Classic Science

STUDENT COPY

ELEMENTARY EARTH SCIENCE

The lab of MR.Q

Scott McQuerry

First of all thank you very much for choosing to use this book with your family. You will not be disappointed! I have been asked by several families the same question, "**Who** are you and **why** are you doing this?" Without going into great detail, E=McQ is owned, operated and stressed over by me. Yep… little o' me. I am an educator by profession and began working with homeschool families several years ago while offering free programs to area families to explore various concepts in science. I guess I can't stop doing what I love!

This product is the fruit of my ten-year labor in science education. Having worked with homeschool families over these years I have gained an appreciation for your needs, struggles and wants. I could not make this curriculum any simpler for your child to master the concepts of science. It is completely reusable, relatively cheap (I tried to keep it under the cost of a tank of gas), adaptable to various needs at home and as fun as humanly possible.

Like I said, I am an "army of one". I have no problem with you using this one copy for your entire family. However, if you give or loan this book out to another family you are putting a lot of pressure on me. If this happens too often, I may not be able to continue producing this curriculum. I am not telling you to keep this curriculum a secret! But I have provided some options for you should another family wish to use this curriculum:

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CHAPTER 1

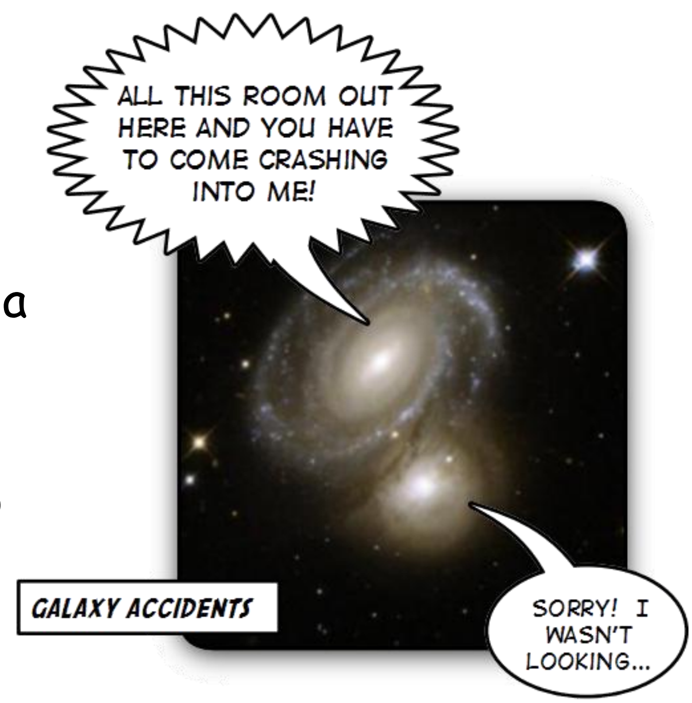
Okay! I know this book is called "Earth Science", but before you can understand how the earth works, you have to look at something much larger...

The Universe

The **universe** is a word we use to describe everything that exists...everywhere! **It is huge!**

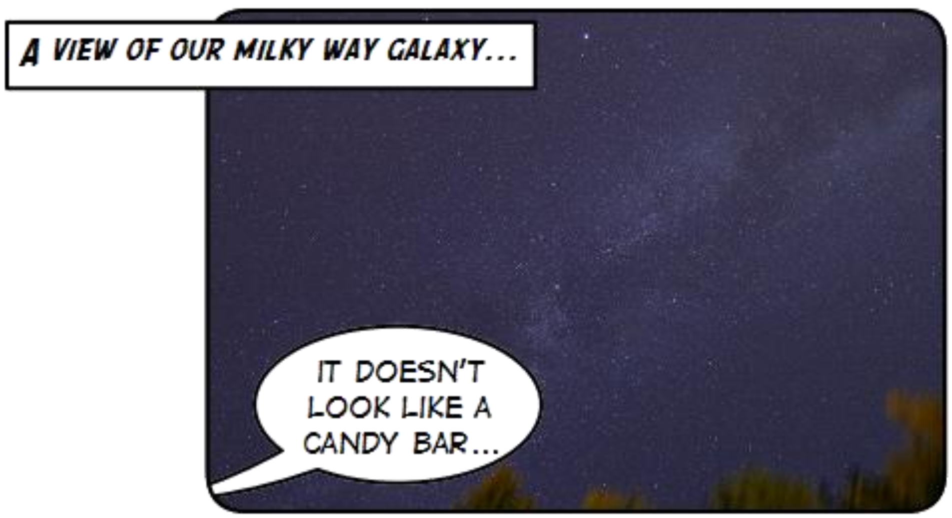
So how big is the universe? *Nobody knows*! Scientists who study the universe are called **astronomers** "a-straw-no-murs". Astronomers have many different ideas about how large the universe is, but they are still working on the answer!

The most important tool that astronomers use to study the universe is the **telescope** "tell-eh-scope". The telescope is a tool that is used to make faraway objects look closer than they are. This makes it easier for people to study objects that are far away!



However, astronomers know that even their most powerful telescopes cannot see everything in the universe!

What astronomers do know is that the universe has billions of what are called **galaxies** "gal-axe-eez". So what makes up a galaxy? A galaxy is made up of gas, dust and also a large group of **stars**.



Before you explore what makes up a star, let's take a closer look at our own galaxy...

Astronomers like to name the galaxies they study. The galaxy we live in has been named... The **Milky Way galaxy!**

So what does the milky way galaxy look like?

Well... astronomers have never taken a vacation beyond our galaxy! So, they have not been able to take a picture of the Milky Way! However, their best guess is that our galaxy looks like a huge spiral! In fact, many of the galaxies that astronomers see have the same spiral shape. If it helps you to think about what a spiral galaxy looks like - go into your bathroom and flush the toilet. Do you see how the water forms a spiral as it flows down the drain? That spiral shape is what a spiral-shaped galaxy looks like!

Let's get back to those huge balls of glowing gas that make up all galaxies...

Stars

Stars are huge balls of hot gas that give off a large amount of energy (like heat and light)! Do you know the name of our nearest star? You guessed it... **the sun!**

Whatever you do...never look straight at the sun! It will hurt your eyes!

Stars give off a lot of heat, but some give off more than others...you can tell how hot a star is by its color!

Blue stars are the hottest stars.
White stars are cooler than blue stars.
Yellow stars are cooler than white stars.
Orange stars are cooler than yellow stars.
Red stars are the coolest of them all!

Red stars may be the coolest star in the group, but they are still very hot...around 4000°F. That's hot! Our own sun is a yellow star and its temperature is about 9500°F. **Ouch!**

To give you an idea of how hot that is... the temperature of your bath water is probably only about 85°F.

Galaxies may be filled with gas, dust and stars...but they also contain everything that is spinning around the stars too! Some of these things are:

Comets
Asteroids "ast-ur-oids"
Meteoroids "meet-ee-or-oids"
and Planets

A **comet** is a chunk of ice, gases and dust that spins around a sun. Some scientists like to call comets, "dirty snowballs." the movement of an object around a sun is known as an **orbit.** (You will need to remember this word! You'll be seeing it a lot!)

But wouldn't a chunk of ice melt as it gets close to the sun?

Yes it does!

In fact, most pictures you see of comets have a long tail that is pointing away from the sun! This tail is made up of melted ice and dust that is leaving the comet as it gets closer to the sun!

Asteroids are large chunks of rock that are floating in space. The size of these rocks can be between 20-600 feet tall. How big is that??? Well... A car is about five feet tall. So the smallest asteroid would be as tall as four cars stacked on top of each other! You would have to stack 125 cars to reach the top of the largest asteroids!

