Name _____

Daily Science
Big Idea 3
WEEK 1

Day 3

Weekly Question

Do we really drink the same water that dinosaurs did?

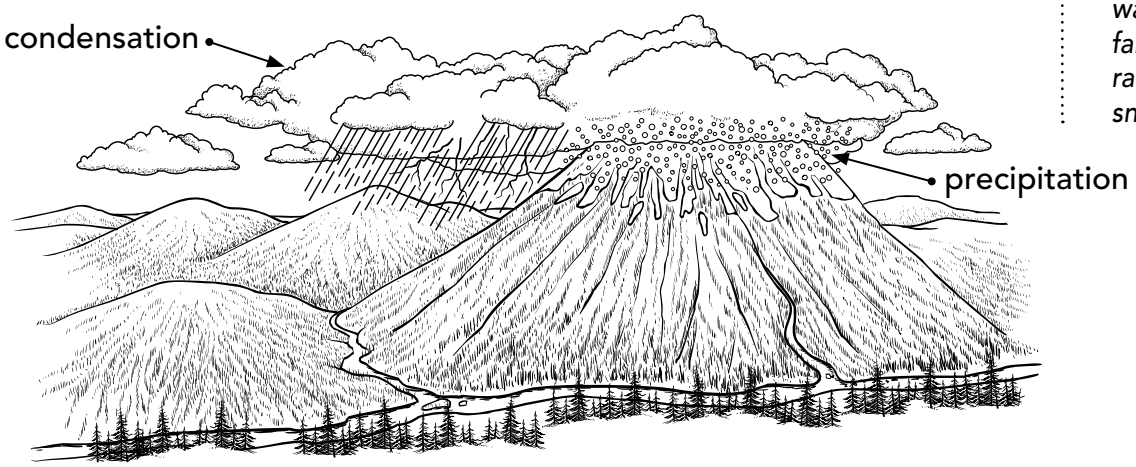
When water vapor is transported to cooler regions—either away from the tropics or higher up into the atmosphere—it cools. As water vapor cools, it gives up its heat energy and changes back into a liquid. We call this process **condensation**. In the atmosphere, condensation takes the form of tiny droplets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

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

Vocabulary

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

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



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

_____

_____

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

- ❒ frost on the window
- ❒ dew on the grass in the morning
- ❒ fog forming in a valley at night
- ❒ boiling water

Name _____

Daily Science

Big Idea 3

WEEK 1

Day 4

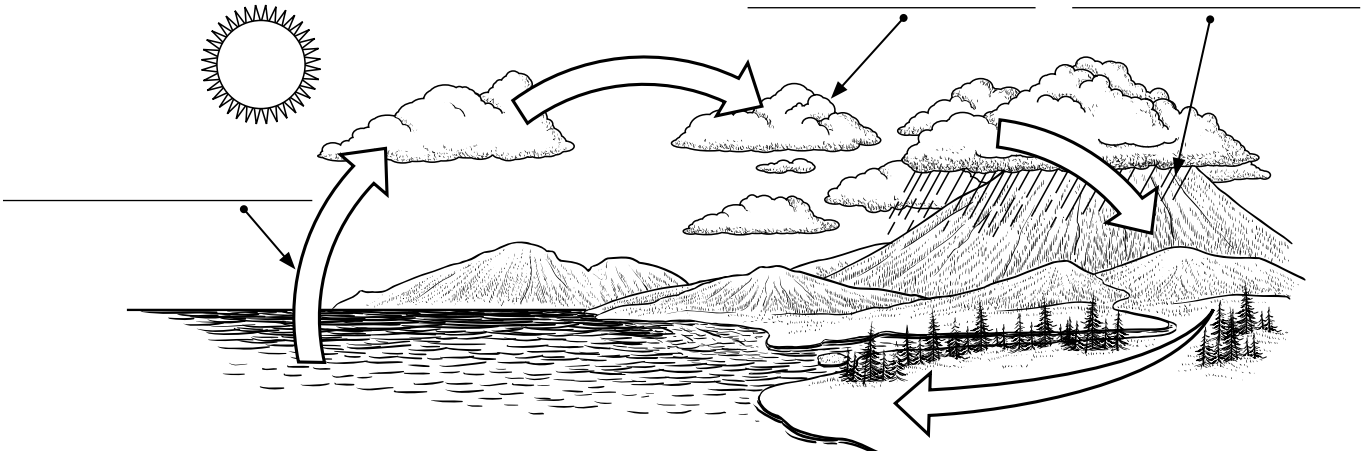
Weekly Question

Do we really drink the same water that dinosaurs did?

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

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

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



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

_____

_____

Name _____

Daily Science
Big Idea 3
WEEK 1

Day 5

Weekly Question

Do we really drink the same water that dinosaurs did?

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

evaporate	**condensation**	**water cycle**
water vapor	**precipitation**	**humidity**

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

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

_____

_____

_____

_____

Week 2

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

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

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

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

Day One

Vocabulary: *groundwater, irrigation*

Materials: page 75

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

Day Two

Vocabulary: *aquifer, porous, water table*

Materials: page 76

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

Day Three

Vocabulary: *surface water*

Materials: page 77; glass jar, sand, water

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

Day Four

Materials: page 78

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

Day Five

Materials: page 79

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

Name _____

Daily Science
Big Idea 3
WEEK 2

Day 1

Weekly Question

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

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

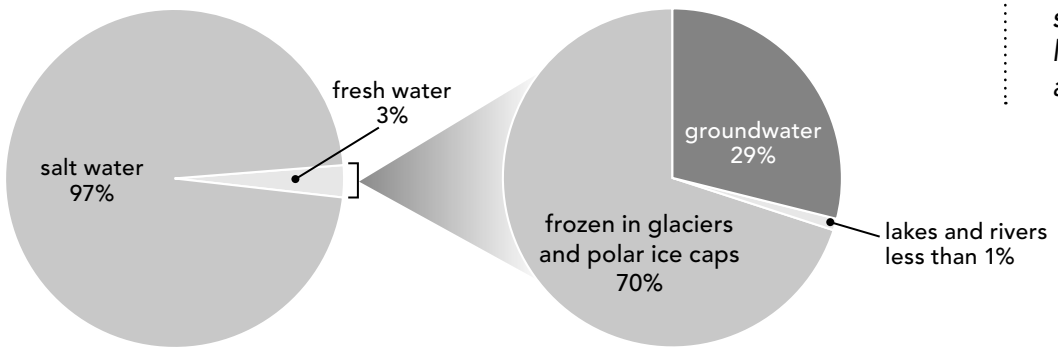
The second-greatest store of fresh water on Earth is in the ground. This type of water is called **groundwater**. Places that don't have access to fresh water from rivers and lakes depend on groundwater for drinking, **irrigation**, manufacturing, and industry.

Vocabulary

groundwater
GROWND-wah-ter
fresh water that exists underground

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

A. Look at the diagram and answer the questions.



Water on Earth **Where Fresh Water Is Stored**

1. About what percentage of Earth's fresh water is found in groundwater, rivers, and lakes? _____

2. Why is most of Earth's fresh water difficult to use?

_____

B. Use the vocabulary words to complete the sentences.

1. A farmer uses an _____ system to water his crops.

2. The farmer is not near a river, so he uses _____ instead.

Name _____

Daily Science
Big Idea 3
WEEK 2

Weekly Question

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

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

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

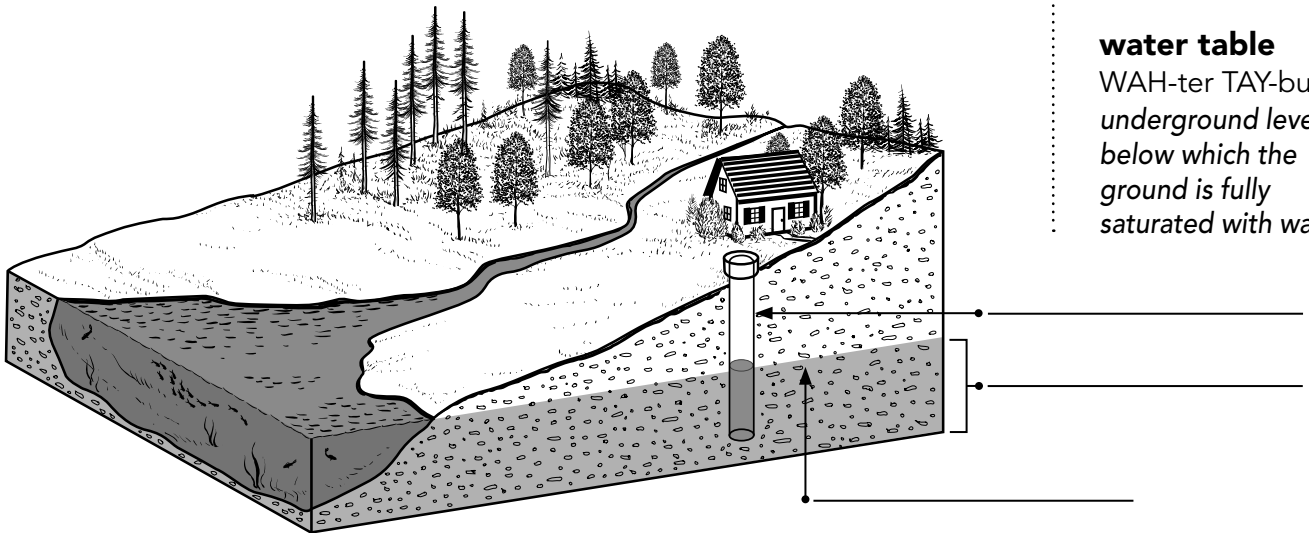
Vocabulary

aquifer
AH-kwih-fur
an underground layer of rock or soil that contains water

porous
POR-us
able to absorb water

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

A. Label the *aquifer*, *water table*, and *well*.



B. *Porous* is a word that can apply to other objects or materials besides rock. What are two other things that you think are porous?

