3: Week 2 • Day 1

A. 1. 30%
2. It is frozen in glaciers and polar ice caps.
B. 1. irrigation
2. groundwater

Big Idea 3: Week 2 • Day 2

A.



B. Answers will vary—e.g.,
1. sponge 2. skin
C. The water table gets so low that it drops below the reach of the well.

Big Idea 3: Week 2 • Day 3

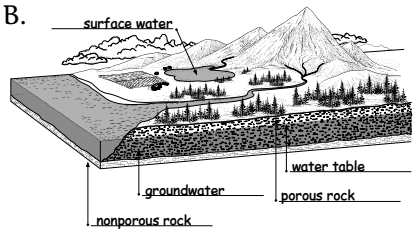
A. *Diagram 1*: The rain is soaking into porous rock, which gets saturated, so the water starts collecting on the surface.
Diagram 2: The rain is falling on nonporous rock, so all the water collects on the surface.
B. Surface water is water you can see above the ground, and groundwater is water that has soaked into the ground.

Big Idea 3: Week 2 • Day 4

A. 1. pollution 2. overuse
B. 1. The water table can drop below the reach of wells.
2. Saltwater intrusion makes groundwater too salty to use.

Big Idea 3: Week 2 • Day 5

A. 1. e 3. f 5. d
2. a 4. b 6. c
B.

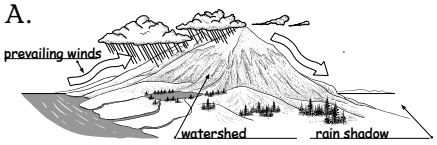


Big Idea 3: Week 3 • Day 1

A. 1. seven
2. Australia
B. All boxes should be checked.

Big Idea 3: Week 3 • Day 2

A.



B. 1. c 2. a

Big Idea 3: Week 3 • Day 3

A. When the winds blow from the Indian Ocean, they bring water vapor with them.
B. 1. The air is too warm for water to condense.
2. Dry prevailing winds blow over land instead of water.

Big Idea 3: Week 3 • Day 4

A. The first two boxes should be checked.
B. Answers will vary—e.g.,
1. *reserve:* to keep for future use
2. *serve:* to assist or help

Big Idea 3: Week 3 • Day 5

A. rain shadow, Prevailing winds, watershed, monsoons, oasis, reservoir
B. Answers should include two of the following: The area is in a rain shadow; Prevailing winds come from over dry land instead of water; The air is too warm for water to condense.
C. Prevailing winds change direction and blow from the ocean, bringing heavy rain.

Big Idea 3: Week 4 • Day 1

A. 1. 9.5 billion 3. 3.5 billion
2. 3 billion
B. 4,380 gallons

Big Idea 3: Week 4 • Day 2

A. 1. A drought is caused by less rainfall than usual.
2. In some places, water is too contaminated to drink.
B. Answers will vary—e.g.,
Agriculture: The crops might not grow.
Drinking water: There might not be enough water to drink.
Economy: Businesses such as restaurants might not be able to operate.

Big Idea 3: Week 4 • Day 3

A. 2, 4, 1, 5, 3
B. 1. It is an expensive process.
2. It can provide water easily only to people who live near the ocean.

Big Idea 3: Week 4 • Day 4

1. bathroom
2. Answers will vary—e.g., dishwasher, sprinkler system

TALK: Answers will vary—e.g., only water the lawn once a week, don't take long showers, don't leave the faucet running, etc.

Big Idea 3: Week 4 • Day 5

A. 1. conservation
2. reclamation
3. contaminate
4. desalination
5. drought
B. 1. true 3. false 5. true
2. false 4. true

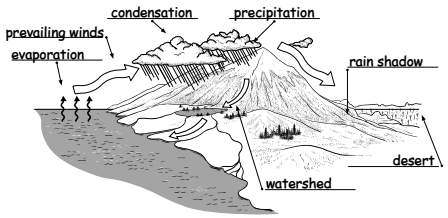
Big Idea 3: Week 5 • Unit Review 1

1. B 3. D 5. C 7. D
2. A 4. B 6. D

Big Idea 3: Week 5 • Unit Review 2

1. water vapor
2. groundwater
3. monsoons
4. rain shadow
5. humidity
6. oasis
7. drought
8. porous
9. surface water
10. reclamation
11. irrigation
12. watershed
13. contaminate
14. conservation
15. water table
16. aquifer
17. desalination
18. water cycle

***Big Idea 3:** Week 5 • Unit Review 3*



Answers will vary—e.g., On one side of the mountain, where there is precipitation and a watershed, the land is fertile and has more trees. On the other side, or the rain shadow, the land is dry and becomes a desert.