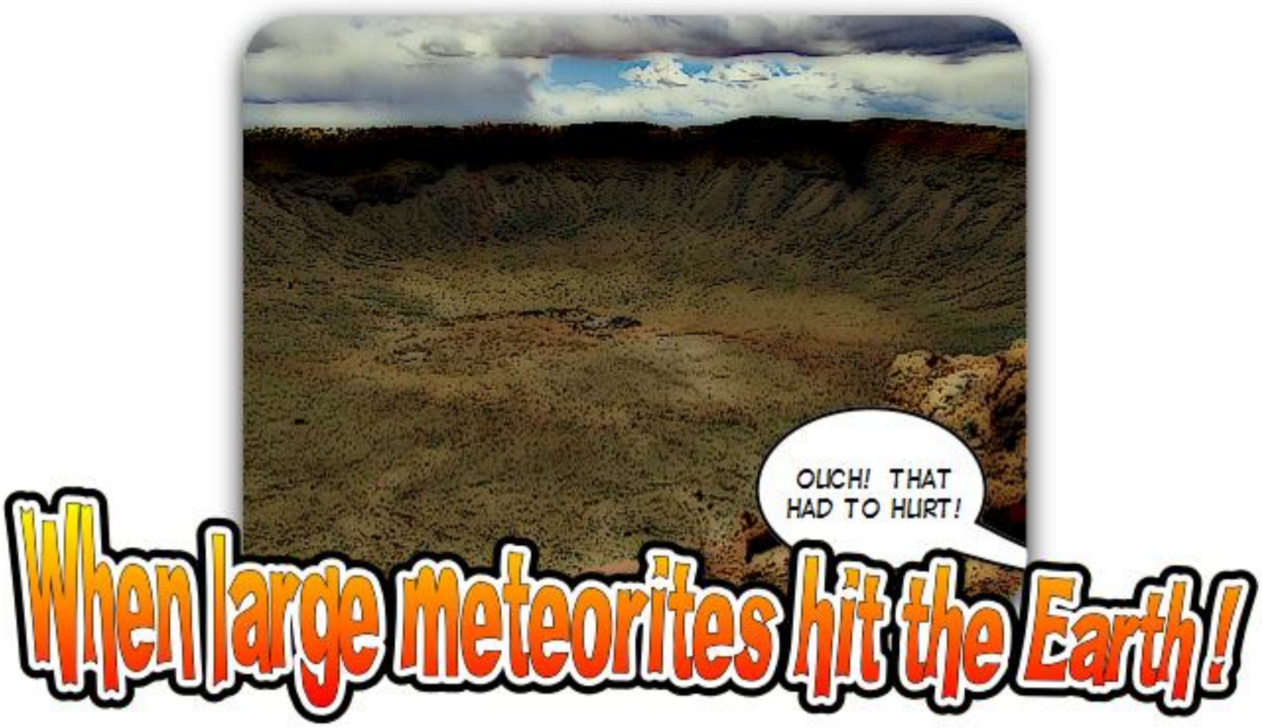
Meteoroids are smaller chunks of rock (less than 20 feet long) that float around in space. Millions of meteoroids float towards us everyday. When this happens, the meteoroid is called a **meteor** "meet-ee-or". You may have heard of meteors as "shooting stars" or "falling stars"! These small chunks of rock are moving very quickly and heat up quite a lot! In fact, they get so hot that pieces of them burn off and leave a trail behind them!

Most meteors burn up before they reach the ground, but not all of them! If a meteor smashes into the ground, it can cause a lot of damage! When this happens, astronomers call the meteor a **meteorite** "meet-ee-or-ite".

Finally, many stars have very large round bodies of rock or gas that orbit around them. These objects are called **planets**. There are nine planets that orbit our sun! Our planet, **Earth**, is the third planet from the sun.

All of the planets, asteroids, meteoroids and comets that orbit a star make up one **Solar system** "so-lar sis-tem". Astronomers have found many different solar systems in our own Milky Way galaxy.

In the next chapter, you are going to explore the planets that make up our solar system!



Match the words in the first column to the best available answer in the second column.

____	Meteor	1)	Huge balls of hot gas that give off a large amount of energy (like heat and light)!
____	Earth	2)	The movement of an object around a sun
____	Solar system	3)	"Shooting stars" or "falling stars"; falling meteoroids that move so quickly through the air that they get very hot and burn up, leaving a glowing trail behind them in the air
____	Meteoroids	4)	Our nearest star
____	Planets	5)	Smaller chunks of rock (less than 20 feet long) that float around in space
____	Meteorite	6)	Very large round bodies of rock or gas that orbit around stars
____	Orbit	7)	The name given to a meteor that does not burn up in the air and smashes to the ground

_____	Stars	8)	Large chunks of rock that are floating in space
_____	Milky way galaxy	9)	Our home planet, the third planet from the sun
_____	Telescope	10)	All of the planets, asteroids, meteoroids and comets that orbit a star
_____	Comet	11)	Scientists who study the universe
_____	Asteroids	12)	A tool that is used to make faraway objects look closer than they are.
_____	Sun	13)	The name of the galaxy that we live in
_____	Galaxies	14)	A large group of gas, dust and many stars.
_____	Universe	15)	A chunk of ice, gases and dust that spins around a sun; a "dirty snowball"
_____	Astronomers	16)	A word we use to describe everything that exists

Compare and contrast
the
Stars and Planets

Compare (things that are the **same** between these two)	Contrast (things that are **different** between these two)

Place the following in order from largest to smallest:

Stars
Universe
Solar system
Comet
Meteoroid
Meteorite
Galaxies

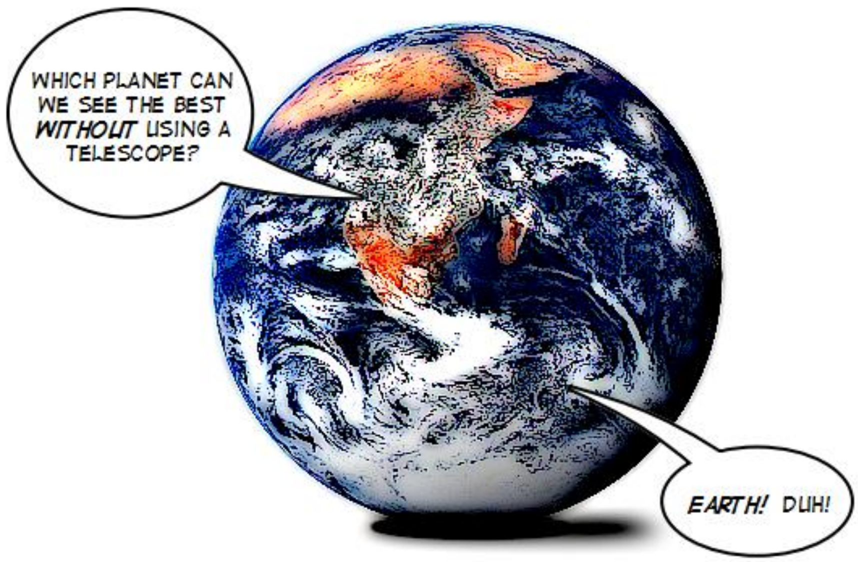
1.
2.
3.
4.
5.
6.
7.

CHAPTER 2

In the last chapter, you learned about how the universe is made up of billions of galaxies. And, each of these galaxies may have billions of stars and solar systems in them... That is very hard to imagine, isn't it?

This week, you are going to start exploring a part of the Milky Way galaxy that is closer to our home...

Our solar system!



Our solar system is made up of everything you learned about in the last chapter: planets, meteoroids, comets and asteroids.

Let's take a closer look at the eight planets that are in our solar system...

Mercury
Venus ("vee-nus")
Earth
Mars
Jupiter ("joo-pit-er")
Saturn
Uranus ("yur-ah-nus")
and **Neptune**

If you were looking from the sun, the first planet you would find would be Mercury, then Venus, Earth and finally Mars.

These planets are known as the **terrestrial planets**. Terrestrial ("tur-rest-tree-ul") means "Earth-like" or "made of rock". People have known about Mercury, Venus and Mars for a very long time because you can see these planets without using a telescope! Although a telescope is very helpful when you study these planets!

But if you could use a telescope to look at these planets, you may find something about them that is very much like Earth...

Moons!

Moons are large bodies of rock that orbit a planet! Earth only has one moon, but some planets have many more! Let's take a closer look into these planets...

Mercury is the closest planet to our sun and it does not have a moon. It is less than half the size of Earth! If you were to visit Mercury, there would be no air for you to breathe at all! In fact, visiting Mercury would not be such a good idea since the temperature of this planet reaches 800°F (to give you an idea of how hot this is, paper burns at 451°F)

Venus, The second planet in our solar system, is almost the same size as Earth. Venus does not have a moon either, but it is surrounded by air. Now before you start thinking about taking a trip to this planet next summer, there's something you need to know about the air around Venus. It is filled with a gas called **carbon dioxide**! This is the gas that our bodies breathe out! We cannot survive by breathing mostly carbon dioxide. Plus, all of the gas that surrounds Venus traps a lot of heat on the planet...think of this gas as a blanket that keeps you warm at night! In fact, The temperature of Venus is warmer than Mercury...870°F !