1. _____ **2.** _____

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

_____

Name _____

Daily Science
Big Idea 3
WEEK 2

Day 3

Weekly Question

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

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

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

Vocabulary

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

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

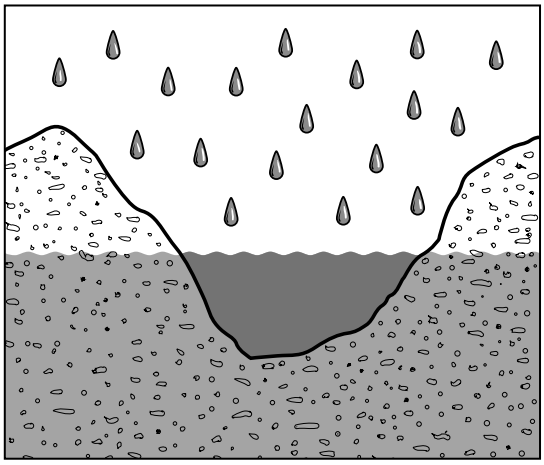


diagram 1

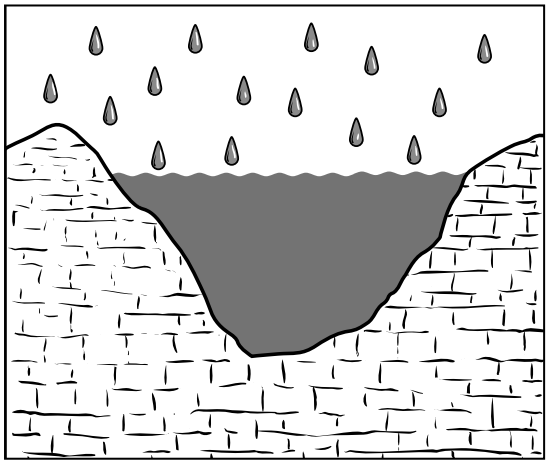


diagram 2

_____ _____

_____ _____

B. Describe the difference between surface water and groundwater.

_____

_____

Name _____

Daily Science
Big Idea 3
WEEK 2

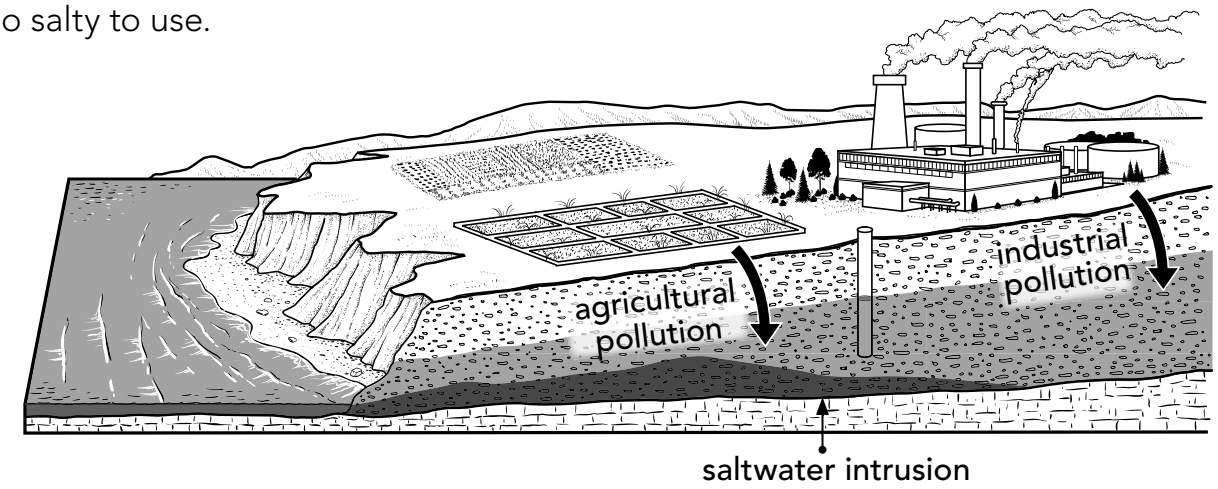
Day 4

Weekly Question

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

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

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



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

1. _____ **2.** _____

B. What are two results of overuse of groundwater?

1. _____

2. _____

Name _____

Daily Science
Big Idea 3
WEEK 2

Day 5

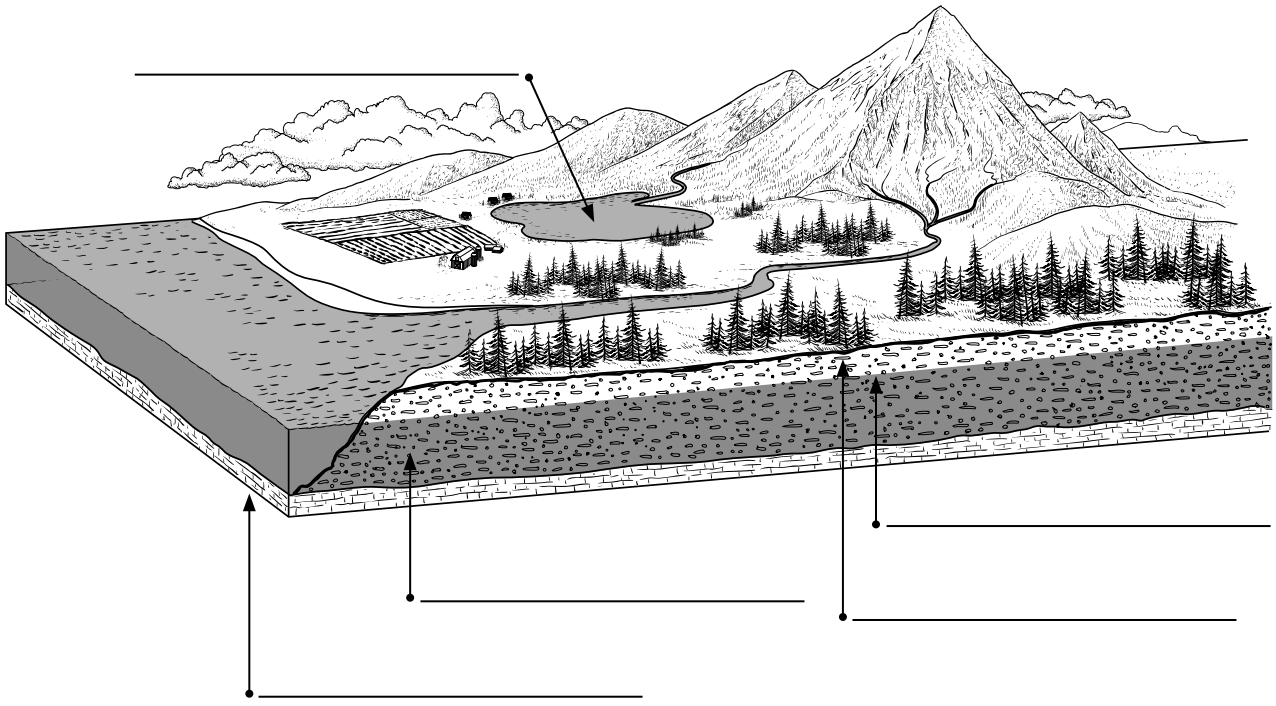
Weekly Question

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

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

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

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



Week 3

What makes deserts so dry?

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

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

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

Day One

Materials: page 81

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

Day Two

Vocabulary: *prevailing winds, rain shadow, watershed*

Materials: page 82; regional physical map (optional)

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

Day Three

Vocabulary: *monsoon*

Materials: page 83

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

Day Four

Vocabulary: *oasis, reservoir*

Materials: page 84

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

Day Five

Materials: page 85

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

Name _____

Daily Science
Big Idea 3
WEEK 3

Day 1

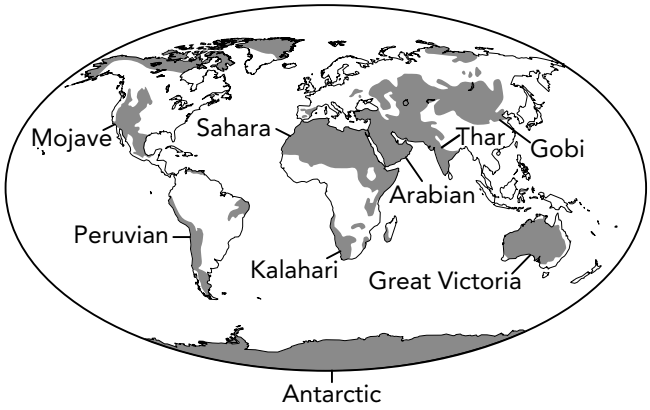
Weekly Question

What makes deserts so dry?

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

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

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



1. On how many continents are there deserts? _____

2. Besides Antarctica, which continent is made up almost entirely of desert? _____

B. Check the box next to each word or phrase that correctly completes the sentence.

Deserts are found in places that are _____.

- ❒ hot
- ❒ near the ocean
- ❒ cold
- ❒ far from the ocean

Name _____

Daily Science
Big Idea 3
WEEK 3

Day 2

Weekly Question

What makes deserts so dry?

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

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

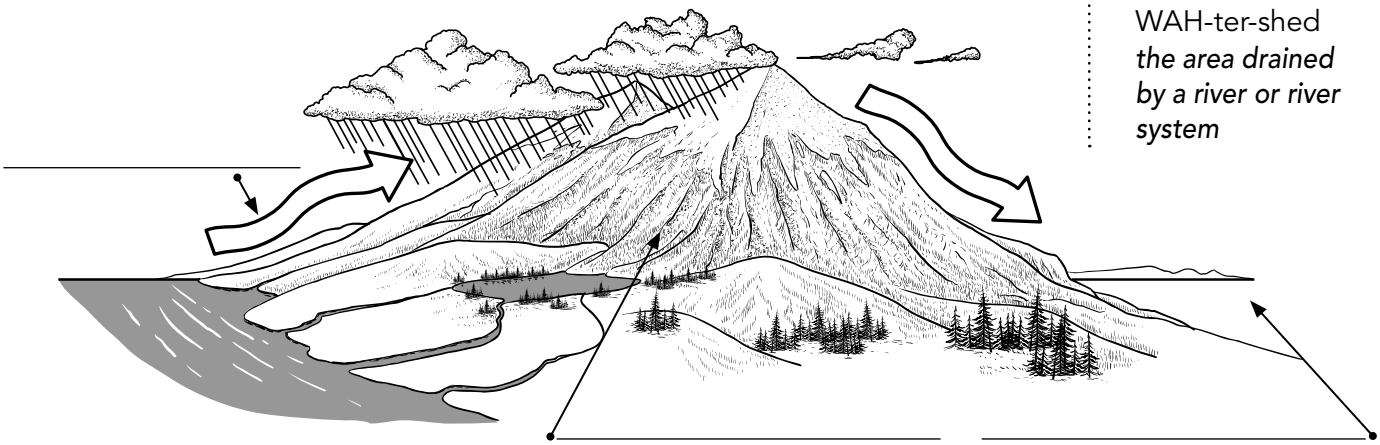
Vocabulary

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

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

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

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



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

1. In a rain shadow, there is very little _____.

Ⓐ sunlight Ⓑ soil Ⓒ precipitation Ⓓ elevation

2. Deserts are *not* located in a _____.

Ⓐ watershed Ⓑ windy area Ⓒ rain shadow Ⓓ cold climate

Name _____

Daily Science
Big Idea 3
WEEK 3

Day 3

Weekly Question

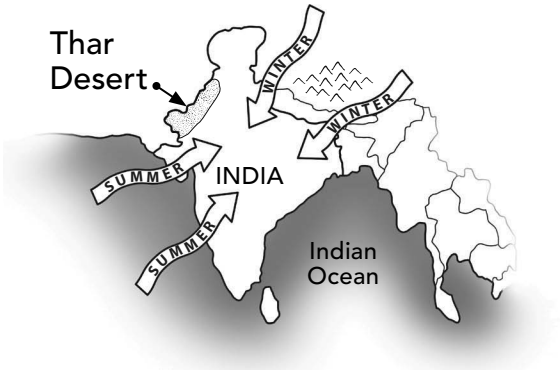
What makes deserts so dry?

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

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

Vocabulary

monsoon
mon-SOON
a wind that reverses direction when the seasons change



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

_____

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

1. _____

2. _____

Name _____

Daily Science
Big Idea 3
WEEK 3

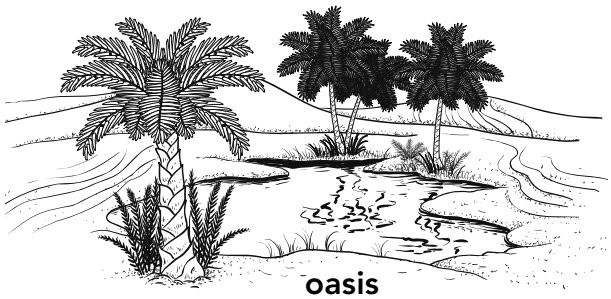
Day 4

Weekly Question

What makes deserts so dry?

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

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



oasis

Vocabulary

oasis
oh-AY-siss
a fertile place in the desert

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

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

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

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

1. _____

2. _____

Name _____

Daily Science
Big Idea 3
WEEK 3

Day 5

Weekly Question

What makes deserts so dry?

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

reservoir	**watershed**	**prevailing winds**
oasis	**monsoons**	**rain shadow**

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

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

B. Name two ways that deserts form.

1. _____

2. _____

C. Describe what happens during a monsoon.

_____

_____

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

Week 4

Can we run out of water?

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

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

Day One

Materials: page 87

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

Day Two

Vocabulary: *contaminate, drought*

Materials: page 88

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

Day Three

Vocabulary: *desalination, reclamation*

Materials: page 89

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

Day Four

Vocabulary: *conservation*

Materials: page 90

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

Day Five

Materials: page 91

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

Name _____

Daily Science
Big Idea 3
WEEK 4

Day 1

Weekly Question

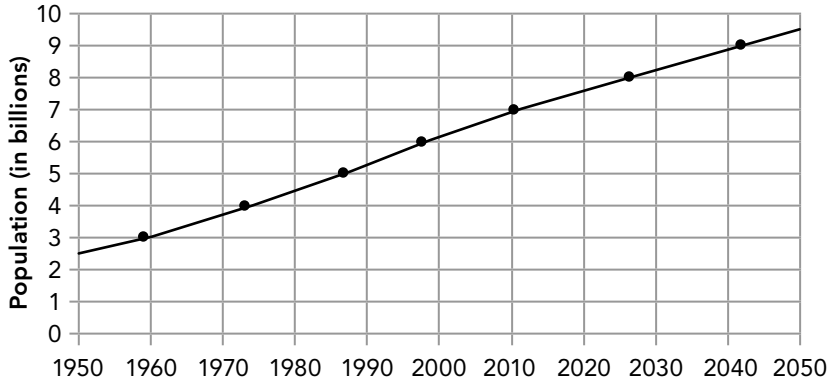
Can we run out of water?

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

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

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

World Population: 1950–2050



1. About how many billion people will there be on the planet by the year 2050? _____

2. About how many more people were on Earth in the year 2000 than in 1960? _____

3. About how many more people will there be in 2050 than there were in 2000? _____

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

Name _____

Daily Science

Big Idea 3

WEEK 4

Day 2

Weekly Question

Can we run out of water?

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

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

Vocabulary

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

drought
drowt
a long period of unusually low rainfall

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

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

_____

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

_____

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

Agriculture: _____

Drinking water: _____

Economy: _____

Name _____

Daily Science
Big Idea 3
WEEK 4

Day 3

Weekly Question

Can we run out of water?