***Big Idea 3:** Week 5 • Unit Review 4*

1. It evaporated, condensed on the plastic, and then ended up in the cup.
2. ½ cup—about the same amount we started with
3. This made the condensed water gather over the cup so it could fall there, instead of back into the soil.
4. It could work, but it would be slower. There would need to be some sunlight in order for the water to evaporate.

***Big Idea 4:** Week 1 • Day 1*

A. 1. true 3. true
2. false 4. true

B. The gravitational force on the moon is not as strong as the gravitational force on Earth, so the astronaut weighs less.

***Big Idea 4:** Week 1 • Day 2*

A. 1. bowling ball 3. nail
2. washcloth 4. quarter

B. Earth has much more mass than we do.

C. Because the sun is so much farther away, its gravity doesn't have as much of an effect.

***Big Idea 4:** Week 1 • Day 3*

A. 1. 54.2
2. child's weight on Earth; 40 lbs
3. the adult, because he or she has more mass in general, and mass doesn't change between Earth and the moon

B. Both, because when you change the size of your body, you are losing mass. With less mass, the pull of gravity is less, and so you weigh less as well.

***Big Idea 4:** Week 1 • Day 4*

A. 1. Saturn
2. Jupiter
3. Mercury and Mars

B. An object's mass determines its gravitational force. The gravitational force of Phobos is weaker than the gravitational force of a neutron star.

***Big Idea 4:** Week 1 • Day 5*

A. 1. gravitational force
2. weight
3. mass

B. 1. Mass is the amount of matter in an object, and weight is measured by the pull of gravity on a given mass.
2. because the gravitational force is nearly the same everywhere on Earth

C. 1. an object's mass
2. the distance between the objects

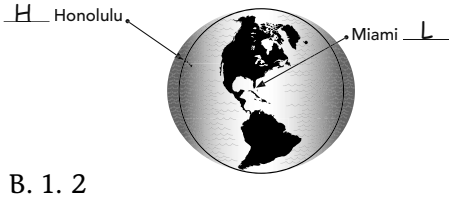
***Big Idea 4:** Week 2 • Day 1*

A. 1. 8 feet
2. 3 feet

B. Answers will vary—e.g., No, because you are so far out to sea that you won't notice the change of the water rising a couple of feet. It also happens too slowly to see the small change.

***Big Idea 4:** Week 2 • Day 2*

A.



B. 1. 2
2. The tides would be even more exaggerated, with bigger bulges and lower dips in the ocean.

***Big Idea 4:** Week 2 • Day 3*

1. 24
2. because it is so much closer to Earth
3. spring tides, because when the sun, moon, and Earth are aligned, there are higher high tides and lower low tides

***Big Idea 4:** Week 2 • Day 4*

A. Answers will vary—e.g., Newton realized that both the sun and the moon exert gravitational force on the tides, and these forces combine during full or new moons, which is when the sun, Earth, and moon are aligned.

B. Answers will vary—e.g., full moon, because it provides more light

TALK: Answers will vary—e.g., when you want to launch a boat in the harbor, so you will know if there will be enough water for safe passage

***Big Idea 4:** Week 2 • Day 5*

A. spring tides, tidal range, neap tides, navigate

B. 1. new moon
2. June 22
3. June 16

***Big Idea 4:** Week 3 • Day 1*

A. basketball

B. 1. They are spherical.
2. They orbit the sun.
3. Their gravity controls all objects in the area around them.

TALK: Answers will vary—e.g., moons and rings

***Big Idea 4:** Week 3 • Day 2*

A. 1. true 2. false 3. false

B. 1. coalesce 2. accretion

***Big Idea 4:** Week 3 • Day 3*

A. *Center of mass* is to *planet* as *axis* is to *Earth*.

B. Answers will vary—e.g., As the mass of an object increases, gravity pulls more matter to the center. Finally, when the object becomes very massive, gravity forces it into a round shape so that all the mass is as close to the center of mass as possible.