Earth is the third planet from our sun. We know more about our own planet than all of the others in our solar system. We are going to explore our own planet in the next two chapters...

Mars is the fourth planet from our sun and it is the coldest of all the terrestrial planets. The temperature on Mars is around -80°F most of the time! Mars is known as the "red planet" because of its rust color. It gets this color from a metal called iron that is found inside the soil on Mars. Two moons orbit this planet. However, much like Venus, the air around Mars is filled with carbon dioxide gas.
The next four planets in our solar system...

Jupiter, Saturn, Uranus and Neptune

...are known as **gas giants** because they do not have much (if any) solid ground at all! They are made up of gas!

Jupiter is the largest planet in our solar system. You could fit 1,000 Earth's inside Jupiter! Much like the terrestrial planets, Jupiter can easily be seen without a telescope! Astronomers have found 39 moons orbiting this gas giant! The average temperature on Jupiter is around -211°F. Most of the gas found on Jupiter is called **hydrogen** "hi-dro-jen". Hydrogen is the most common chemical found in the known universe!

A huge storm has been taking place on Jupiter for hundreds of years. Astronomers call it the **"great red spot"** because it looks like a swirling group of red clouds. The neat thing about the great red spot is that it is larger than our own planet!

Saturn is the sixth planet from the sun and it can also be seen without a telescope. Saturn is much larger than Earth – by almost ten times! Much like Jupiter, most of the gas found on Saturn is made up of hydrogen. Astronomers have found 47 moons orbiting Saturn and a thick band of seven rings that surround the planet. These rings are made up of small pieces of ice that orbit Saturn all the time. Saturn is much colder than Jupiter, with an average temperature of -285°F.

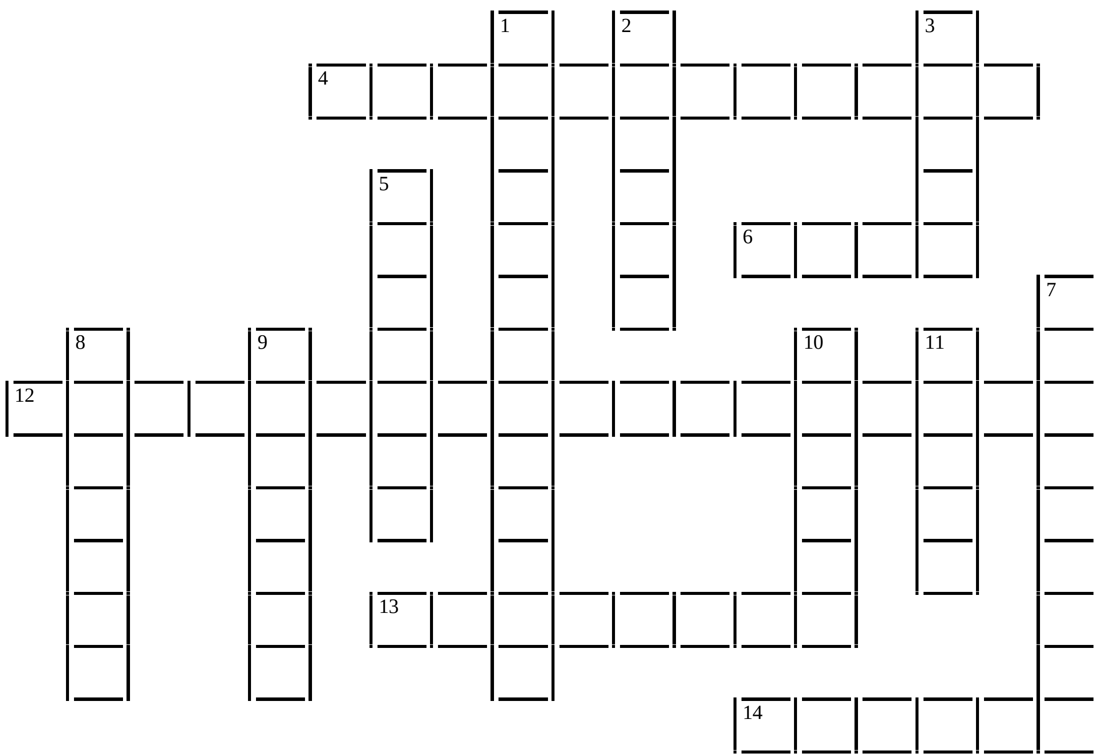
Uranus, the seventh planet in our solar system, is almost four times larger than the Earth! Astronomers have found 21 moons orbiting Uranus and three small rings of ice, much like Saturn. It is not very easy to see this planet without a telescope, but it can be done! If you think that this planet is colder than Saturn, you are correct! The average temperature on Uranus is -328°F. The gases that are found on Uranus are mostly hydrogen too!

Neptune is the last gas giant in our solar system and it is the eighth planet from the sun. This planet cannot be seen without the use of a telescope! It is too far away! Neptune and Uranus are about the same size, making them much larger than Earth. Astronomers have found eleven moons and four rings orbiting Neptune. Most of the gas on Neptune is also made up of hydrogen and it is very cold...-346°F. One of the moons of Neptune, called **"Triton"** "try-ton", is one of the largest moons in our solar system.

Okay! Take a deep breath! That was a lot of information! Next week, we are going to spend some time looking at our own planet...

Earth!

Place the answers to the following clues in the boxes below. Each box should contain one letter.



ACROSS

4 A huge storm on Jupiter that has lasted for hundreds of years

6 The fourth planet from our sun; the coldest of all the terrestrial planets (about -80°F); known as the "red planet" because of its color

12 Planets that are "Earth-like" or "made of rock"; in our solar system they would be Mercury, Venus, Earth and Mars

13 The most common chemical found in the known universe

14 A gas giant within our solar system; the seventh planet in our solar system

DOWN

1 A gas that our bodies breathe out

2 A moon which orbits Neptune

3 Large bodies of rock that orbit a planet

5 The largest planet in our solar system

7 Planets which do not have much (if any) solid ground at all

8 The closest planet to our sun

9 The last gas giant in our solar system

10 A gas giant within our solar system; the sixth planet from the sun

11 The second planet in our solar system

Which one is right? Circle the correct answer.

1. All of the following are gas giants except for?

a) Jupiter
b) Mars
c) Uranus

2. What would you find within the great red spot?

a) Carbon dioxide gas
b) A large storm
c) Hydrogen gas

3. Which of these planets is warmer than Jupiter?

a) Earth
b) Uranus
c) Neptune

4. All of the following are terrestrial planets except...

a) Venus
b) Mercury
c) Saturn

5. Which of these planets has only one moon?

a) Saturn
b) Triton
c) Earth

6. Planets and moons are different because?

a) Moons orbit planets
b) Planets orbit moons
c) Only planets orbit a star

Draw a picture of our solar system. Within your picture you must show the sun, all eight planets and their orbits around the sun. Be certain to label all of these objects!

CHAPTER 3

So far, you have explored a tiny amount of the information about each of the planets in our solar system…except for one:

The Earth

Scientists who study the Earth are called **geologists** "gee-all-o-jists". Geologists know more about the earth than any other planet in the solar system! But they have been looking at our own planet for a much longer amount of time! Let's see what our geologists have found out so far:

Geologists have found that the Earth looks very much like a round ball. It takes this shape because of a force that you may have heard about... **gravity**!

Gravity ("gra-vi-tee") is a force that pulls objects towards each other in space. Our earth has its own gravity that pulls objects towards the middle of our round planet. Gravity is the reason why you always fall back down to the ground after you jump into the air! You are being pulled towards the center of the earth.

It doesn't matter where you are standing on the Earth... gravity will always pull you back down towards its center!

YOUNG JOHNNY LEARNS HOW CRUEL GRAVITY CAN BE...

Planets look like round balls because gravity is always pulling on the earth towards its center... if everything on a planet is being pulled towards its center, the planet is going to start looking like a huge ball! The force of gravity does not only work on the Earth...

Everything in the universe has gravity!

That's right... everything has a force pulling objects towards its center! The cool thing is... the larger the object, the stronger its gravity! So... our gas giants (Jupiter, Saturn, Uranus and Neptune) have a stronger amount of gravity than the smaller terrestrial planets (Mercury, Venus, Earth and Mars).