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

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

Vocabulary

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

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

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

____ Waste materials are separated from the water.

____ Chemicals are added to the water to kill off microorganisms.

____ Waste water is collected at a treatment plant.

____ Recycled water is returned to a community's water system.

____ Small particles are filtered from the water.

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

1. _____

2. _____

Name _____

Daily Science Big Idea 3 WEEK 4

Day 4

Weekly Question

Can we run out of water?

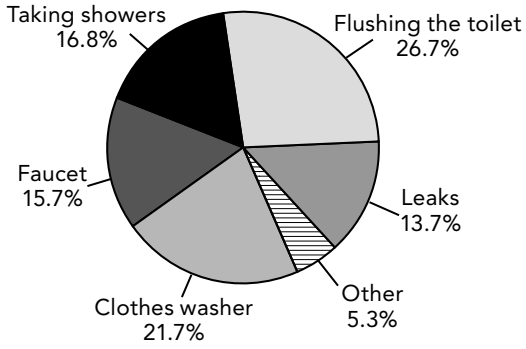
One of the best ways to address the problem of shrinking water supplies is to practice **conservation** of water. This is especially true in agriculture, which is our biggest use of water. Unfortunately, when crops are irrigated, more than 40% of that water can be wasted due to evaporation. But today,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

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

Vocabulary

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

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



1. In which room of the house do people use the most water? _____

2. According to the chart, "other" activities account for more than 5% of people's home water use. What might these be? Name two other ways you use water besides the ways noted in the chart.

_____

Talk

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

Name _____

Daily Science

Big Idea 3

WEEK 4

Day 5

Weekly Question

Can we run out of water?

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

conservation	**reclamation**	**drought**
desalination	**contaminate**	

1. In order to protect our water supply, people have practiced the preservation of water. _____

2. The process of water recovery allows people to recycle used water. _____

3. People can pollute water by dumping waste materials or chemicals into it. _____

4. The process of salt removal allows people to use seawater for drinking. _____

5. Many farmers' businesses suffer during a rain shortage. _____

B. Write *true* or *false*.

1. Earth has a limited supply of usable water. _____

2. If a region has no rainfall for one week, it is experiencing a drought. _____

3. Reclaimed water can be used for drinking. _____

4. Contaminated water can carry disease. _____

5. The biggest use of water is for agriculture. _____

Name _____

Unit Review

Comprehension

Earth's Water Supply

Daily Science Big Idea 3 WEEK 5

Fill in the bubble next to the correct answer.

1. The three elements of the water cycle are _____.
- Ⓐ conservation, desalination, reclamation
- Ⓑ evaporation, condensation, precipitation
- Ⓒ groundwater, rainwater, surface water
- Ⓓ water vapor, water table, watershed

2. People store water for future use in a(n) _____.
- Ⓐ reservoir
- Ⓑ oasis
- Ⓒ aquifer
- Ⓓ aqueduct

3. Which of these does *not* reduce our water supply?
- Ⓐ growing population
- Ⓑ contamination
- Ⓒ drought
- Ⓓ desalination

4. We measure the amount of water vapor in the air as _____.
- Ⓐ gas
- Ⓑ humidity
- Ⓒ clouds
- Ⓓ fog

5. Where is the most fresh water found on Earth?
- Ⓐ rivers
- Ⓑ oceans
- Ⓒ ice
- Ⓓ groundwater

6. Many deserts are formed by a(n) _____.
- Ⓐ aquifer
- Ⓑ watershed
- Ⓒ oasis
- Ⓓ rain shadow

7. Which of these is *not* an example of precipitation?
- Ⓐ rain
- Ⓑ snow
- Ⓒ hail
- Ⓓ fog

Name _____

Daily Science

Big Idea 3

WEEK 5

Unit Review

Vocabulary

Water Words

Write the vocabulary word that answers or completes each clue.

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

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

Name _____

Daily Science
Big Idea 3
WEEK 5

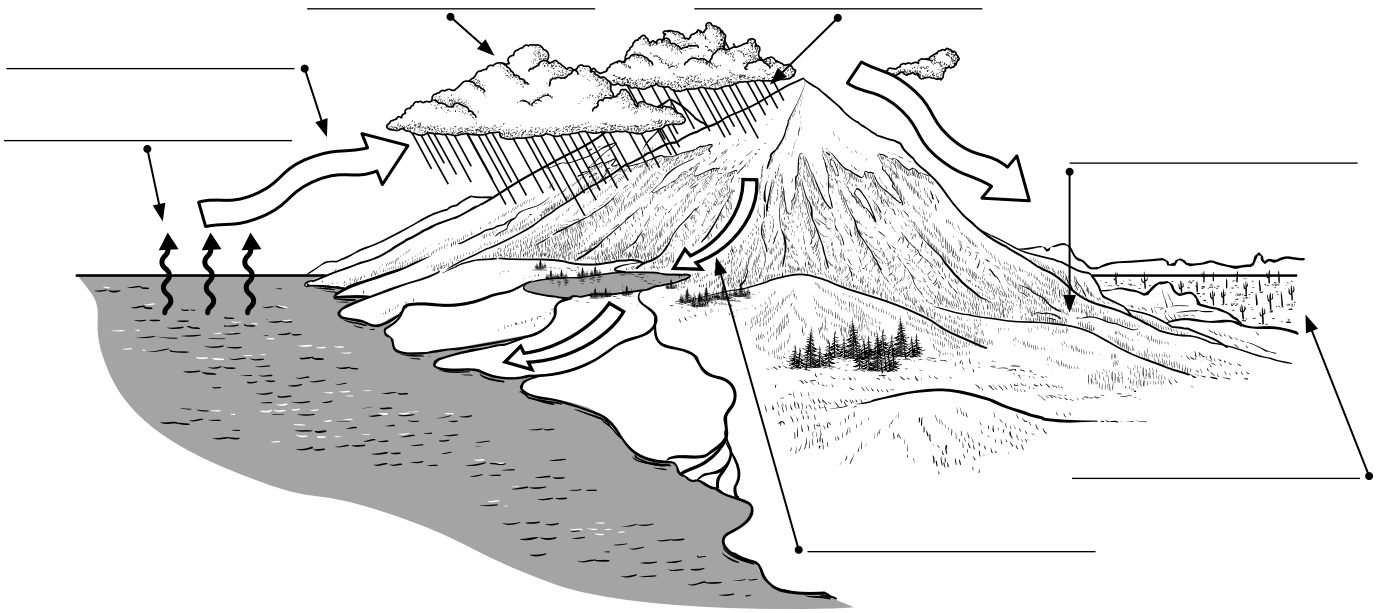
Unit Review

Visual Literacy

From Ocean to Land

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

condensation	evaporation	watershed	desert
precipitation	rain shadow	prevailing winds	



_____

_____

_____

_____

Name _____

Daily Science
Big Idea 3
WEEK 5

Unit Review

Hands-on Activity

Create Your Own Water Cycle

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

What You Need

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

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

What Did You Discover?

1. What happened to the water?

_____

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

_____

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

_____

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

_____

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

Key Concept
Gravity

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

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

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

Teacher Background

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

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

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

Unit Overview

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

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

Content Vocabulary: *gravitational force, mass, weight*

WEEK 2: What causes ocean tides?

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

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

WEEK 3: Why are planets round?

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

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

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

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

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

WEEK 5: Unit Review

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

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

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

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

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

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

Week 1

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

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

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

Day One

Vocabulary: *gravitational force*

Materials: page 99

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

Day Two

Vocabulary: *mass*

Materials: page 100; baseball, large inflated balloon

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

Day Three

Vocabulary: *weight*

Materials: page 101

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

Day Four

Materials: page 102

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

Day Five

Materials: page 103

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

Name _____

Daily Science
Big Idea 4
WEEK 1

Day 1

Weekly Question

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

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

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

Vocabulary

gravitational force
grav-ih-TAY-shun-ul FORSS
the force of attraction between any two bodies in the universe

A. Write *true* or *false*.

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

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

_____

_____

Name _____

Daily Science
Big Idea 4
WEEK 1

Day 2

Weekly Question

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

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

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

Vocabulary

mass
mass
the amount of matter in an object

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

1.	❒ bowling ball	❒ basketball	**3.**	❒ toothpick	❒ nail
2.	❒ paper towel	❒ washcloth	**4.**	❒ leaf	❒ quarter

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

_____

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

_____

Name _____

Daily Science
Big Idea 4
WEEK 1

Day 3

Weekly Question

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

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

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

Vocabulary

weight
wayt
measurement of the effect of gravity on a given mass

A. Use the chart to answer the questions.

	Weight on Earth	Weight on the Moon
Child	65 lbs	10.8 lbs
Adult	150 lbs	25 lbs

1. How many fewer pounds does the child weigh on the moon than on Earth? _____

2. Which is greater, the adult's weight on the moon, or the child's weight on Earth? What is the difference between them in pounds?

_____

3. Who has more mass on the moon, the child or the adult? Explain.

_____

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

_____

_____

Name _____

Daily Science
Big Idea 4
WEEK 1

Day 4

Weekly Question

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

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

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

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

Mercury	57 lbs	**Jupiter**	381 lbs
Venus	137 lbs	**Saturn**	140 lbs
Earth	150 lbs	**Uranus**	120 lbs
Mars	57 lbs	**Neptune**	180 lbs

1. On which planet would you weigh the closest to what you weigh on Earth? _____

2. Which planet exerts the strongest gravitational force? _____

3. On which two planets is gravity the weakest? _____

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

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

Name _____

Daily Science
Big Idea 4
WEEK 1

Day 5

Weekly Question

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

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

gravitational force	mass	weight

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

B. Answer the questions.

1. What is the difference between mass and weight?

_____

_____

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

_____

_____

C. What are two factors that determine an object's gravitational force on another object?

1. _____
2. _____

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

Week 2

What causes ocean tides?

The daily ebb and flow of ocean tides has been observed by humans for millennia, but not until Sir Isaac Newton proposed his theory of gravity in 1687 did we understand what caused the cyclic rise and fall of sea level. This week students learn that the moon exerts gravitational force on the world's oceans, resulting in a high tide, or "bulge" in the sea's surface that follows the moon as Earth rotates. The sun also contributes to the tidal bulge in the ocean, but because the sun is so far away, its contribution is only half that of the moon's. When the sun and moon are aligned, as happens twice each month, they produce higher high tides and lower low tides than when they are not aligned.

Over the course of a month, the relative positions of the moon and sun change as the moon completes its orbit around Earth. This means that the tides are also correlated with phases of the moon, a relationship that ancient people observed and students can now understand.

Day One

Vocabulary: *tidal range, tide*

Materials: page 105

Introduce the vocabulary and explain to students that *tidal range* is a change in sea level height, as might be measured along a pier piling. It is not the distance that the edge of the water advances or retreats along a beach. After students have read the passage, have them complete the activities. For activity A, you may want to review how to add positive and negative integers.

Day Two

Materials: page 106

After students read the passage, point out that the "bulge" in sea level always faces the moon, even as Earth rotates. Explain to students that, although a tide can be thought of as a gigantic wave, this is not the same as a "tidal wave," or tsunami, which is caused by earthquakes. Have students complete the activities and review the answers together.

Day Three

Vocabulary: *neap tide, spring tide*

Materials: page 107; beach ball, globe, tennis ball

Introduce the vocabulary and inform students that it takes the moon 29½ days to complete one orbit around Earth. After students read the passage, have volunteers demonstrate the positions of the sun (beach ball), moon (tennis ball), and Earth (globe) during the course of the month to reinforce the concept that spring tides don't occur only in the spring. Have students complete the activity and review the answers together.

Day Four

Vocabulary: *navigate*

Materials: page 108; diagram of complete moon phases (optional)

Have students read the passage and look at the diagram. You may want to review additional phases of the moon, including waning crescent (between last quarter and new moon), waxing crescent (between new moon and first quarter), waxing gibbous (between first quarter and full moon), and waning gibbous (between full moon and third quarter). Then have students complete the activities. For the oral activity, have students talk in pairs or small groups.

Day Five

Materials: page 109

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

Name _____

Daily Science
Big Idea 4
WEEK 2

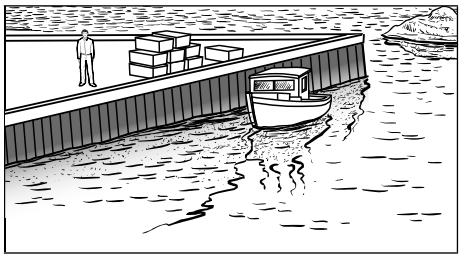
Day 1

Weekly Question

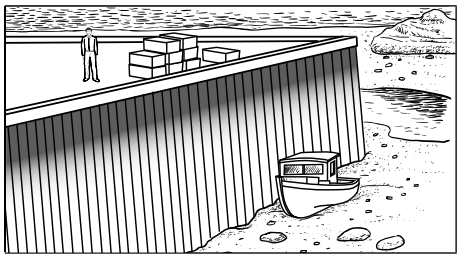
What causes ocean tides?