***Big Idea 4:** Week 3 • Day 4*

1. Earth's rotation creates centrifugal force that pushes out Earth's surface at the equator.
2. It would have to stop rotating.
3. When you are farther from the center of mass, gravity is less, so you weigh less.

***Big Idea 4:** Week 3 • Day 5*

A. 1. centrifugal force
2. spherical, center of mass
3. coalesced, accretion

B. Answers will vary—e.g., Gravity acts to pull everything toward an object's center of mass. When objects are as massive as planets, gravity forces them into a round shape so that all their mass can be as close to the center of mass as possible.

C. 1. orbit the sun
2. control all objects in its region

***Big Idea 4:** Week 4 • Day 1*

A. 1. inertia 2. gravity

B. 1. ~~Gravity~~ Inertia
2. ~~unaffected~~ determined
3. ~~less~~ more

***Big Idea 4:** Week 4 • Day 2*

A. 1. inertia 2. friction 3. orbit

B. elliptical

***Big Idea 4:** Week 4 • Day 3*

trajectory, free fall, gravity, inertia

***Big Idea 4:** Week 4 • Day 4*

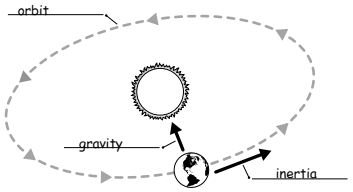
1. false 2. true 3. false

TALK: Answers will vary—e.g., Many scientists believe an asteroid collision led to the extinction of dinosaurs. This allowed mammals to thrive and eventually paved the way for humans.

***Big Idea 4:** Week 4 • Day 5*

A. 1. free fall 4. Inertia
2. elliptical 5. comets
3. trajectory

B.



***Big Idea 4:** Week 5 • Unit Review 1*

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

***Big Idea 4:** Week 5 • Unit Review 2*

1. elliptical
2. gravitational force
3. spherical
4. coalesce
5. accretion
6. weight
7. free fall
8. spring tides
9. inertia
10. tidal range
11. centrifugal force
12. mass
13. neap tides
14. trajectory
15. navigate

***Big Idea 4:** Week 5 • Unit Review 3*

1. inertia, because the hockey puck is continuing its forward motion
2. gravity and inertia, because gravity pulls the car down while inertia makes the hat fly off the person's head
3. gravity, because the sky diver is falling down toward Earth's surface
4. inertia, because the boy and the skateboard are moving forward in a straight line
5. gravity, because gravity makes the rain fall to the ground

***Big Idea 4:** Week 5 • Unit Review 4*

1. ball and rock
2. feather
3. the feather and wad of cotton, because they took longer to fall
4. They would all hit the ground at the same time.

***Big Idea 5:** Week 1 • Day 1*

A. 1. ~~slower~~ faster
2. ~~Heat~~ Temperature
3. ~~heat~~ kinetic
4. ~~color~~ mass

B. Temperature is the measure of a molecule's kinetic energy, and heat is energy that flows between objects of different temperatures.

***Big Idea 5:** Week 1 • Day 2*

A. more thermal energy, because a higher temperature means the air molecules have more kinetic energy, which means they transfer more thermal energy

B. because you have to wait for the molecules of the thermometer to reach the same temperature as the molecules in your mouth

***Big Idea 5:** Week 1 • Day 3*

A. 3, 4, 2, 5, 1

B. snow being formed into a snowball

***Big Idea 5:** Week 1 • Day 4*

A. B

B. 1. temperature
2. the properties of substances change when the temperature changes

***Big Idea 5:** Week 1 • Day 5*

A. 1. kinetic energy
2. temperature
3. Thermal energy
4. phase change
5. Heat

B. When you apply heat to ice, its molecules speed up and their kinetic energy increases. The ice goes through a phase change and turns into water. Then, with even more heat, the water molecules gain kinetic energy and turn into gas.