I said earlier that the Earth looks like a round ball, and that is almost true. In fact, the earth has a small "bump" that surrounds its surface. Like a large rubber band that is stretched around a ping-pong ball! This bump is found around the middle of the earth which is called the **equator** ("ee-quay-tor").

The equator divides our ball-shaped earth into two equal sides. Each of these sides is called a **hemisphere** ("hem-es-fear"). Earth has two hemispheres which are called the:

Northern hemisphere

and the

Southern hemisphere

What does Northern and Southern mean?

Before we go any farther, let's go over how people in the world know which direction they are traveling. First of all, imagine that you and your parents are all facing a different direction. Now if someone told all of you to turn right, could you do it? Of course you could! However, would all of you be facing the same direction? No way! Since everyone started off by facing a different direction, when all of you turned to your right, you all ended up facing different directions again!

To make things easier, there are a set of directions that have been created to help everyone face the same way if they need to. These directions are called the **cardinal directions** ("card-in-all") and they are named: **north, south, east** and **west!**

No matter where you are on Earth, if you are told to travel north, you should be able to do it! In fact, if you are told to travel north, everyone would end up somewhere in the "northern" hemisphere! Pretty cool, huh?

In fact, there is a point in the northern hemisphere where you cannot go any farther north. It is called the **North Pole!** You can do the very same thing with the southern hemisphere too! The area of the southern hemisphere where you cannot travel any farther south is called the **South Pole!**

Imagine placing a pencil all the way through a small snowball. Now stand the snowball up so that the pencil is standing straight up! The area where the pencil sticks out of the top of the snowball would be the north pole and the area where the pencil sticks out of the bottom would be the south pole.

Every place on the Earth that is north of the equator is within the Northern hemisphere. And, every place that is south of the equator is within the southern hemisphere.

The other two cardinal directions, **east** and **west**, can be found with the help from our sun!

If you are traveling in the direction of the sun as it first start to rise in the morning... you are heading **East**!

If you are facing the sun at the end of the day, when it is starting to get dark outside...you are facing **west**! The sun always rises in the east and it sets in the west.

Now that you know what direction you are traveling, let's take a closer look what is underneath you...

If you could slice the earth in half, you would see that the earth is made up of many layers. These layers look like the layers inside an onion. Geologists have named these layers:

the Crust
the Mantle
and
the Core

The **crust** is what all of see nearly every day! This is the outside area of our planet. Our crust is very thin... however, don't grab a shovel and try to dig your way through the crust! You will never make it! Even though the crust is "thin", you should know that it is still almost 25 miles deep!

Underneath the crust you will find the **mantle**. This is a large area of the earth that is nearly 1,800 miles deep! The area where the crust and the mantle meet is mostly solid rock... however, the farther you travel towards the center of the Earth, the hotter it gets! The deeper parts of the mantle are where most of the hot lava comes from when you see a volcano erupting!

The deeper parts of the mantle, where you would find melted rocks, is always moving around very slowly... like a bowl full of syrup. So... the area where the top of the mantle and the crust meet are always floating on the huge amount of lava inside the deeper areas of the mantle.

The center of the Earth is where you would find the **core!** The size of the core is about 4400 miles long! This is about the size of the planet Mars and it is made mostly of metal! As you travel towards the center of the core, geologists believe you would find an area of metal that is as hot as 12,000°F! **Yikes!** To give you an idea of how hot that is, the oven that you have in your home probably does not get much hotter than 500°F ! You should know that your oven can get very very hot!

It is really cooking inside our Earth!

Next week, you are going to explore something else that really cooks inside our solar system... ***the sun!!!***

Match the words in the first column to the best available answer in the second column.

_____	equator	1)	a force that pulls objects towards each other in space
_____	gravity	2)	the outside area of our planet
_____	hemisphere	3)	The very hot center of the earth that is made up of different kinds of metals
_____	crust	4)	the most northern spot in the northern hemisphere
_____	mantle	5)	an imaginary line that divides a planet into two equal sides
_____	cardinal directions	6)	Scientists who study the Earth
_____	geologists	7)	large area of the earth under the crust; this area contains large amount of solid and melted rock
_____	south pole	8)	north, south, east and west; a set of directions created to help everyone face the same way
_____	north pole	9)	the most southern spot in the southern hemisphere
_____	core	10)	equal sides of a planet

Circle the hidden words from below:

U E E V H S T O I N N A A H Q O S M E S R C G T S
T I N R O R O S O S A L Q E E U T E L T G L T P E
N O L E N S P H I T C V Q O S Q O T O T L E S T N
M E R E H E O M N H S C R R R E U I R E E O S G E
I P U I S E I E O U T E H E R G E A G L U T R R H
H P H U U I G O T P T O P E E Y P E T T Q A T R R
G S T T R T T E A T R O H R O A R R H O V R V N E
U R C P I O E Q O G E P E Y C U I P H I R P O O R
S S O P C E H Y U L S L T S R G O O T S G T E L E
S T R S E E R O S I M P R S E L U Y O I A O E S L
E O R O L V T L M L A R L E E G R V N R L M E H E
L T E R G S P E H I S M P E R P E E R E E T I S A
H H R V G P H T R L T A E E P P H O E G N C S R E
C S T A E R C O C R A T R V Y G U Q I N T M L R E
H Q E E E G E H G E S R R E O C T A E S E G E N O
E R S E R T E E T I R O R T L N C C L Q T L U L A
H S T E A E E O L N L I Y U O L G S G H T E P O C
O S I G L E E Y L E R R P E T M E E T N E R L O H
T G E G G O T S L O O A R T E O G G A T T E R E H
G S E A T M P E E E G S G O T T R M G E S E E S R
P N O A S E P H U A T I O I G A E M O G E U G R E
E P E R O C N O T G U U S E Y H O R G V T I R I H
S R T E R S M G O R H V U T O R O G R R E S O C T
E L R E N G A S R G O O R A S L E L U C E C E O O
H O T O G L L L T I L N G O O T Y L G S M E E R G

geologists	**south pole**	**north pole**
gravity	**crust**	**hemisphere**
equator	**mantle**	**core**

Just for fun, imagine you could dig all the way through the Earth! Describe your journey as you reach the core and continue to dig through to the other side of our planet. What do you see?

CHAPTER 4

So far, you have explored all of the objects that can be found in our solar system except for two things:

The Sun and the Moon

Our sun is a huge ball of hot gas in the center of the solar system. Most of the gas that is found in our sun is made up of hydrogen! If you remember, hydrogen is the most common chemical found in the known universe and makes up most of the gas giants in our solar system!

However, unlike the gas giants, the gas in our sun is super heated! The outside part of the sun has a temperature of 10,000°F and its core can reach up to 27,000,000°F!

When gas is heated to these high temperatures, they start to do some weird things. Sometimes, these super hot gases can start to act like a magnet!

When superheated gas starts to act like a magnet, scientists call it **plasma**. Every star that you see in the night sky is made up of a huge amount of plasma! It is safe to look at all of these stars that fill up our night sky. They are too far away to hurt your eyes.

But never never never look at our sun!
It can hurt your eyes very badly!

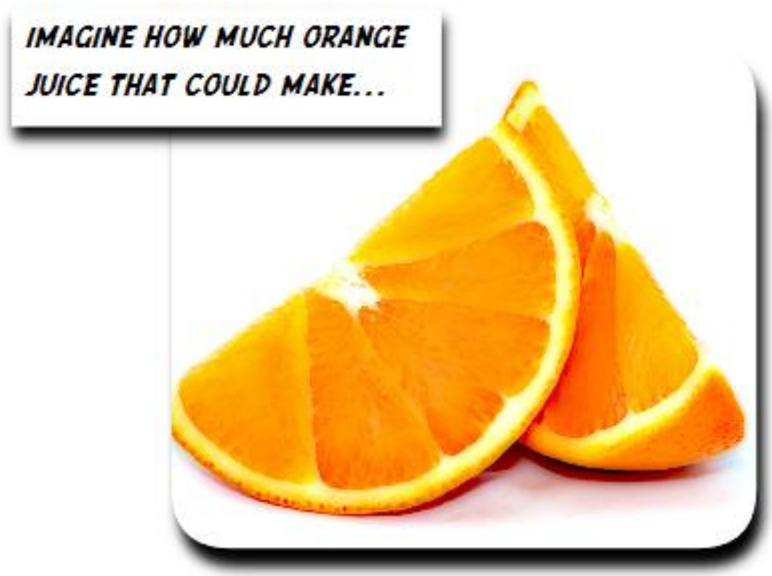
Now, let's talk about size...