The daily rise and fall of the sea can be seen at beaches around the world. These changes in sea level are called **tides**. A high tide occurs when the sea level is at its highest point of the day. At low tide, the water level is at its lowest. These regular cycles of changing sea levels are caused by the gravitational pull of the moon and sun.

The difference between high and low tide is called the **tidal range**. The tidal range varies between locations, depending on the shape of the coastline. The most extreme tidal range in the world is in the Bay of Fundy in eastern Canada. Here, water is funneled from a wide bay into a narrowing river, causing dramatic sea level changes. In fact, the difference between high and low tide can exceed 55 feet!



high tide



low tide

Vocabulary

tide
tyde
the rise and fall of sea level

tidal range
TY-dul raynj
the difference in height between high and low tide

A. The average height of the ocean's surface at a particular location is measured as 0 feet. Use this information to answer the questions.

1. If the water measures −5 feet at low tide and 3 feet at high tide, what is the tidal range? _____

2. What is the tidal range if the water measures 2 feet at high tide and −1 foot at low tide? _____

B. It usually takes about 6 hours to go from high tide to low tide. If you were in a boat out in the middle of the ocean, do you think you would notice the change in sea level? Explain your answer.

_____

Name _____

Daily Science
Big Idea 4
WEEK 2

Day 2

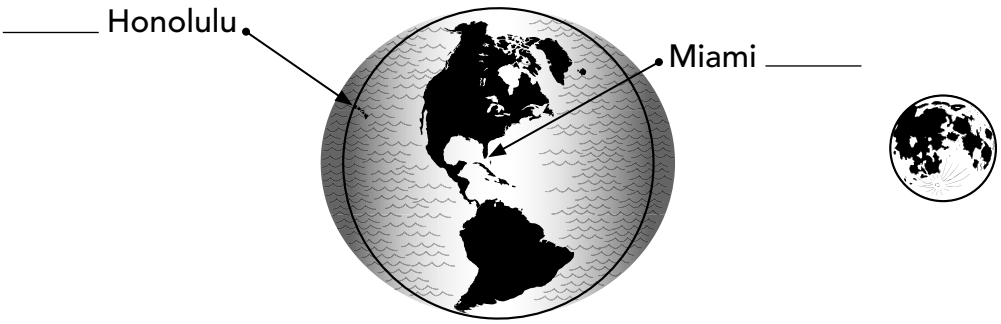
Weekly Question

What causes ocean tides?

To understand the effect of gravity on ocean tides, the first thing to remember is that every object with mass exerts gravitational force. Simply put, the moon has mass, so its gravity pulls on Earth. Earth's oceans respond to the tug of the moon by bulging up toward it. This bulge is what we experience as high tide. The bulge actually forms on both sides of Earth—one directly under the moon, and one on the opposite side. In between the bulges, the ocean dips. These dips are the low tides.

As Earth rotates, the giant bulges in the ocean move so that one bulge always stays directly under the moon, while the other stays on the opposite side. You might think of the tide as a giant wave that follows the moon across the ocean. In one 24-hour period, two high tides and two low tides sweep across the planet.

A. Write an "H" next to the city experiencing high tide and an "L" next to the city experiencing low tide.



B. Answer the questions.

1. How many high tides does the planet experience each day? _____

2. If the moon had more mass, what effect do you think this would have on Earth's tides? Explain what would happen to the bulges and dips in the ocean.

_____

_____

Name _____

Daily Science
Big Idea 4
WEEK 2

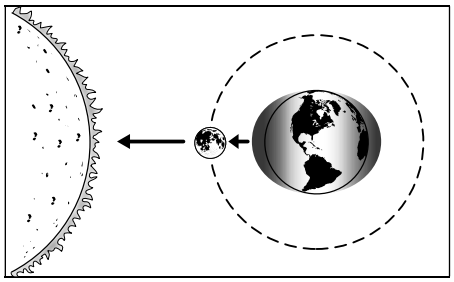
Day 3

Weekly Question

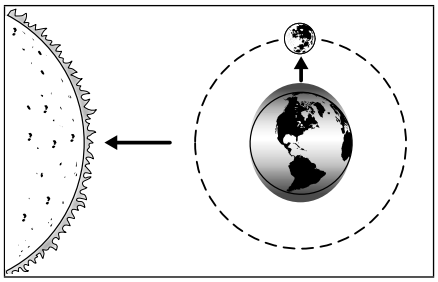
What causes ocean tides?

The moon is not the only thing that affects Earth's tides. The sun's gravity also has an effect, but it is less than the moon's. This is because, although the sun is much more massive than the moon, it is much farther away. The sun is so distant that its gravitational effect on our tides is only half that of the moon's.

The fact that the moon orbits Earth means that sometimes the sun, moon, and Earth are aligned. When the sun and moon are aligned, their gravitational effects combine to produce the highest high tides and the lowest low tides. These tides are called **spring tides**, and they occur twice a month, every month of the year. When the sun and moon are at right angles to each other, however, their gravitational effects work against each other. High tides are not very high and low tides are not very low. These tides are called **neap tides**. Like spring tides, neap tides also happen twice a month.



spring tide



neap tide

Vocabulary

neap tide
NEEP tyde
a tide that occurs twice a month and results in the smallest change in sea level

spring tide
SPRING tyde
a tide that occurs twice a month and results in the greatest change in sea level

Answer the questions.

1. About how many spring tides occur each year? _____

2. Why does the moon have a stronger pull on the tides than the sun does?

_____

3. When is there a greater tidal range, during spring tides or neap tides? Explain your answer.

_____

_____

Name _____

Daily Science
Big Idea 4
WEEK 2

Day 4

Weekly Question

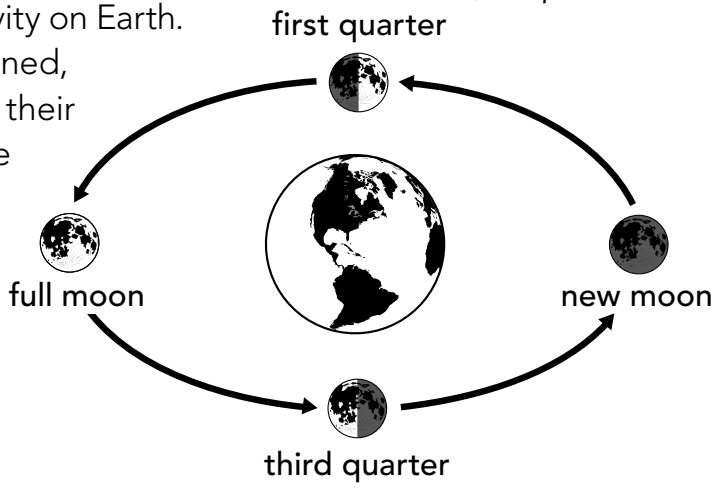
What causes ocean tides?

Predicting tides is important for many reasons, especially because low tides sometimes expose dangerous rocks or shallow areas that are difficult for ships to **navigate** around. In the past, sailors used the phases of the moon to predict tides. Sailors discovered that spring tides happened at the same time as the full or new moon. And the neap tides occurred during the first or third quarters of the moon.

It wasn't until Sir Isaac Newton produced his theory of gravity in 1687 that people understood why there was a relationship between the height of a tide and the phase of the moon. Newton knew that the sun and moon exerted gravity on Earth. He theorized that when these bodies aligned, as happened during a full or new moon, their gravitational forces combined to make the tides more extreme.

Vocabulary

navigate
NAV-ih-gayt
to steer or follow a planned course



A. Explain how Isaac Newton's theory of gravity accounted for the occurrence of spring tides when the moon was full or new.

_____

_____

B. Even though the tides are the same during a full moon and a new moon, one of these moon phases helps sailors navigate better at night. Which one? Explain your answer.

_____

Talk

What other reasons might there be for predicting the tides? When and where would it be important to know how high or low the tide will be?

Name _____

Daily Science
Big Idea 4
WEEK 2

Day 5

Weekly Question

What causes ocean tides?

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

tidal range	**neap tides**
spring tides	**navigate**

Tides are caused by the gravitational pull of the moon and the sun. When the moon and sun are aligned, they produce _____, or tides with the biggest _____. When the sun and the moon are at right angles to each other, they produce _____. Sailors predicted these tides so they could better _____ through dangerous waters.

B. The chart below shows the early morning low tides and evening high tides for Monterey Bay, California, in June of 2009. Use it to answer the questions.

	Low Tide		High Tide		Phase
June 16	12:08 AM	2.0 feet	6:08 PM	4.8 feet	third quarter ◑
June 17	1:11 AM	1.3 feet	6:42 PM	5.2 feet	
June 18	2:04 AM	0.6 feet	7:20 PM	5.6 feet	
June 19	2:52 AM	−0.2 feet	8:01 PM	6.0 feet	crescent ◑
June 20	3:38 AM	−0.9 feet	8:46 PM	6.4 feet	
June 21	4:24 AM	−1.4 feet	9:33 PM	6.7 feet	
June 22	5:10 AM	−1.9 feet	10:22 PM	6.8 feet	new moon ●
June 23	5:57 AM	−1.7 feet	11:13 PM	6.7 feet	

1. The lowest tides occurred during which phase of the moon? _____

2. On which date did the spring tides occur? _____

3. On which date was the tidal range the least? _____

Week 3

Why are planets round?

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

This week students learn that planets are round due to the amount of mass, and thus gravity, they have. Gravity acts from a center of mass, pulling all matter in toward it. When an object becomes big enough, the only way for all its matter to be as close to the center of mass as possible is to form a sphere.

While all planets must be round, not all round objects are planets. For example, Pluto is round but is no longer considered a planet because scientists discovered that it does not exert enough gravitational force to control all the objects around it in space. Students also learn that while all planets look round, not all of them have a perfectly spherical shape. In fact, Earth itself bulges slightly at the equator due to the centrifugal force of its rotation.

Day One

Vocabulary: *spherical*

Materials: page 111

Introduce the vocabulary word and point out its relationship to the word *sphere*. Before students read the passage, discuss the names and descriptions of the planets of the solar system and the order of their distance from the sun. After students have finished reading, have them complete the activities. For the oral activity, point out to students that a planet's gravity can control both man-made objects, such as satellites, and natural objects, such as moons or rings.

Day Two

Vocabulary: *accretion, coalesce*

Materials: page 112

Introduce the vocabulary. Then ask students to give examples of things that get bigger because they "stick together," or accrete. (e.g., dust balls under the bed, wads of sticky tape, rain droplets in a cloud, etc.) After students read the passage, have them complete the activities. Review the answers together.

Day Three

Materials: page 113

After students read the passage, invite them to try to balance their pencils across the end of one finger. Explain that if you want to balance an object, you have to find its center of mass. Have students complete the activities. Review the answers together.

Day Four

Vocabulary: *centrifugal force*

Materials: page 114

Introduce the vocabulary word and, to confirm students' understanding, draw a circle and an arrow pointing away from its center to show the direction of centrifugal force. After students read the passage, have them complete the activity. For question 3, you may want to review with students the effects of gravity on weight (Week 1), and how distance from an object's center of mass decreases gravitational force.

Day Five

Materials: page 115

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

Name _____

Daily Science Big Idea 4

WEEK 3

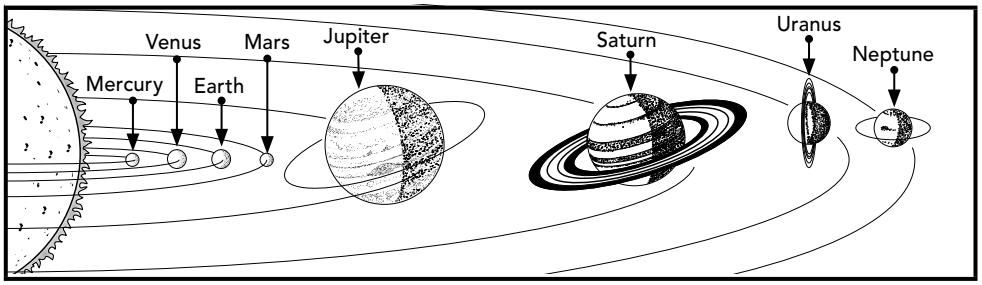
Day 1

Weekly Question

Why are planets round?

There are eight planets in our solar system: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune. Some planets are much larger than others, and some are surrounded by rings or moons. But all planets have three things in common. They orbit the sun, they are massive enough that their gravity controls all the objects in the area around them, and they are **spherical**.

Although you might not think of "roundness" as a particularly special or unusual quality, most objects in the solar system are not round. Millions of asteroids between the orbits of Mars and Jupiter are irregularly shaped chunks of rock. Planets are round because of their large mass and gravitational force.