C. *kinetic energy* is to *motion*

***Big Idea 5:** Week 2 • Day 1*

1. ~~shorter~~ longer
2. ~~X-ray radiation~~ Microwaves are
3. ~~most~~ least OR ~~longest~~ shortest
4. ~~matter~~ energy

***Big Idea 5:** Week 2 • Day 2*

A. 1. absorbs 5. neither
2. reflects 6. neither
3. neither 7. reflects
4. absorbs 8. absorbs

B. 1. They are easily absorbed by water molecules, fats, and sugar found in food.
2. They are not absorbed by plastics, glass, paper, or ceramics.

***Big Idea 5:** Week 2 • Day 3*

A. 1. conventional oven
2. microwave oven
3. both
4. microwave oven

B. electromagnetic fields, molecules

***Big Idea 5:** Week 2 • Day 4*

1. cold floor ⟵ bare feet
2. microwaved dinner ⟶ plate
3. egg ⟵ frying pan
4. ice cream ⟵ bowl

TALK: Answers will vary—e.g., to conduct an orchestra is to *lead* musicians *through* the music they are playing; to conduct an experiment is to *go through* the process of doing something to see what happens; etc.

***Big Idea 5:** Week 2 • Day 5*

A. microwave, radiation, wavelength, conventional, electromagnetic, conduction

B. 1. radiation 4. conduction
2. conduction 5. reflection
3. reflection

***Big Idea 5:** Week 3 • Day 1*

A. Answers will vary—e.g.,
1. strong winds
2. heavy rains
3. high seas
4. spiral of clouds

B. satellite, hurricane

C. because heat moves from warmer places to cooler ones

***Big Idea 5:** Week 3 • Day 2*

A. 1. true 3. false
2. false 4. true

B. B

***Big Idea 5:** Week 3 • Day 3*

A. 1. heat of condensation
2. heat of condensation
3. convection

B. Heat is absorbed during evaporation in the waters off the coast of Africa and then released during heat of condensation when the vapor condenses over Texas.

***Big Idea 5:** Week 3 • Day 4*

A. 1. Water 2. magma 3. Air

B. sun, Earth's core

***Big Idea 5:** Week 3 • Day 5*

A. 1. hurricane 4. condensation
2. convection 5. Circulating
3. satellite

B. 1. ~~freezes~~ condenses
2. ~~equator~~ poles
3. ~~snow~~ rain

C. 1. convection
2. heat of condensation

***Big Idea 5:** Week 4 • Day 1*

A. 1. container, hands
2. hand, container

B. 1. ~~warmer~~ colder
2. ~~warm~~ cold
3. ~~condensation~~ conduction

***Big Idea 5:** Week 4 • Day 2*

A. 1. It has an inner bottle that has little contact with the outer bottle.
2. Any places where the bottles touch are made from insulators.

B. Answers will vary—e.g., I would make the bottom of the pot from good conductors so it could cook the spaghetti quickly. I would make the handles from insulators so I wouldn't burn my hands when lifting up the pot.

***Big Idea 5:** Week 4 • Day 3*

A. 1. true 3. true
2. false 4. false

B. 1. vacuum 2. Convection

***Big Idea 5:** Week 4 • Day 4*

A. Inside shiny surfaces block heat loss by radiation, keeping hot drinks hot. Outside shiny surfaces reflect heat from outside and keep it from entering the thermos, which keeps things cold.

B. Answers will vary—e.g.,
1. *thermometer:* a device for measuring temperature
2. *thermal:* having to do with heat
3. *thermostat:* a device that regulates temperature

***Big Idea 5:** Week 4 • Day 5*

A. 1. insulator
2. vacuum
3. conductors
4. room temperature

B. Answers will vary—e.g., The insulators limit heat transfer by conduction, the vacuum limits convection, and the shiny surfaces slow down radiation.

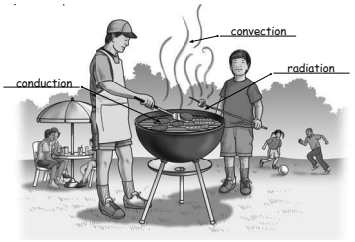
***Big Idea 5:** Week 5 • Unit Review 1*

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

***Big Idea 5:** Week 5 • Unit Review 2*

1. kinetic energy
2. phase change
3. heat
4. radiation
5. wavelength
6. circulating
7. insulator
8. conduction
9. temperature
10. satellite
11. conventional
12. microwave
13. heat of condensation
14. convection
15. vacuum

***Big Idea 5:** Week 5 • Unit Review 3*



Answers will vary—e.g., Heat rises from the fire as smoke and warms the air by convection. Heat from the grill toasts the marshmallow by radiation. And the hamburger is cooked by conduction where it touches the hot metal grill.