Our sun is about 109 times larger than the planet Earth! It is very hard to understand how large this is, so let me show you...

You could line up all of the planets in our solar system three times along the sun's equator and you would still have plenty of room left for one more Saturn, four more Earths and the planet Mercury!

Or how about this one...

If the sun were the size of a large, juicy orange...the Earth would be the size of a sesame seed about 49 feet away!



Okay... okay!
The sun is really big... I get it!
But what does it do for us?

Well, the sun is the major source of energy for our planet. Most of the energy what is given off by the sun can be seen and felt by us every day. This type of energy is called:

Light energy

(it is also known as **radiant energy**)

SARA FINALLY SPEAKS WITH HER MYSTERIOUS FOLLOWER.

Most of the light that you and I can see everyday comes from the sun! This light is known as **visible light**. Red, orange, yellow, green, blue and purple are all kinds of visible light! But humans cannot see all of the light that the sun gives off!

When you go outside on a sunny day you feel warm because the sun is giving off a large amount of **infrared light**. We cannot see infrared light, but we can feel it when it touches our skin.

Right now, the sun is giving off visible and infrared light through space. Both of these forms of light energy are traveling at the same speed, which is called the **speed of light.** Light travels at a speed of over 186,000 miles per second!

Think of the fastest person you know...now imagine that we would speed this person up really quick! Are you thinking of that person in your mind? Good! Now imagine if that same person was able to run all the way around the equator of the Earth in one second! That is really fast! But, if this person was traveling at the speed of light, he would be able to run all the way around the equator of the Earth almost **seven times** in one second!

I think your friend would be winning lots of awards if he could travel that fast!

Think about this...if your friend could travel at the speed of light, and we asked him to run straight into the sun...

(He would look like a burnt matchstick...Don't try this at home!)

...it would take your friend 8 minutes to reach the sun from Earth! That is how long it takes light to travel through space from the sun to our planet!

Remember, you can never look straight into the sun… That would be bad… Very very bad!

But you can see light that bounces off of the sun almost every night!

Where can you see this light???

Well, you would have to be looking for… **the Moon**

The moon is known as a **satellite** ("sat-eh-lite"). A satellite is any object that orbits a larger object. You could say that all of the planets in our solar system are satellites of the sun! The moon is the brightest object in the night sky because it **reflects** (which means "bounces") light off of the sun.

Our moon is very small… Earth is about four times larger than the moon.

If you look at the moon, you would see that it has many bowl-shaped holes. These holes are called **craters**. Most of these craters were made when meteoroids, comets and asteroids smashed into the moon! The moon is not the only satellite that has craters…all of the terrestrial planets have been hit by objects in space! And we all have craters!

Here is one last thing for you to think about:

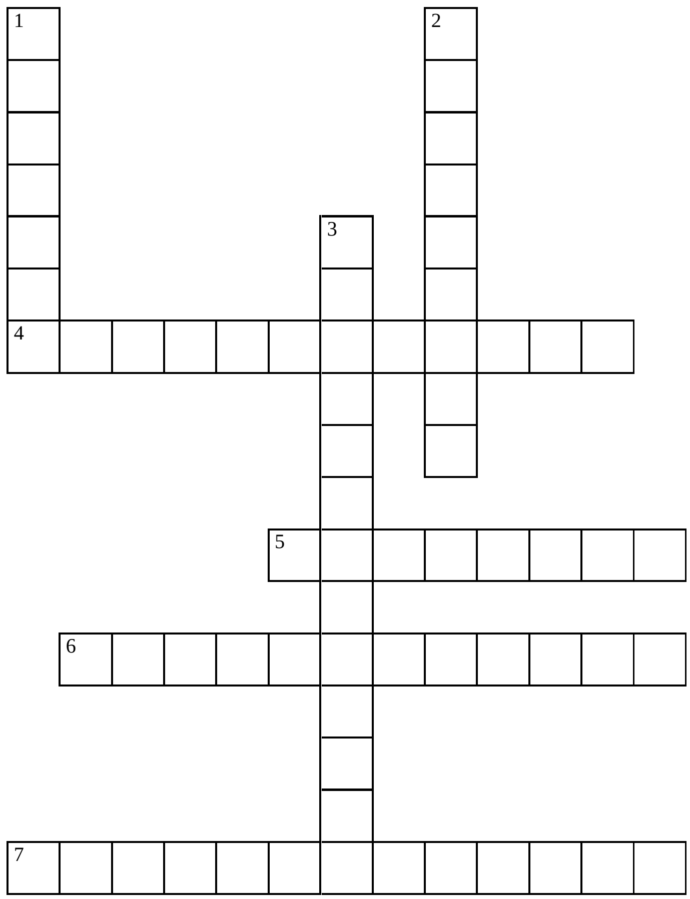
Right now, everything in our solar system is moving! The moon (along with the sun, the Earth and all of the planets) all move in different ways inside our solar system!

In the next unit, you are going to explore how all of these objects are moving... and why they don't crash into each other!

Fill in the blanks with the correct letters. The words in the list on the right provide a clue to the answer.

1. _adi_nt en_rg_	also known as "light energy"
2. _isib_e li_ht	all of the light that can be seen (i.e. all of the colors of the rainbow)
3. i_fra_ed _ight	a form of light given off by the sun which we cannot see but can feel as being warm
4. sp_e_ of li_h_	the speed in which light travels from the sun; 186,000 miles per second
5. s_te_li_e	any object that orbits a larger object
6. _ef_ect	to bounce
7. c_ate_s	bowl-shaped holes found on the moons and other terrestrial planets when meteoroids, comets and asteroids smashes into its surface

Place the answers to the following clues in the boxes below. Each box should contain one letter.



ACROSS

4 The speed in which light travels from the sun; 186,000 miles per second

5 Bounces

6 All of the light that can be seen (i.e. all of the colors of the rainbow)

7 Also known as "light energy"

DOWN

1 Bowl-shaped holes found on the moons and other terrestrial planets

2 Any object that orbits a larger object

3 A form of light given off by the sun which we cannot see but can feel as being warm

Compare and contrast:

Visible light and Infrared light

Compare (things that are the **same** between these two)	Contrast (things that are **different** between these two)

Unit One Review

Imagine you are the smallest particle of light (known as a photon) leaving the sun. Fill in the blanks in the story below with the following words:

Astronomers	The moon	Venus
Asteroids	Mars	Uranus
Speed of light	Jupiter	Milky Way Galaxy
Mercury	Neptune	Saturn

Starting from the sun I travel at the ________________ past the first planet in our solar system, ________________. I'm not slowing down as I reach the second planet, ________________ either. As I speed past Earth, I bounce off its satellite, ________________, and continue through the solar system. I pass the last terrestrial planet, ________________ and keep on moving!

I pass by several large chunks of rock floating around in space which ________________ on Earth call ________________. I speed past ________________, then ________________, ________________ and finally ________________. As I leave our solar system, I continue moving towards other solar system in the ________________.

Be certain to go over your definitions for the test!

CHAPTER 5

In the last unit, you learned that planets, moons, asteroids, comets and meteoroids all orbit a star. All of these objects make up one solar system!

This week, you are going to learn how some of these objects move as they orbit our own star, the sun! Some of these objects move in many different ways. Let's find out how!

Are you ready for a show? Here we go.

Imagine waking up just before **sunrise**. This is the time when the sun can be seen for the first time in the morning. You grab a chair and a cool drink of water and sit out in the front yard to watch how this large ball of glowing-hot gas seems to move across the sky all day long!

If you are watching carefully, you will see that the sun appears to move from the east side of your yard to the west side. The time when the sun can no longer be seen at the end of the day is called **sunset**.

But the show does not end yet! After sunset, you will start to see the moon and many stars in the sky!

Did those stars magically appear from nowhere!?

Of course not!