Vocabulary

spherical
SFEER-ih-kul
round, ball-shaped; having a surface equally distant from the center at all points

A. Check the box next to the object that is *spherical*.

❒ paper tube ❒ egg ❒ football ❒ basketball

B. What are three things that all planets have in common?

1. _____ **3.** _____

2. _____

Talk

Pluto would be classified as the ninth planet if it were not for the fact that there are millions of other space rocks within its orbit that its gravity doesn't control. What are two examples of objects that are controlled by a planet's gravity?

Name _____

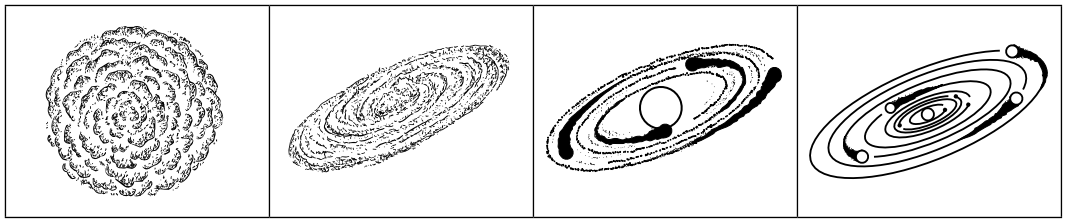
Daily Science
Big Idea 4
WEEK 3

Day 2

Weekly Question

Why are planets round?

Most scientists today believe that the solar system formed when a giant cloud of gas and dust contracted into a rotating disk of matter. Most of this material **coalesced** in the center of the disk and became our sun. The rest formed small, rocky bodies or balls of gas. Over time, gravitational force allowed these objects to attract and collect other chunks of rock or molecules of gas in their regions of space. As these objects grew in size, their gravity increased. This allowed them to attract and gather even more material. This process, called **accretion**, is believed to have formed the planets, asteroids, comets, and other bodies in our solar system.



Formation of the Solar System

Vocabulary

accretion
uh-CREE-shun
the process of becoming larger by adding more material

coalesce
koh-uh-LESS
to unite; to grow together

A. Write *true* or *false*.

1. Our solar system began as a rotating disk of gas and dust. _____
2. As the gravity of objects in the solar system increased, the objects became bigger. _____
3. Most of the gas and dust in the early solar system became the planets. _____

B. Use the vocabulary words to complete the sentences.

1. Dust and other particles of matter can _____ to form the beginning of a planet.
2. Through the process of _____, an object grows in size and increases its gravitational force.

Name _____

Daily Science
Big Idea 4
WEEK 3

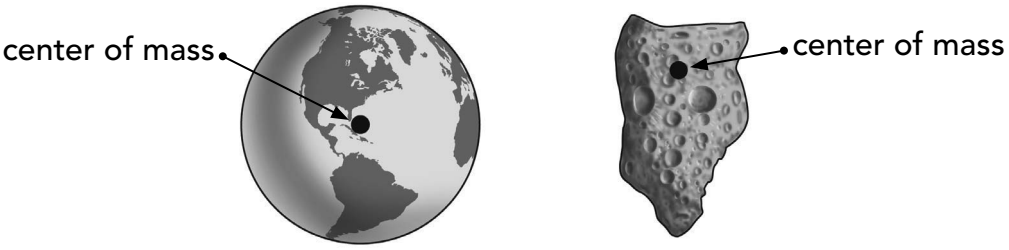
Day 3

Weekly Question

Why are planets round?

Gravity acts to pull everything toward an object's *center of mass*. The center of mass is a single imaginary point inside an object from which gravity seems to act. As an object acquires more mass, its gravity increases and more matter is pulled toward the object's center. When an object is massive enough, gravity forces it into a round shape. This is because the only way to get all of the object's matter as close to its center of mass as possible is to form a sphere. Every point on the surface of a sphere is equally distant from its center.

Objects such as asteroids or small moons are irregularly shaped because they have much less mass than planets. Therefore their gravitational force is not strong enough to form a sphere. Unlike planets, whose center of mass is also the center of the sphere, asteroids have a center of mass that may actually be located off-center, depending on where the most mass has accumulated.



planet asteroid

A. Check the box next to the analogy that is *not* correct.

- ❒ **Center** is to **sphere** as **center of mass** is to **planet**.
- ❒ **Asteroid** is to **irregular-shaped** as **planet** is to **spherical**.
- ❒ **Center of mass** is to **planet** as **axis** is to **Earth**.
- ❒ **Planet** is to **asteroid** as **round** is to **irregular**.

B. Explain in your own words why an object with a lot of mass takes the shape of a sphere.

_____

_____

Name _____

Daily Science
Big Idea 4
WEEK 3

Day 4

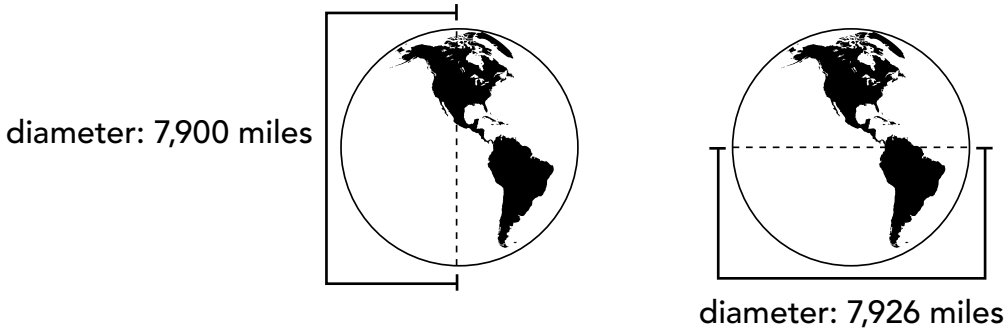
Weekly Question

Why are planets round?

Even though Earth's gravity is strong enough to pull all of the planet's matter evenly toward its center, Earth is not a perfect sphere. This is because Earth's rotation creates **centrifugal force**. Centrifugal force is the same force that causes you to slide to one side when you go around a curve on a roller coaster. On Earth, centrifugal force pushes out the planet's surface at the equator, causing it to bulge slightly around the middle. In fact, Earth's diameter is 26 miles wider when measured at the equator than when measured from the North Pole to the South Pole. Believe it or not, this means that you weigh slightly less at the equator than you do at the poles! This is because at the equator, you are a little farther away from Earth's center of mass than you are at the poles.

Vocabulary

centrifugal force
sen-TRIF-uh-gul forss
the force that tends to push an object outward when it rotates around a center



Answer the questions.

1. Why does Earth's surface bulge at the equator? Use the vocabulary word in your answer.

_____

_____

2. What would have to happen in order for Earth to become a perfect sphere?

_____

3. Why does being farther from Earth's center of mass cause you to weigh less?

_____

Name _____

Daily Science
Big Idea 4
WEEK 3

Day 5

Weekly Question

Why are planets round?

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

center of mass	**accretion**	**spherical**
centrifugal force	**coalesced**	

1. Earth is not a perfect sphere because _____ causes the equator to bulge out slightly.

2. Planets are _____ so that all of their matter can be as close to the _____ as possible.

3. Our solar system formed when gas and dust _____ into bodies that grew larger and larger over time through the process of _____.

B. Explain how mass and gravity cause planets to be round.

_____

_____

_____

C. What two qualities, besides roundness, must an object have in order to be considered a planet?

1. _____

2. _____

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

Week 4

Why don't planets crash into each other?

Except in the plots of science fiction thrillers, we don't expect planets to collide or otherwise smash into each other as they travel through the vast expanses of outer space. Instead, planets move in well-defined and separate paths, orbiting the sun in obedience with the laws of motion and force.

This week students learn that the motions of planets are governed by the opposing influences of gravity and inertia. Planets follow elliptical orbits and, unlike objects in Earth's atmosphere, do not encounter air resistance, friction, or large objects that can impede their path. Early in the history of the solar system, however, small planetary bodies did crash into each other during the process of accretion.

Day One

Vocabulary: *inertia*

Materials: page 117

Remind students that gravity is the force of mutual attraction that exists between any two bodies that have mass. Introduce the vocabulary word and have students read the passage. Then have them complete the activities independently. Review the answers as a group.

Day Two

Vocabulary: *elliptical*

Materials: page 118

Introduce the vocabulary word and point out its relationship to the word *ellipse*. Draw an ellipse and a circle on the board to make sure students understand the difference. Then have students read the passage and complete the activities. Review the answers together.

Day Three

Vocabulary: *free fall, trajectory*

Materials: page 119

Ask students to describe what sensation they imagine astronauts experience when orbiting Earth in a spacecraft. (floating, weightlessness, etc.) Tell students that these astronauts are actually falling in space. Introduce the vocabulary. Then have students read the passage and complete the activity. Review the answers together.

Day Four

Vocabulary: *comet*

Materials: page 120

Review the theory of planetary accretion described in Week 3. Then have students read the passage and complete the activities. For the oral activity, you may want to prompt students by explaining that scientists believe an asteroid collision led to the extinction of the dinosaurs (because dust from the impact blocked out the sun), and this in turn allowed mammals to evolve.

Day Five

Materials: page 121

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

Name _____

Daily Science
Big Idea 4
WEEK 4

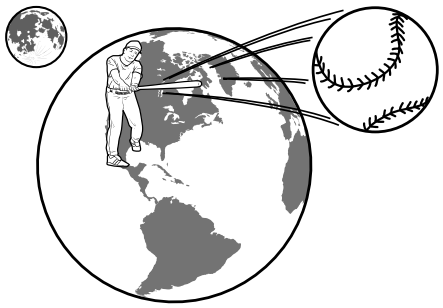
Day 1

Weekly Question

Why don't planets crash into each other?

Just as we know that the sun will rise every morning, we expect the planets and the moon to stay in their orbits. And rightly so. For 400 years, people have understood that the movements of Earth, the moon, the planets, and all the other bodies in the universe are determined by precise and predictable laws of force and motion. These laws tell us that the path of an object is controlled by two forces: gravity and **inertia**.

Inertia keeps an object moving in a straight line and at a constant speed until it is pushed or pulled on by a force. Everything with mass has inertia, and the more massive something is, the more inertia it has. In the absence of all other forces, such as air resistance or gravity, inertia would allow a baseball that was hit out of the park to travel in a straight line all the way to the edge of the universe!



Vocabulary

inertia
ih-NUR-shuh
a property of matter that keeps an object moving in a straight line and at a constant speed

A. What two forces govern the movement of the planets and all other bodies in the universe?

1. _____ **2.** _____

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

1. Gravity keeps an object moving in a straight line at a constant speed.

2. The path of a baseball is unaffected by the laws of motion.

3. The more mass an object has, the less inertia it has.

Name _____

Daily Science
Big Idea 4
WEEK 4

Day 2

Weekly Question

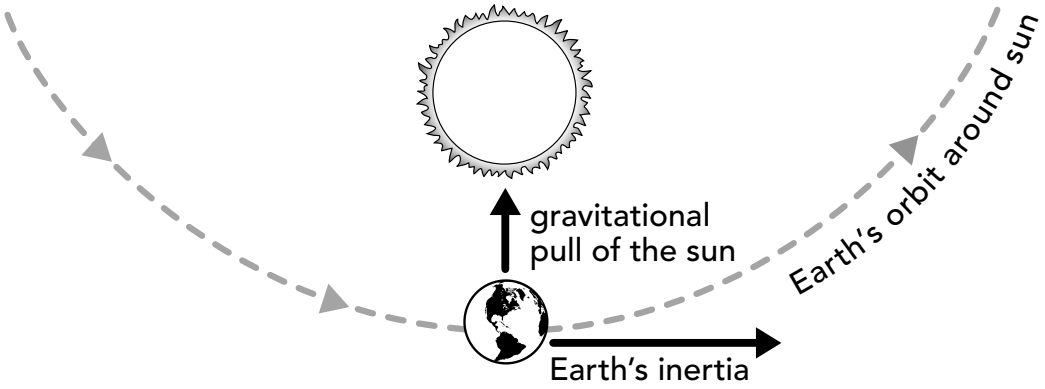
Why don't planets crash into each other?

Planets move in well-defined and separate paths, obeying the laws of force and motion as they orbit the sun. What keeps planets in their orbit is the balance between the opposing forces of gravity and inertia. The sun's gravity pulls planets toward it, and inertia keeps planets moving in a straight line. The combined result is an **elliptical** orbit, meaning that the planets revolve around the sun in oval-shaped paths. The sun is almost, but not quite, at the center of this oval. Similarly, the orbit of the moon around Earth is elliptical.

Unlike a baseball hit through the air, objects in space don't encounter air resistance or other types of friction that could slow their motion. So the planets just keep circling the sun. And in the absence of all other forces, they will continue to do this forever.