***Big Idea 5:** Week 5 • Unit Review 4*

1. Water moves from the side above the hot cup to the side above the cold cup because heat flows from warmer objects to cooler ones.
2. convection and conduction
3. Foam cups act as insulators so they keep hot water hot and cold water cold.
4. the red and blue dye mixed to make purple water

***Big Idea 6:** Week 1 • Day 1*

A. 1. carbonated
2. mixture

B. When the bottle is opened, the gas escapes into the air in the form of bubbles.

***Big Idea 6:** Week 1 • Day 2*

1. gold 3. gold
2. nitrogen 4. water, mercury

***Big Idea 6:** Week 1 • Day 3*

A. 1. sugar
2. carbon dioxide
3. oxygen

B. No, because peanut butter is oily and does not dissolve well in water.

Big Idea 6: Week 1 • Day 4

A. 1. pure water 2. pure water
B. B
C. A pond would freeze first because the ocean is made of salt water, and salt lowers the freezing point of water.

Big Idea 6: Week 1 • Day 5

A. 1. mixture, solution
2. boiling point
3. carbonated
4. freezing point
B. 1. ~~solid~~ liquid
2. ~~oxygen~~ CO_2/carbon dioxide
3. ~~increases~~ decreases
4. ~~solution~~ mixture
C. B

Big Idea 6: Week 2 • Day 1

A. 1. corrosion
2. chemical reaction
B. A substance that goes through a physical change keeps the same chemical makeup. A substance that goes through a chemical reaction changes into a new substance with a different chemical makeup.

Big Idea 6: Week 2 • Day 2

A. 1. takes up more space
2. crumbles easily
B. 1. ~~oxide~~ oxygen
2. ~~a single element~~ two or more elements
3. ~~the same as~~ different from
C. product

Big Idea 6: Week 2 • Day 3

A. 1. apple 3. food
2. stain 4. iron key
B. B

Big Idea 6: Week 2 • Day 4

A. 1. by painting it
2. by adding a substance that makes it less able to give away its electrons
B. 1. It doesn't oxidize as quickly.
2. It has carbon and chromium added to it.
C. plate

Big Idea 6: Week 2 • Day 5

A. chemical reaction, reactants, compound, product, oxidized, reduced, corrosion
B. 1. true 3. false 5. false
2. true 4. true

Big Idea 6: Week 3 • Day 1

A. 1. false 2. true 3. true
B. 1. size
2. cost
3. lifetime
4. amount of electric current produced

Big Idea 6: Week 3 • Day 2

A. 1. chemical 4. chemical
2. physical 5. physical
3. chemical
B. Physical properties can be observed without changing the composition of a substance, while chemical properties can be observed only when a substance undergoes a chemical change.

Big Idea 6: Week 3 • Day 3

A. product
B. lead sulfate, produces, removes

Big Idea 6: Week 3 • Day 4

A. 2, 1, 3, 4
B. Answers will vary—e.g.,
1. MP3 player: wall outlet/house current
2. cell phone: wall outlet/house current

Big Idea 6: Week 3 • Day 5

A. 1. electrochemical, electrodes
2. acid
3. chemical properties
4. current
B. 1. true 4. true
2. false 5. false
3. true

Big Idea 6: Week 4 • Day 1

A. 1. ignite
2. combustion
B. Matches couldn't start burning if they had no source of oxygen.

Big Idea 6: Week 4 • Day 2

Potassium chlorate and antimony sulfide are relatively stable substances.
Rubbing your hands together is an example of friction.
TALK: Answers will vary—e.g., It keeps us from slipping when we walk or ride a bike; we can skin our knees when we fall, or get rug burn if we slide around on a rug.