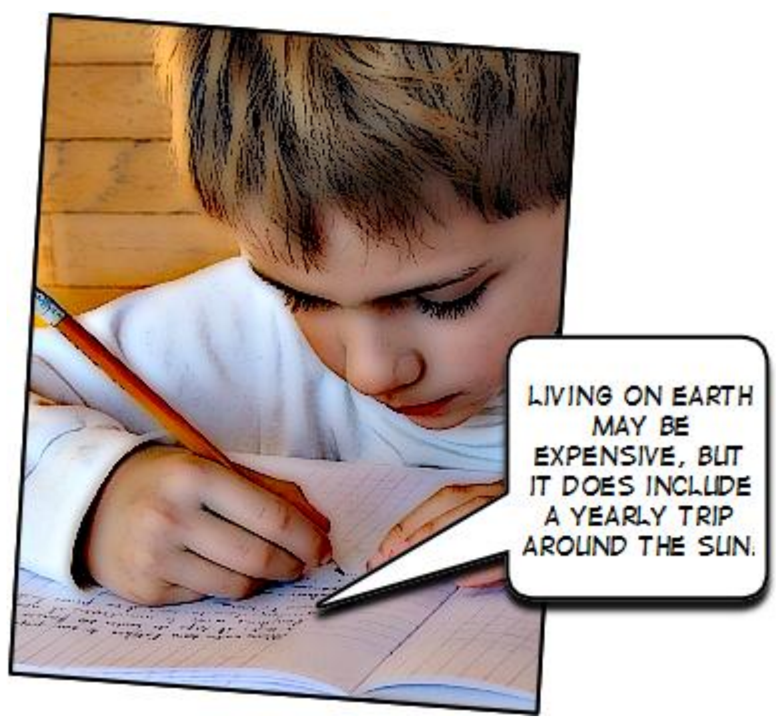
Those stars were always out there, we just cannot see them very well because our sun is so bright! That is right! The visible light from the fills our sky with so much bright light that we cannot see the stars that are around us.

Now, back to the show.

If you keep an eye on the moon you will see that it also seems to move throughout the night sky! So do the stars!

What is going on?

First of all, everything in the universe is moving in some way! Our sun, our planet and our moon are all moving right now!



You need to understand a couple of definitions before we go any further:

Rotating
and
Revolving

Whenever something is orbiting a star, it is said to be **revolving** around the star! Imagine running around your home right now. You would be revolving around the house!

If something is **rotating**, it is going through a different kind of motion. The best example of something rotating is a top. A top spins around and around, but it doesn't move too far from where you started spinning it, right?

In chapter three, you learned about the north and south poles with this example.

Imagine placing a pencil all the way through a small snowball. Now stand the snowball up so that the pencil is standing straight up! The area where the pencil sticks out of the top of the snowball would be the north pole and the area where the pencil sticks out of the bottom would be the south pole.

The pencil makes a line that goes all the way through the snowball, right? This imaginary line is known as the **axis**.

If you could spin the snowball on the tip of the pencil (just like a top) you would say that the snowball is **rotating** on its **axis**!

Now what does all of this have to do with our solar system?

Well, everything in our solar system is revolving around our sun. This means every planet, moon, comet, asteroid and meteoroid!

And. every moon in our solar system is revolving around its planet! So. Earth, Jupiter, Saturn, Uranus and Neptune all have moons orbiting around them right now!

That may seem like a lot of movement. but we are not done yet!

Planets and moons go through another kind of motion as they revolve in space. They also rotate on an axis. Every planet and moon rotates on an axis, just like a spinning top!

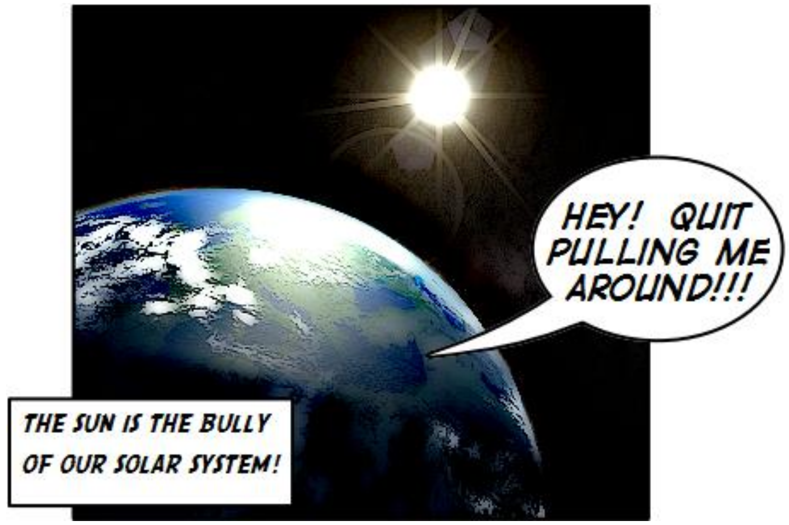
The really cool thing about all of this motion is that scientists can predict where every planet and moon is going to be at any time! Planets and moons go through all of their rotations and revolutions in an easy-to-follow path. This is why their motion is called an orbit!

But don't planets or moons go flying off into space? Why doesn't their orbit change?

The reason why we are spinning around the sun right now is because of the force of gravity!

If you remember, gravity is a force that pulls objects towards each other in space. The larger the object, the stronger the pull of gravity!

Since our sun is the largest object in our solar system, it has the greatest amount of gravity. Our orbit does not change around the sun because the sun's gravity keeps pulling on us as we revolve! Gravity causes our moon to revolve around us too! Earth's gravity pulls on the moon and causes it to move in orbit around us!



So how does gravity work?

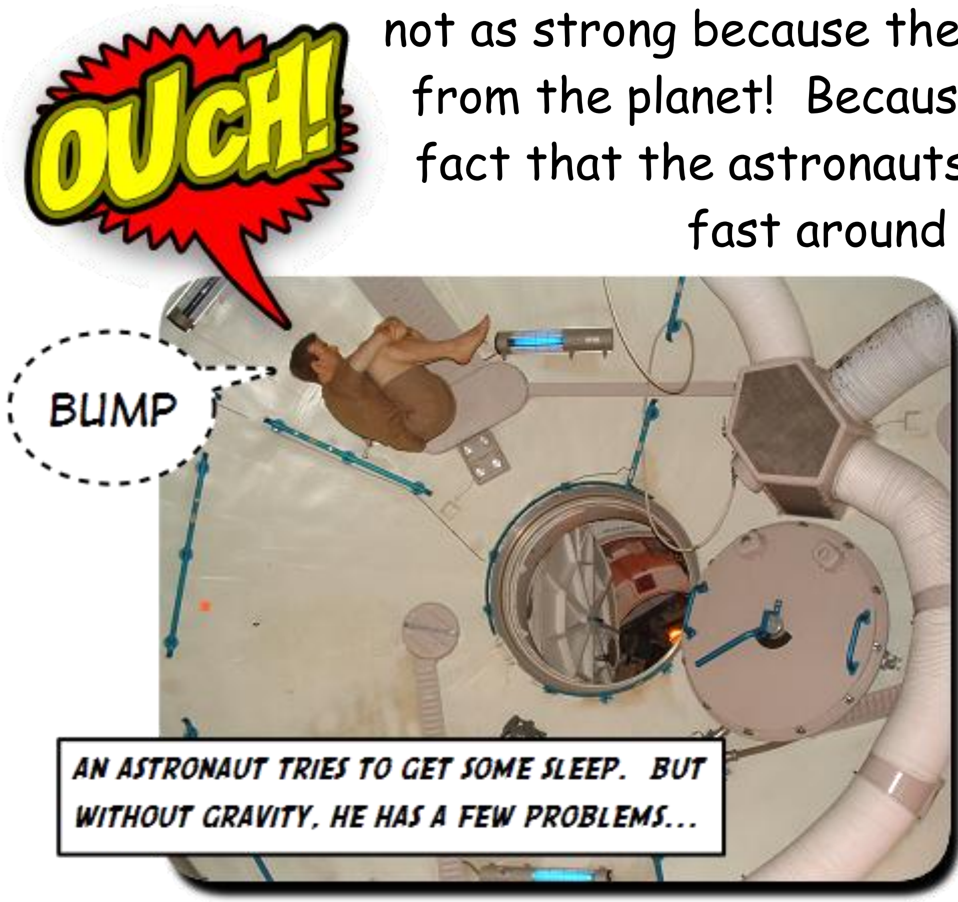
Nobody knows how exactly how gravity works! There are a lot of ideas out there and scientists are working hard to figure it out. But right now, scientists cannot explain how gravity works. But they **can** predict what it can do!

What we do know is that every planet has its own gravity that affects itself and its moons as they revolve around the sun. Gravity also has an effect on how the Earth and moon rotate on their axis.

So what causes everything to float in space?