Vocabulary

elliptical
ee-LIP-tih-kul
having the shape of an oval or flattened circle



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

1. The balance between gravity and _____ keeps planets in their orbits.
2. Air resistance is a kind of _____ that slows down an object's motion.
3. Gravity and inertia maintain the moon's _____ around Earth.

B. Complete the analogy.

Circle is to **round** as **oval** is to _____.

Name _____

Daily Science
Big Idea 4
WEEK 4

Day 3

Weekly Question

Why don't planets crash into each other?

Astronauts orbiting Earth in a spacecraft are subject to the same laws of gravity and inertia that control the motions of the moon and planets. When you see astronauts floating inside their spacecraft, they may appear to be weightless, but they are actually still in the grip of Earth's gravity. Astronauts float because they are in **free fall**. During free fall, the gravitational force that causes a spacecraft and its contents to "fall" toward Earth is exactly matched by the forces of inertia that keep the spacecraft traveling in a straight line. The result is a curved **trajectory**—an elliptical orbit around Earth. Because downward fall is balanced by sideways motion, the spacecraft doesn't ever actually hit Earth.

You, too, may have experienced free fall momentarily on an amusement park ride. During a sudden drop, there is a brief sensation of weightlessness as your seat takes the plunge and inertia attempts to keep you in place. But hold on to your belongings, because coins and sunglasses will seem to "float" out of your pockets!

Vocabulary

free fall
FREE fall
the unchecked fall of an object

trajectory
trah-JEK-tuh-ree
the path of an object moving through space

Use the vocabulary words and information from the passage to complete the paragraph below.

Every object that moves through space follows a _____.

Even astronauts who appear to be floating are actually in _____.

This means that the downward force of _____ is exactly balanced by _____.

Name _____

Daily Science
Big Idea 4
WEEK 4

Day 4

Weekly Question

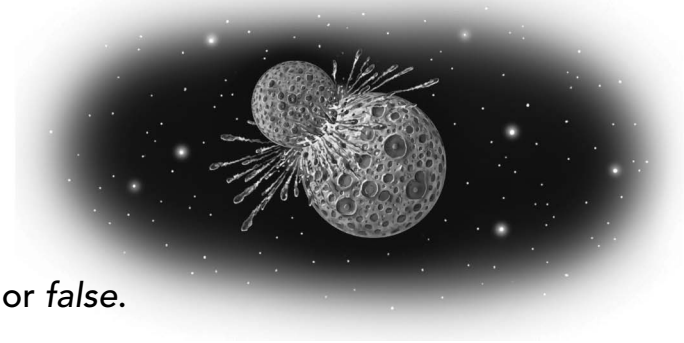
Why don't planets crash into each other?

Although the balance between inertia and gravity keeps the planets in stable, predictable trajectories around the sun, this was not the case when the solar system first formed. At that time, small, solid bodies that coalesced early in the solar system's history did not have stable orbits. These bodies crashed into each other, and through the process of accretion, became the large planets orbiting the sun today. Objects such as **comets** and asteroids may be the leftovers.

One of the most spectacular collisions between large bodies in our solar system may have happened right in our own "neighborhood." Scientists hypothesize that very early in Earth's history, an object the size of Mars collided with Earth and punched out a huge mass of material that became our moon. Luckily for us, a similar collision is probably impossible today.

Vocabulary

comet
KAH-mit
an icy chunk of rock from a region of space beyond the orbit of Neptune



Write *true* or *false*.

1. When the solar system first formed, objects in space moved in predictable trajectories. _____
2. Comets may be remains from the formation of the solar system. _____
3. The moon was formed when Earth and Mars crashed into each other. _____

Talk

In the past, Earth was a planet where collisions with asteroids, meteorites, and comets happened regularly. How do you think these collisions helped shape life on Earth today?

Name _____

Daily Science
Big Idea 4
WEEK 4

Day 5

Weekly Question

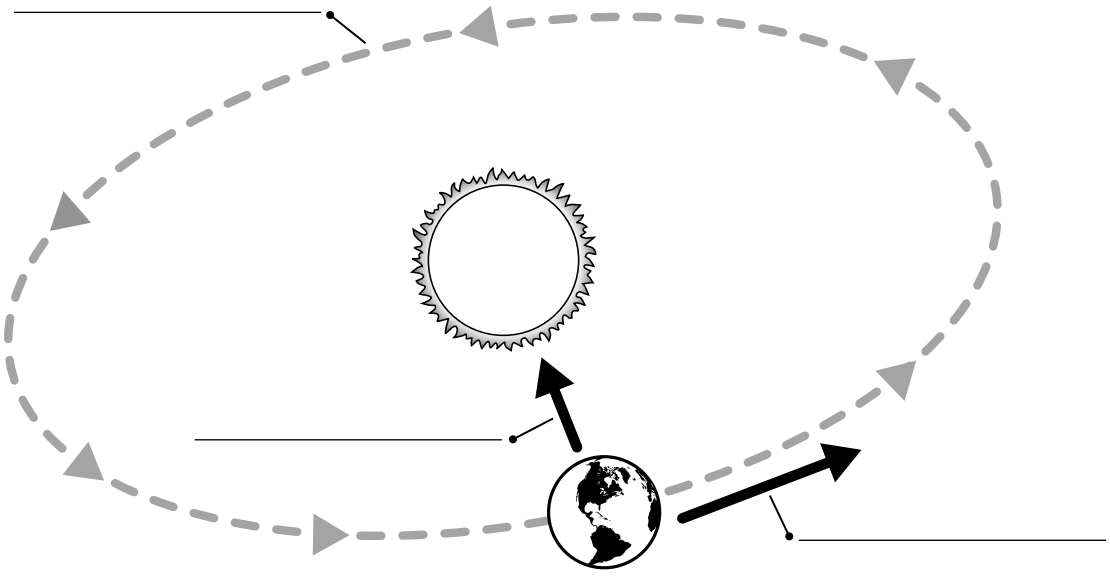
Why don't planets crash into each other?

A. Write the word from the box that completes each sentence.

elliptical	**comets**	**trajectory**
free fall	**inertia**	

1. When astronauts float in space, they are really in _____.
2. The orbit of Earth around the sun is _____, instead of completely circular.
3. An object's _____ is the path it takes through space.
4. _____ is the property of matter that keeps it moving in a straight line.
5. Scientists believe that _____ may be leftovers from the solar system's formation.

B. Label *gravity*, *inertia*, and *orbit* in the diagram below.



Name _____

Unit Review

Comprehension

Matter of Fact

Daily Science Big Idea 4 WEEK 5

Fill in the bubble next to the correct answer.

1. Which statement is true about gravity?

Ⓐ Gravity doesn't exist on small planets or moons.
Ⓑ Gravity has nothing to do with an object's mass.
Ⓒ Gravity decreases as distance from the center of mass increases.
Ⓓ Gravity only works if you are touching something.

2. Which statement is true about tides?

Ⓐ Spring tides only happen in the spring.
Ⓑ The lowest tides happen during a full or a new moon.
Ⓒ Tides are caused by Earth's orbit around the sun.
Ⓓ Tides are caused by tsunamis.

3. In order to be a planet, an object must be round, orbit the sun, and _____.

Ⓐ control other objects in its region
Ⓑ shine at night
Ⓒ rotate around its axis
Ⓓ have inertia

4. Why don't the planets in our solar system crash into each other?

Ⓐ Gravity forces them apart.
Ⓑ Laws of motion don't apply in space.
Ⓒ They move too fast.
Ⓓ Gravity and inertia are balanced.

5. Weight is determined by _____.

Ⓐ mass alone
Ⓑ mass and gravitational force
Ⓒ gravitational force alone
Ⓓ gravitational force and inertia

6. The bulge at Earth's equator is due to _____.

Ⓐ gravitational force
Ⓑ an elliptical orbit
Ⓒ centrifugal force
Ⓓ a buildup of dust and gas

Name _____

Unit Review

Vocabulary

Word Accretion

Daily Science Big Idea 4

WEEK 5

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

1. Earth has an _____ orbit around the sun.
2. a force of attraction between two bodies _____
3. shaped like a ball _____
4. to come together or unite _____
5. Planets became larger through the process of _____.
6. measured in pounds _____
7. A feeling of weightlessness happens in a state of _____.
8. When the sun and moon are aligned, they produce _____.
9. This property keeps objects moving in a straight line. _____
10. The difference between high and low tide is called the _____.
11. a force created by Earth's rotation _____
12. the amount of matter in an object _____
13. When the sun and moon are at right angles, they produce _____.
14. the path of an object in space _____
15. Low tides may make it difficult for ships to _____.

accretion
centrifugal force
coalesce
elliptical
free fall
gravitational force
inertia
mass
navigate
neap tides
spherical
spring tides
tidal range
trajectory
weight

Name _____

Daily Science
Big Idea 4
WEEK 5

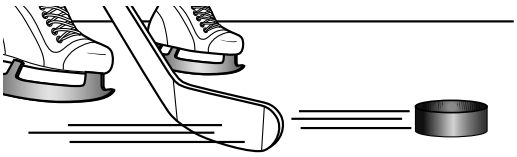
Unit Review

Visual Literacy

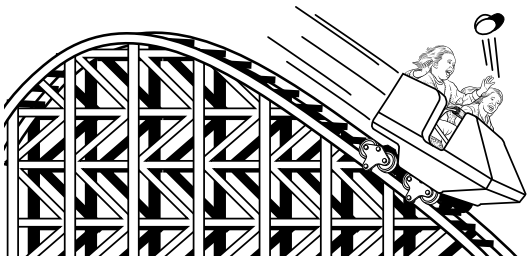
It All Falls Together

Look at the pictures below. Write whether the force of *gravity*, *inertia*, or *both* is being demonstrated. Explain your answer.

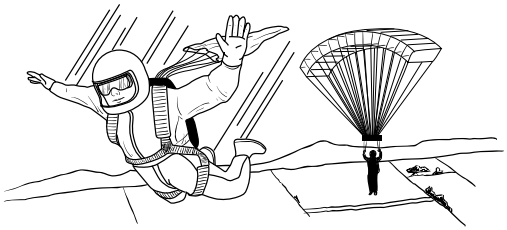
1.



2.



3.



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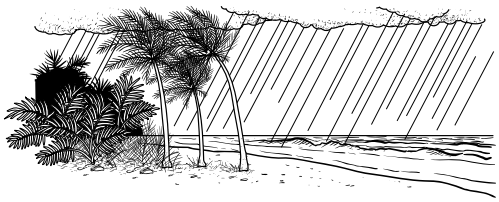


Name _____

Daily Science
Big Idea 4
WEEK 5

Unit Review

Hands-on Activity

Gravity's Pull

The famous thinker Galileo argued that, in the absence of air resistance, two objects of different mass that are dropped at the same moment from the same height should strike the ground at the same time. Legend says he dropped items from the Leaning Tower of Pisa to prove the point. Now you can discover whether Galileo's hypothesis was right.

What You Need

- ball
- small rock
- feather
- wad of cotton

1. Line up the items along the edge of a desk or table.
2. Push all the objects off the table at the same time.
3. Record the order in which the objects hit the floor.
4. Repeat the experiment as often as needed to be sure of your results.

What Did You Discover?

1. Which object(s) hit the floor first?

_____

2. Which object(s) hit the floor last?

_____

3. Which objects do you think encountered air resistance? Why?

_____

4. What do you think would happen if you dropped the items in a vacuum, where there is no air?

_____

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

Key Concepts
Conduction, Convection, and Radiation

National Standard
Heat moves in predictable ways, flowing from warmer objects to cooler ones until both reach the same temperature.

While students may intuitively understand the concept of heat flowing from warmer objects to cooler ones, they are not likely to be familiar with the specific ways in which heat is transferred between objects of different temperatures. In this Big Idea, students learn:

- the difference between heat and temperature;
- how microwaves heat food by means of radiation and how hot food heats containers by conduction;
- that hurricanes move heat from the tropics to the poles by means of convection; and
- that a thermos bottle slows heat transfer by blocking conduction, convection, and radiation.

Teacher Background

Anyone who has ever warmed his or her hands by the fire has experienced the effects of heat transfer: heat from the fire flows to the cold hands and warms them up. Yet the same is true of an ice cube in a bowl of hot soup. Coldness from the ice cube doesn't flow to the soup. It is heat from the soup that flows to the ice cube.

Heat moves between objects of different temperatures in a variety of ways. If you warm your hands on a hot cup of cocoa, heat flows from the cup to your hands by means of conduction, which is the transfer of heat through physical contact. When you warm your hands by a fire, waves of energy from the flames transfer heat to your hands by means of radiation, or movement of energy through matter or empty space. And blowing hot air on your hands warms them by convection, which is the transfer of heat through the movement of a liquid or gas. Understanding these three different processes makes it possible to comprehend everything from how thermoses and microwave ovens work to what causes weather disturbances such as hurricanes.