Big Idea 6: Week 4 • Day 3

A. A strike-anywhere match has both reactants on the tip. On a safety match, the reactants are physically separated.
B. phosphorous
C. ~~stable~~ reactive

Big Idea 6: Week 4 • Day 4

A. 1. The reactants are all used up.
2. The products of the reaction are not reactive.
3. The chemical reaction is irreversible.
B. *Obvious:* fire/smoke, soot
Not obvious: potassium chloride and phosphorous oxides

Big Idea 6: Week 4 • Day 5

A. ignites, reactive, combustion, stable, friction, irreversible
B. Answers will vary—e.g.,
1. use more stable reactants
2. physically separate the reactants

Big Idea 6: Week 5 • Unit Review 1

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

Big Idea 6: Week 5 • Unit Review 2

1. reactive
2. soluble
3. irreversible
4. ignite
5. product
6. chemical properties
7. combustion
8. friction
9. solution
10. boiling point
11. mixture
12. stable
13. freezing point
14. reactant
15. corrosion

Big Idea 6: Week 5 • Unit Review 3

A. Answers will vary—e.g.,
1. solid wax
2. melted wax
3. the flame from the match
4. fire
B. 1. physical
2. chemical
3. chemical

Big Idea 6: Week 5 • Unit Review 4

1. Bubbles formed on the pennies.
2. They were much shinier than the untreated pennies.
3. The half that was in the solution was coated in copper from the pennies.

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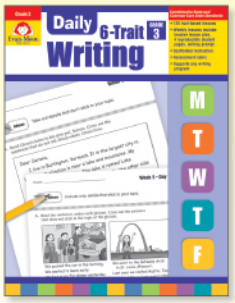

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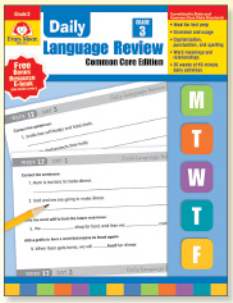

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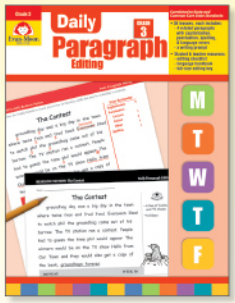

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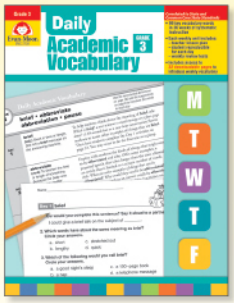

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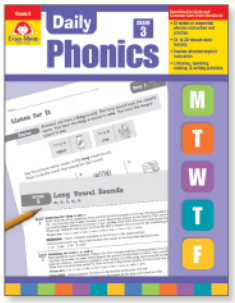

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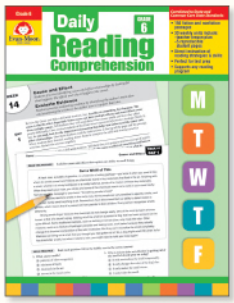

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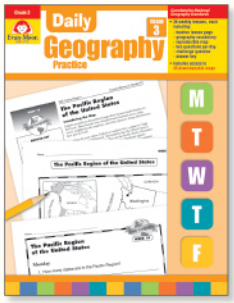

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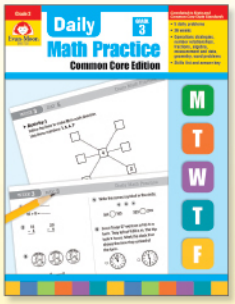

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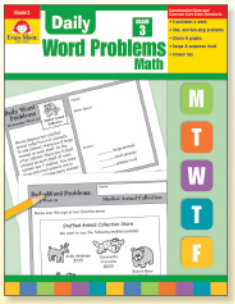

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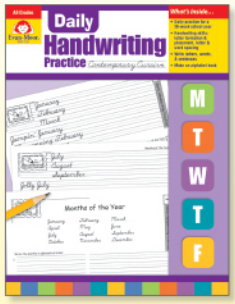

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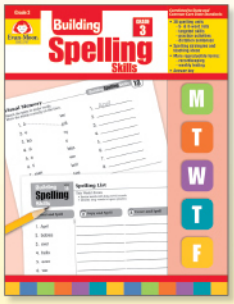

Building Spelling Skills
160 reproducible pages.
Grades 1–6

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