When **astronauts** (these are people who travel in outer space) leave the Earth, gravity is still pulling them to the ground! *That's right! There is gravity in space!*

All astronauts and space ships that are in orbit around a planet are in something called **weightlessness** or **microgravity**. This means that the effects of gravity are not as strong because they are farther away from the planet! Because of this, and the fact that the astronauts are traveling very fast around the Earth, causes them to float in space!



Almost everyone uses their knowledge of Earth's Rotation and revolution every day.

How ?

The answer lies in next week's chapter. Stay tuned!

Match the words in the first column to the best available answer in the second column.

___ astronauts	1)	the time when the sun can be seen for the first time in the morning
___ axis	2)	also known as microgravity; a smaller amount of gravity; when astronauts are "floating" in space, gravity is not pulling on them very much, making them "weightless"
___ revolving	3)	the time when the sun can no longe be seen at the end of the day
___ rotating	4)	when an object moves around another object (for example… wher a planet orbits a sun, it is revolving around the sun)
___ sunrise	5)	people who travel in outer space
___ sunset	6)	when an object spins around, like a top
___ weightlessness	7)	an imaginary line that connects the north and south poles through a planet

Compare and Contrast: Rotation and Revolution

Compare (things that are the **same** between these two)	Contrast (things that are **different** between these two)

Look at your drawing from last week's test of the orbit of the moon and Earth around the sun.   Draw the path of these two objects around the sun once more. Would you like to change anything?

CHAPTER 6

Last week, you learned that the planets and moons in our solar system move as they orbit our sun. The rotation and revolution of these objects affect our lives everyday! In fact, they are so important I would guess that all of you have used this knowledge at some time in your lives!

Let me show you how.

Think of a day in your life that involves cake, presents and lots of fun. If you are thinking about your birthday you are right on track!

How often do you celebrate your birthday? Every week, Every month? Nope!

You celebrate your birthday once every year! You may wish that you had a birthday party every three months, but you can't. Sorry! You have to wait 365 days in between your birthday parties.

However, there is a way to change that!

If you lived on the planet Venus, you would be able to have a birthday party every 225 days!

And if you lived on the planet Mercury, you could blow out the candles on your birthday cake every 88 days!

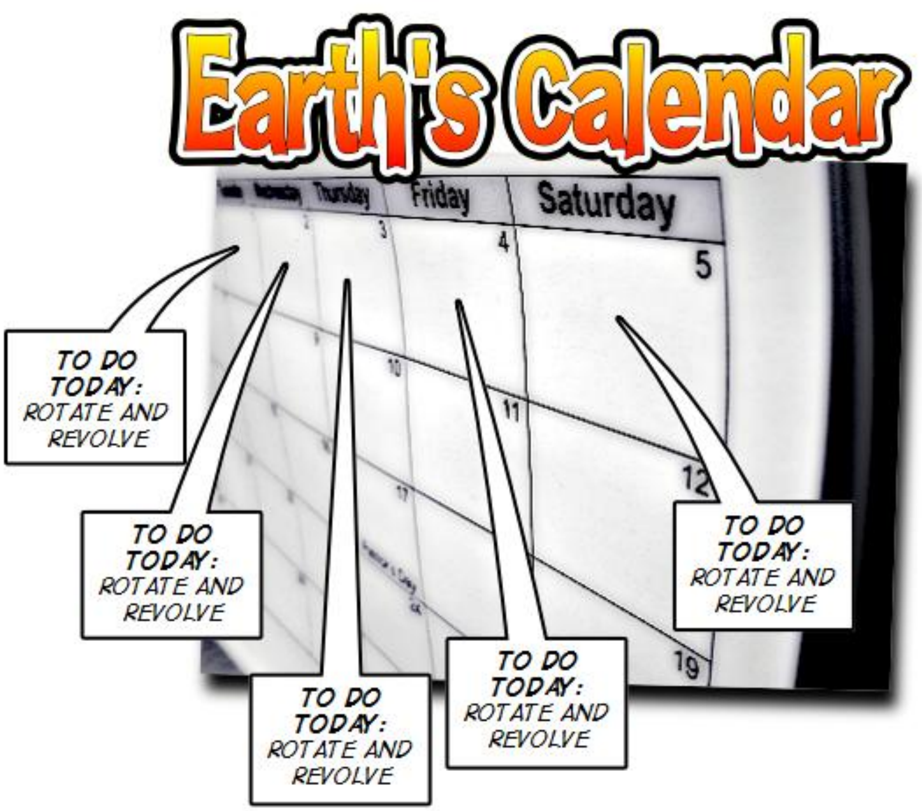
But how ?!?

Your age is measured in **years**, right? And every 365 days, you get one year older. Well, on Earth…

…one year = 365 days

But why isn't one year equal to 7 days so that I can have a birthday every week?!?

Because your teeth would rot from the huge amount of cake and cookies you would eat during all of those parties!



One year equals 365 days because that is how long it takes for the Earth to make one complete orbit around the sun.
So your age depends on how many times you have revolved around the sun!

For example, if you are ten years old, you have traveled ten times around the sun! If you are thirty years old, you have made thirty complete orbits around the sun! Do you get the idea?

But why doesn't it take 365 days for Mars or Venus to revolve around the sun?

That is a good question. In fact, Earth is the only planet that takes 365 days to make one revolution around the sun.

The closer you get to the sun, the shorter your orbit around the sun. This means that it does not take nearly as long for Mercury to travel around the sun as it does for Neptune! Here is a list of the amount of (Earth) days it takes for all of the planets to revolve around the sun:

Planet	Revolution around the sun in (Earth) days
Mercury	88 days
Venus	225 days
Earth	365 days
Mars	686 days
Jupiter	4329 days
Saturn	10,753 days
Uranus	30,664 days
Neptune	60,148 Days

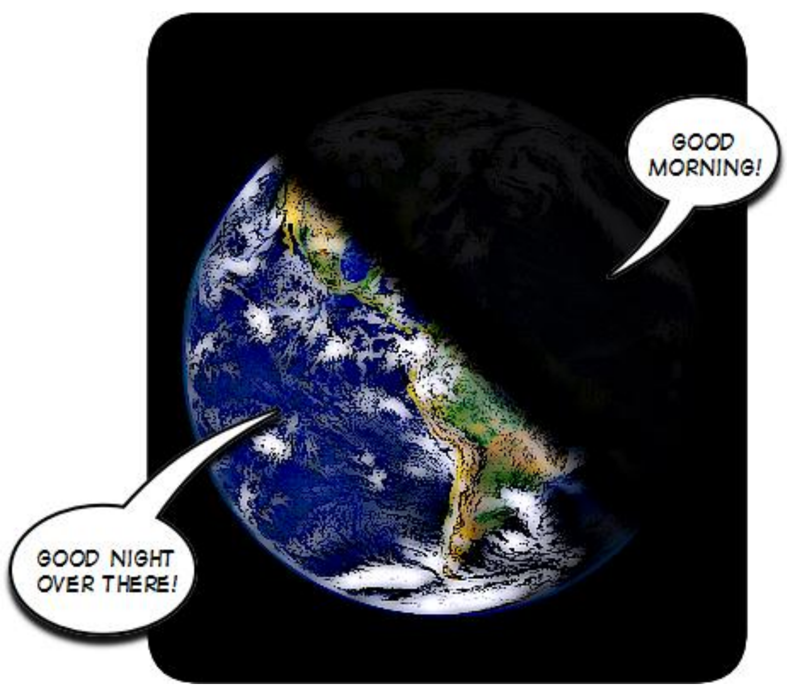
You can see why birthdays would be so rare on Neptune! You would never live long enough to blow out the candles on your first birthday cake!!!

I was looking at the table and it said "(Earth) days".

How is an "Earth day" different from any other day on a planet?

This is another good question.

It takes the Earth 24 hours to make one complete rotation on its axis. This period of time is called a **day**!



It takes 24 hours on Earth to go from sunrise to sunset and back again to another sunrise. But this is not the same amount of time for other planets in our solar system!

Here is another table that will show you how long it takes objects in our solar system to make one complete rotation:

Planet	Time to make one complete rotation (in Earth time)
Sun	27 days
Mercury	59 days
Venus	243 days
Earth	1 day
moon	29 ½ days
Mars	1 day
Jupiter	10 hours
Saturn	11 hours
Uranus	17 hours
Neptune	16 hours

Wait a minute. You added the moon and the sun in this table! Are you saying that they rotate too?