For specific background information on each week's concepts, refer to the notes on pp. 128, 134, 140, and 146.

Unit Overview

WEEK 1: How does a thermometer work?

Connection to the Big Idea: A thermometer measures temperature, which is not the same thing as heat. Temperature is the measure of the kinetic energy of a substance's molecules. Heat is the transfer of thermal energy between substances. Students learn that outdoor thermometers measure temperature with the help of liquid that expands or contracts in response to gaining or losing kinetic energy.

Content Vocabulary: *heat, kinetic energy, phase change, room temperature, temperature, thermal energy*

WEEK 2: How does a microwave oven cook food?

Connection to the Big Idea: Microwaves transfer thermal energy by means of radiation to cook food, and hot food transfers heat to its container by means of conduction. Students learn that radiation is the movement of energy through empty space and matter, and conduction is heat transfer through physical contact.

Content Vocabulary: *conduction, conventional, electromagnetic, microwaves, radiation, wavelength*

WEEK 3: What causes hurricanes?

Connection to the Big Idea: Hurricanes provide an example of convection, or the transfer of heat through the movement of a liquid or a gas. Students learn that hurricanes are a powerful mechanism for transferring heat from tropical oceans to higher latitudes. Heat mixes into the atmosphere through convection of warm air. As the air cools, more heat is released into the atmosphere when water vapor condenses into raindrops.

Content Vocabulary: *circulating, convection, heat of condensation, hurricane, satellite*

WEEK 4: How does a thermos work?

Connection to the Big Idea: A thermos bottle is designed to slow the flow of heat by conduction, convection, and radiation. Students learn that through its use of insulating materials, mirrored surfaces, and a vacuum, this simple device can keep both hot things hot and cold things cold.

Content Vocabulary: *insulator, vacuum*

WEEK 5: Unit Review

You may choose to do these activities to review concepts about heat transfer.

p. 152: Comprehension Students answer multiple-choice questions about key concepts in the unit.

p. 153: Vocabulary Students write vocabulary words from the unit to match clues.

p. 154: Visual Literacy Students label a picture of a hot grill to show where conduction, convection, and radiation are taking place.

p. 155: Hands-on Activity Students use food coloring to watch how heat moves by means of convection through water of different temperatures. Instructions and materials needed for the activity are listed on the student page.

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

Week 1

How does a thermometer work?

While it might be common knowledge that thermometers are used to measure temperature, few people realize that temperature is *not* the same thing as heat. Temperature is a measurement of the average kinetic energy, or energy of motion, of a substance's molecules. Heat, on the other hand, refers to the flow of thermal energy between objects of different temperatures.

This week students learn how the jostling and bouncing of molecules results in the exchange of thermal energy between the air and an outdoor thermometer, causing its liquid to expand or contract. When thermal energy stops flowing, the molecules inside the thermometer have reached the same temperature as the air, and the level of the liquid indicates the temperature. Students also discover that the properties of water make it unsuitable for use in a thermometer because water becomes ice at temperatures below 0˚C and a gas at temperatures above 100˚C.

Day One

Vocabulary: *heat, kinetic energy, temperature*

Materials: page 129

Invite students to imagine themselves stepping outside on a really hot day and to describe what it feels like. Explain that while heat may make them feel slow or sluggish, heat makes the molecules in the air move faster and more energetically. Introduce the vocabulary and direct students to read the passage. Then have them complete the activities.

Day Two

Vocabulary: *thermal energy*

Materials: page 130

Introduce the vocabulary word and have students read the passage. Then explain to students that when they feel heat, they are actually experiencing the transfer of thermal energy. Have students complete the activities and review the answers together.

Day Three

Vocabulary: *phase change*

Materials: page 131

Introduce the vocabulary word and review the three phases of water. (solid, liquid, gas) Then instruct students to read the passage. Have students complete the activities and review the answers together.

Day Four

Vocabulary: *room temperature*

Materials: page 132; different thermometers (optional)

Before students read the passage, you may want to show them different kinds of thermometers, such as a bulb thermometer, spring thermometer, and digital thermometer. Introduce the vocabulary word and have students read the passage. Then have them complete the activities.

Day Five

Materials: page 133

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

Name _____

Daily Science
Big Idea 5
WEEK 1

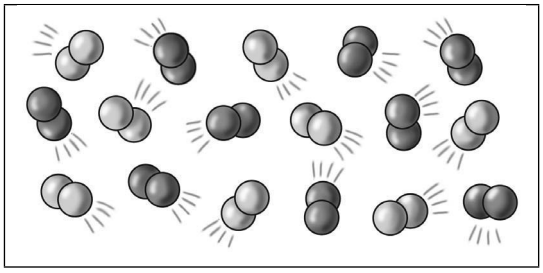
Day 1

Weekly Question

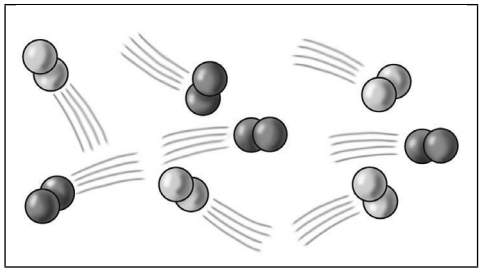
How does a thermometer work?

Check the thermometer on a hot day, and it will tell you that the **temperature** is high. But even though you may "feel the heat" when you step outside, **heat** and temperature are not the same thing.

The best way to understand the difference between heat and temperature is to think about molecules. Molecules are the individual particles that make up a substance. Molecules have both mass and speed, and the hotter a substance is, the faster its molecules move. Temperature is the measure of the energy that this motion generates, which is called **kinetic energy**. Heat, on the other hand, is the *flow* of energy from warm objects to cool ones as the result of their being at different temperatures.



Air molecules on a cool day



Air molecules on a hot day

Vocabulary

heat
heet
energy that flows between objects of different temperatures

kinetic energy
kih-NET-ik EN-ur-jee
energy of motion

temperature
TEM-per-uh-CHUR
the average kinetic energy of the molecules of a substance

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

1. The hotter a substance is, the slower its molecules move.

2. Heat measures the average kinetic energy of molecules.

3. Energy generated by the movement of molecules is called heat energy.

4. Molecules have both color and speed.

B. Explain in your own words the difference between temperature and heat.

_____

_____

Name _____

Daily Science
Big Idea 5
WEEK 1

Day 2

Weekly Question

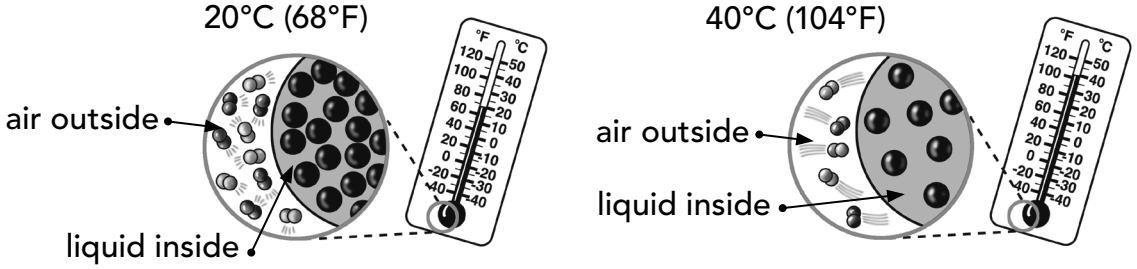
How does a thermometer work?

A typical outdoor thermometer consists of a thin glass tube filled with a colored liquid. Like most substances, the liquid inside a thermometer expands when it is heated and contracts when it is cooled. The height of the column of liquid, which "tells" you the temperature, is read from a scale along the side of the thermometer.

Knowing that temperature is actually a measure of the kinetic energy of molecules makes it easier to understand how a thermometer works. As molecules of air move, they hit the walls of a thermometer with kinetic energy. Each collision between an air molecule and the wall of the thermometer results in a transfer of **thermal energy** from the air to molecules in the thermometer. This causes the molecules in the liquid to gain kinetic energy and move farther apart, expanding the liquid. When the liquid inside the thermometer reaches the same temperature as the air, thermal energy stops flowing and the liquid stops expanding. Now you can read the temperature.

Vocabulary

thermal energy
THER-mul
EN-ur-jee
energy of a substance expressed as heat



A. If the temperature is 80˚F outside, does the air transfer *more* or *less* thermal energy to a thermometer than if it is 60˚F? Explain your answer.

_____

_____

B. Explain why, when you have a fever, you have to keep a thermometer in your mouth for a certain length of time in order to read your correct temperature.

_____

_____

Name _____

Daily Science
Big Idea 5
WEEK 1

Day 3

Weekly Question

How does a thermometer work?

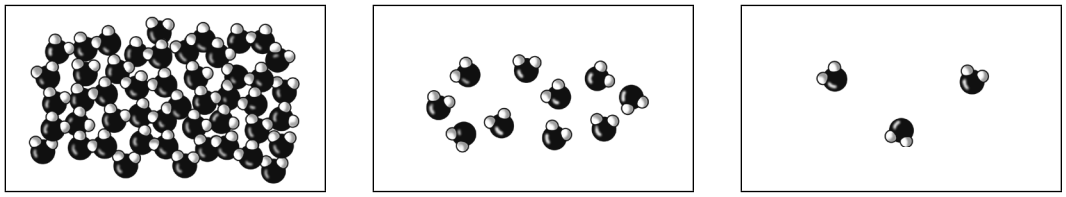
Water is the most common liquid on Earth, but it is not used in thermometers. Why not? Water is a liquid only between 0°C (32°F) and 100°C (212°F), which means that when the outside temperature dips below 0°C, the water in the thermometer freezes. And when the temperature is above 100°C, the water turns to gas.

These changes in water's form show that heating or cooling a substance doesn't just affect its temperature. It can also result in a **phase change**. Imagine heating ice cubes in a sauce pan on a stove. First, the ice cubes melt. Then, the water boils. What is happening? The molecules of ice do not have a lot of kinetic energy, so they stay in a fixed place. Heat increases the kinetic energy of the molecules to the point that they leave the solid and begin to flow as liquid water. With enough heat, the molecules move fast enough to leave the liquid and enter the air as a gas.

Vocabulary

phase change
FAZE chaynj
a change from one state of matter into another

Molecules of Water



solid liquid gas

A. Number the steps in the correct order to show how ice changes into gas.

____ The molecules gain enough kinetic energy to leave their solid form.

____ The water becomes liquid and gets hotter.

____ Ice is heated and the molecules speed up.

____ The molecules leave their liquid form and enter the air as a gas.

____ Ice molecules vibrate in a fixed place.

B. Which of these is *not* a phase change? Check the correct box.

❒ steam coming out of a kettle ❒ snow being formed into a snowball

❒ ice cream melting ❒ clouds forming

Name _____

Daily Science Big Idea 5 WEEK 1

Day 4

Weekly Question

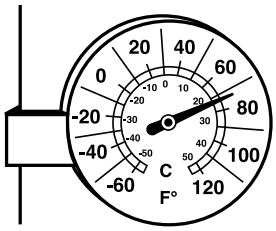
How does a thermometer work?

The liquid that once filled most thermometers was mercury, a heavy metal that has the unusual property of being a liquid at **room temperature**. Unfortunately, mercury was discovered to be toxic and is no longer commonly used. Instead, most thermometers today are filled with red-colored alcohol.

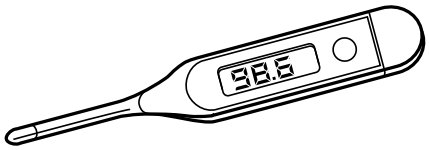
Some thermometers, however, don't use any liquid. For example, a spring thermometer contains a coiled piece of metal that expands when heated. And a digital thermometer detects temperature by using an electronic sensor. But however they are designed, all thermometers have two things in common. They all measure temperature, and they all work because of one basic law of nature—the properties of substances change when the temperature changes.

Vocabulary

room temperature
room TEM-per-uh-CHUR
an average temperature of 20–25°C (68–77°F)



spring thermometer



digital thermometer

A. Since the liquid substance used in most thermometers is alcohol, what does this tell you about the properties of alcohol? Fill in the bubble next to the correct answer.

Ⓐ It is toxic.
Ⓑ It is a liquid at room temperature.
Ⓒ It is a solid at room temperature.
Ⓓ It becomes a gas at 100°C and a solid at 0°C.

B. Complete the sentences to name two things that all thermometers have in common.

1. They measure _____.

2. They work based on the fact that _____

_____.

Name _____

Daily Science
Big Idea 5
WEEK 1

Day 5

Weekly Question

How does a thermometer work?

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

phase change	**thermal energy**	**heat**
temperature	**kinetic energy**	

1. All molecules move, and the energy of their motion is called _____.

2. The measurement of the average amount of kinetic energy in the molecules of a substance is _____.

3. _____ is energy expressed as heat.

4. Heating or cooling a substance can result in a _____.

5. _____ is the transfer of thermal energy.

B. Summarize the process of how water changes from ice into a gas. Use the words *kinetic energy*, *heat*, and *phase change* in your answer.

_____

_____

_____

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

Thermal energy is to **heat** as _____.

- ❒ **temperature** is to **phase change**
- ❒ **ice** is to **gas**
- ❒ **thermometer** is to **temperature**
- ❒ **kinetic energy** is to **motion**

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

Week 2

How does a microwave oven cook food?

One of the most familiar and ubiquitous appliances in kitchens today is the microwave oven. Students may be surprised to learn that the technology behind this popular household device originated in a secret weapons program operated by Allied forces during World War II!

This week students discover that microwave ovens cook food by means of radiation—waves of energy that can pass through matter or empty space. Microwave radiation is absorbed by the water molecules in food or beverages; the molecules "flip" back and forth in response to the oscillating electromagnetic fields of the microwaves. It is this molecular motion that then translates into heat, which cooks the food. Since microwave radiation is only absorbed by water molecules, and not by plastic or glass, the containers generally stay cooler than the food. However, a container can heat up in a microwave oven due to physical contact with the hot food itself, which transfers heat to the plate, cup, or bowl by means of conduction.

Day One

Vocabulary: *microwaves, radiation, wavelength*

Materials: page 135

Before students read the passage, draw a wavy line on the board and point out its troughs and peaks. Introduce the vocabulary and, to demonstrate how scientists measure a wavelength, draw a horizontal line between the two peaks you drew on the board. Then have students read the passage and complete the activity. Review the answers together.

Day Two

Materials: page 136

Explain to students that one of the first uses of microwaves was by the British, who used them to detect enemy planes during World War II. This "secret weapon" was known as *radar* (Radio Detection And Ranging). After students have read the passage, have them complete the activities.

Day Three

Vocabulary: *conventional, electromagnetic*

Materials: page 137

After introducing the vocabulary, write *electromagnetic* on the board. Underline *electro* and *magnetic* separately, and explain to students that each underlined phrase stands for the type of energy produced. (electric and magnetic) Then have students read the passage and complete the activities. Review the answers together.

Day Four

Vocabulary: *conduction*

Materials: page 138

Introduce the vocabulary word and have students read the passage and complete the activities. For the oral activity, have students discuss the questions in pairs and then share their answers with the class. If students have trouble coming up with ideas, suggest that they think about things that can be conducted. (an orchestra, a train, an experiment, a meeting, etc.)

Day Five

Materials: page 139

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

Name _____

Daily Science
Big Idea 5
WEEK 2

Day 1

Weekly Question

How does a microwave oven cook food?

When you hear the word **radiation**, you might think of x-ray machines or even nuclear weapons. But radiation is also what cooks your food in a microwave oven. Does that mean the food becomes radioactive? Of course not! Radiation is simply the transfer of energy by waves. These waves can move through matter as well as empty space. In fact, radiation from the sun travels 93 million miles through mostly empty space before it reaches Earth.

The sun's energy, or solar radiation, radiates in waves of different **wavelengths**. Waves with the longest wavelengths have the least energy. Waves with the shortest wavelengths have the most energy. **Microwaves** are longer than visible light and have wavelengths measured in centimeters (cm). Microwaves that are about 12 cm in length are the ones used to heat food in microwave ovens.

Use information from the passage and the diagram at the bottom of the page to fix each of the following statements. Cross out the incorrect words and write the correct ones above them.

1. Microwaves are shorter than visible light waves.

2. X-ray radiation is used to heat food.

3. The longest wavelengths have the most energy.

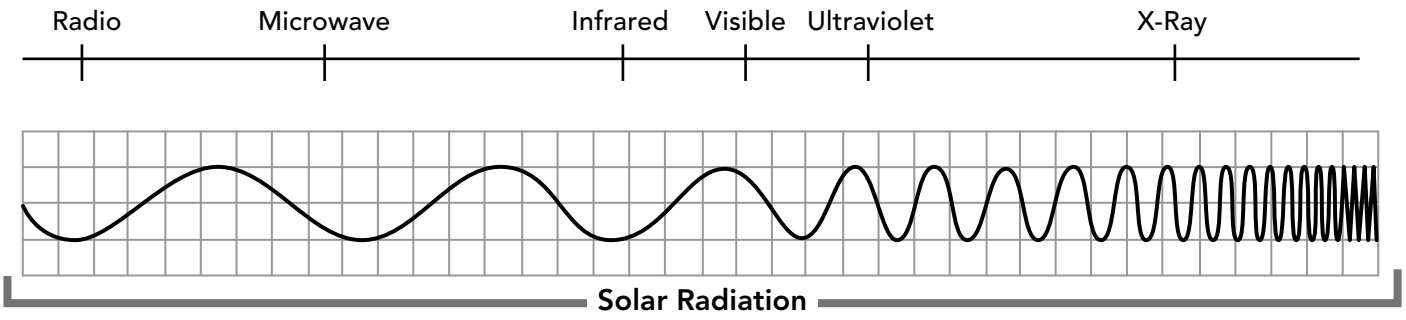
4. Radiation is the transfer of matter by waves.

Vocabulary

microwaves
MY-krow-wayvz
energy waves between 1 meter and 1 millimeter in length

radiation
RAY-dee-AY-shun
transfer of energy by waves that move through matter and space

wavelength
WAYV-lenkth
the distance between one peak and the next in a wave



Name _____

Daily Science
Big Idea 5
WEEK 2

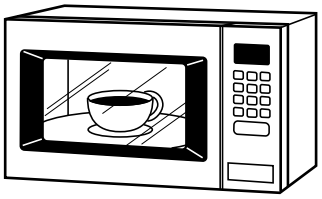
Day 2

Weekly Question

How does a microwave oven cook food?

Before microwave ovens were invented, microwave radiation was used by the military to detect enemy aircraft. This system was called *radar*. Then, in 1945, a man named Percy Spencer was experimenting with a device that produced microwaves and discovered that the waves had accidentally melted a candy bar in his pocket! Spencer's discovery helped scientists realize that microwaves could also be used to cook food.

Microwaves have two properties that make them ideal for cooking food. First of all, they are easily absorbed by water molecules, as well as by some fats and sugars—substances commonly found in the food we eat. When these molecules absorb microwaves, the energy is converted directly into thermal energy. The second useful property of microwaves is that they are *not* absorbed by most plastics, glass, paper, or ceramics. This means that food and beverages can be cooked in cups, bowls, and plates without the containers getting too hot. Metal, however, reflects microwaves. Microwaves can generate electric currents in metals and create sparks, which is why you can't put anything metal in microwave ovens.



A. After each word, write whether the material *absorbs*, *reflects*, or *neither* absorbs nor reflects microwaves.

1. coffee _____

2. metal spoon _____

3. plastic spoon _____

4. potato _____

5. empty glass _____

6. paper cup _____

7. silver tray _____

8. pizza _____

B. What are the two properties of microwaves that make them ideal for cooking food?

1. _____

2. _____

Name _____

Daily Science
Big Idea 5
WEEK 2

Day 3

Weekly Question

How does a microwave oven cook food?

The invention of microwave ovens has changed the way people cook. Cooking with microwaves is much, much faster and uses less electricity compared to cooking with **conventional** electric ovens. Electric ovens create heat by passing an electric current through metal wires called *filaments*. The filaments get hot and heat the air inside the oven, which in turn gradually heats the food. In contrast, a microwave oven sends out waves that directly excite the water molecules in food, causing them to heat up almost immediately.

This heating effect is the result of **electromagnetic** fields that microwaves produce. The fields change direction billions of times each second, and water molecules move in tune with these fields. As the water molecules try to align with the constantly changing direction of the electromagnetic fields, the water molecules flip back and forth at a very fast pace. This movement translates into heat.

Vocabulary

conventional
kun-VEN-shun-ul
ordinary, typical

electromagnetic
ee-LEK-troh-mag-NET-ik
having both electric and magnetic energy

A. Write *conventional oven*, *microwave oven*, or *both* to answer each question.

1. Which kind of oven has metal filaments that get hot when electricity flows through them? _____
2. Which kind of oven uses less electricity than the other? _____
3. Which kind of oven uses heat to cook food? _____
4. Which kind of oven excites the water molecules in food? _____

B. Complete the paragraph.

Microwaves produce _____ that are constantly changing directions. Water _____ try to move in tune with these fields.

Name _____

Daily Science
Big Idea 5
WEEK 2

Day 4

Weekly Question

How does a microwave oven cook food?

Although microwaves are not absorbed by the materials in many food containers, you must still be careful when you remove a dish from a microwave oven because it could be hot. But this is not because of microwave radiation. It is from the dish being in contact with hot food. Remember that heat flows from warmer objects to cooler ones until both objects reach the same temperature. In the case of microwaved food, heat is transferred from the food to the dish through the process of **conduction**. In other words, when hot food comes into contact with a cool container, heat flows from the food to the container.

Vocabulary

conduction
kun-DUK-shun
transfer of energy by physical contact

Radiation and conduction work together in other ways to transfer heat. If you have ever walked barefoot in the summer, you know that pavement or sand can feel hot under your feet. The sun's radiation has caused the ground to heat up, and conduction transfers this thermal energy to your feet as soon as they touch the ground.

Draw an arrow between the words in each pair to show the direction in which heat is being conducted between the objects.

1. cold floor bare feet

2. microwaved dinner plate

3. egg frying pan

4. ice cream bowl

Talk

The word *conduction* contains the root word *conduct*. What other meanings of *conduct* can you think of? In what ways, if any, are they related to the meaning of *conduction*? Brainstorm with a partner.

Name _____

Daily Science
Big Idea 5
WEEK 2

Day 5

Weekly Question

How does a microwave oven cook food?

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

microwave	**wavelength**	**conventional**
radiation	**conduction**	**electromagnetic**

The first _____ oven was called a Radarange® because it cooked food with a kind of _____ that was used in military radar technology. Microwaves used in cooking have a _____ of about 12 cm. The microwaves are readily absorbed by water molecules in food, and they cook the food much faster than a _____ oven does. The water molecules flip back and forth with the _____ fields. This motion is converted to heat, which flows to cooler parts of the food and container through the process of _____.

B. Write whether each of the following is an example of *radiation*, *conduction*, or *reflection*.

1. sun heating the sand _____

2. bottle of soda chilling on ice _____

3. an image being seen in a mirror _____

4. a pan heating on a stove top _____

5. microwaves bouncing off metal _____

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

Week 3

What causes hurricanes?

This week students learn that hurricanes are tropical phenomena that are the result of uneven heating of Earth. These massive storm systems transport heat from the equator to higher latitudes, and they accomplish this in two ways: through convection, which relies on the mixing and movement of air molecules to convey heat, and through the heat released when water vapor condenses, delivering thermal energy to the atmosphere.

Although hurricanes can be extremely violent, modern technology allows us to know when they are coming and to prepare for them. Conditions that spawn potentially destructive storms are well understood, and weather satellites constantly monitor the warm ocean waters that are the breeding grounds for tropical storms and hurricanes.

Day One

Vocabulary: *hurricane, satellite*

Materials: page 141; globe, flashlight

After introducing the vocabulary, use the flashlight and globe to demonstrate how the sun heats Earth unevenly. Shine the flashlight first on the equator and then at the poles. Explain that because Earth is a sphere, sunlight hits the equator directly but strikes the poles at an angle, which means that the light reaching the poles is not as strong as the light reaching the equator. Have students read the passage and complete the activities. Review the answers together.

Day Two

Vocabulary: *convection*

Materials: page 142

Invite students to guess why hurricanes and tornadoes spin. Then explain that the movement of water and air on Earth is changed by Earth's rotation. Scientists call this effect the *Coriolis force*. Introduce the vocabulary word and have students read the passage and complete the activities.

Day Three

Vocabulary: *heat of condensation*

Materials: page 143

Before students read the passage, remind them that water molecules must absorb thermal energy in order to evaporate and become a gas. Then, after students have finished reading, reiterate that thermal energy isn't actually "lost" when the vapor condenses. It stays in the atmosphere when water vapor condenses back into a liquid. Have students complete the activities and review the answers together.

Day Four

Vocabulary: *circulating*

Materials: page 144

Point out to students that hurricanes are just one of many convection systems on Earth. Then have them read the passage. If students have trouble understanding how convection happens in the mantle, explain that this process applies to any material that flows. So, even though magma is technically a solid, it flows like taffy in the mantle, and thus transfers heat by convection. Have students complete the activities.

Day Five

Materials: page 145

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