Yes I am! The moon rotates on its axis once every 27 days. This is known as the **lunar day**. This is very close to the same time it takes the moon to revolve around the Earth one time.

The moon rotates at just the right speed so that we only see one side of the moon!

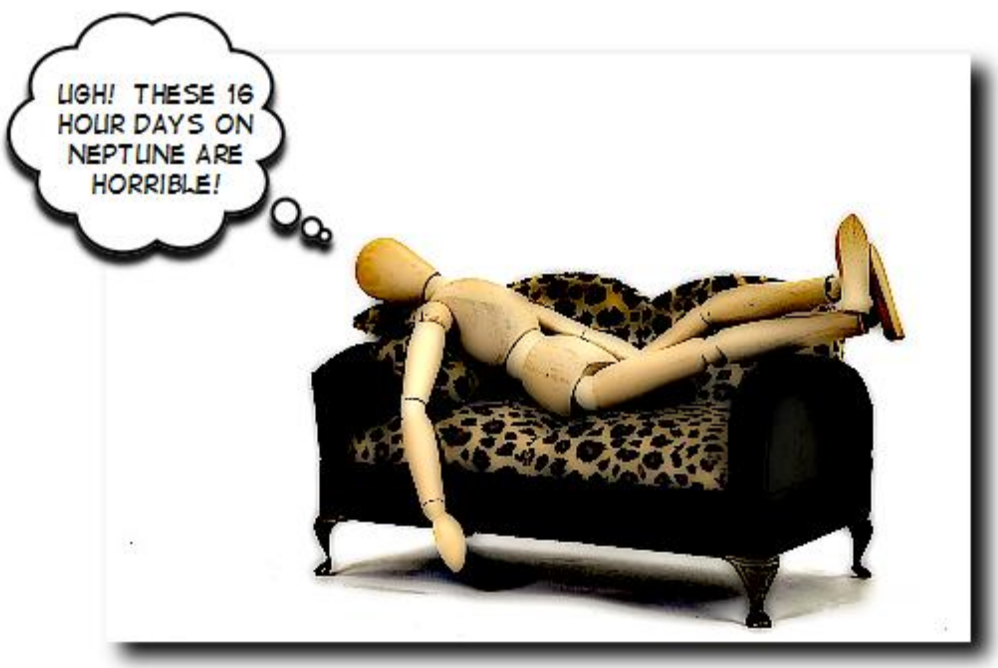
The moon is the reason why we measure time in **months**. there is a lot of history that can explain why some of our months have different numbers of days in them! We are not going to get into that in this book. But it is the motion of the moon that gives us the lengths of our months!

Our sun may not revolve around anything in our solar system, but it does rotate on an axis! It takes the sun about 25 days to rotate once on its axis. Scientists discovered the speed of the sun's rotation by looking at the movement of its **sunspots**. Sunspots are small, cooler areas on the sun that appear darker in color. As the sun rotates on its axis, scientists can measure how fast the sun it traveling.

Unlike the other planets, our sun rotates at different speeds. Near its equator, the sun rotates once every 25 days. However, the north and south poles of the sun rotate a little bit slower. around once every 28 days!

As you can see, how we tell time is related to our understanding of how objects rotate and revolve in our solar system!

Have you ever noticed that the moon looks different every night? If so, you are going to love next week's lesson. Stay tuned!



Fill in the blanks with the correct letters. The words in the list on the right provide a clue to the answer.

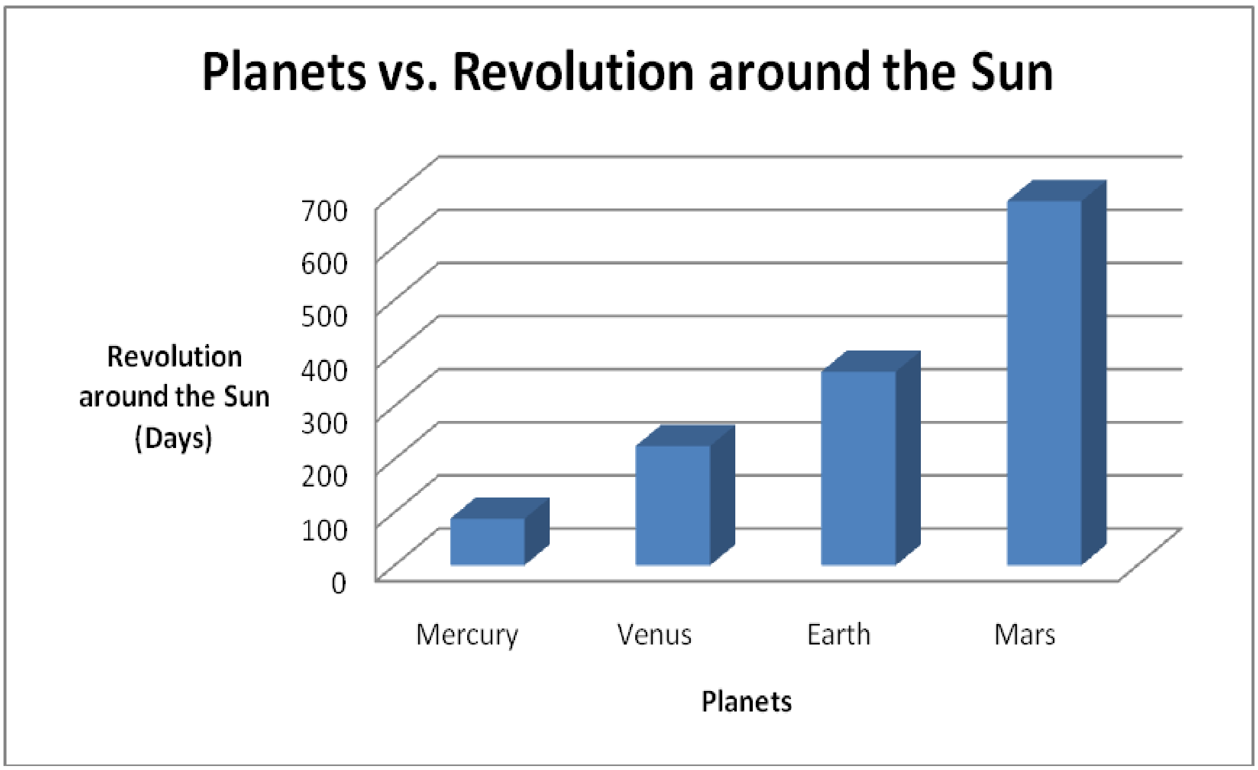
1) _ea_	the time it takes for a planet to make one revolution around its sun
2) _ay	the time it takes for a planet to make one rotation on its axis
3) Lu_a_ da_	the time it takes for the moon to rotate once on its axis; 27 days
4) M_nths	measurement of time on Earth that is closely related to the lunar day
5) _un_pots	small, cooler areas on the sun that appear darker in color.

Circle the hidden words from below:

N	H	S	O	O	T	T	N	S	O	N	A	O	T	I	T	R	E	R	R	Y	L	S	U	I
A	S	D	E	N	U	A	P	Y	T	R	D	A	T	L	N	R	N	T	M	M	A	A	N	R
N	A	U	Y	I	R	R	T	H	S	O	Y	H	M	L	M	E	M	H	N	M	T	T	A	T
I	T	A	N	T	S	Y	S	N	N	R	T	I	T	A	A	O	I	O	H	N	E	S	E	H
S	D	R	O	R	O	V	S	S	T	R	N	N	E	R	L	P	O	Y	A	A	V	N	R	R
N	R	T	E	D	T	P	I	N	A	A	O	E	T	N	O	T	S	N	R	E	R	A	T	L
U	A	O	N	S	R	O	S	E	L	I	Y	H	M	T	T	E	X	R	S	E	S	E	U	T
R	I	H	Y	T	U	M	T	Y	T	T	L	D	A	O	I	Y	E	O	S	R	A	N	Y	O
D	T	N	B	Y	O	R	H	U	E	P	N	O	M	T	U	T	N	O	A	A	A	A	S	O
R	E	O	E	S	O	N	L	D	E	A	M	P	T	T	N	O	N	A	S	R	R	R	D	I
L	U	S	T	N	D	O	D	A	I	U	R	P	A	A	H	O	M	L	D	S	T	O	S	N
L	E	O	B	N	V	H	A	P	N	E	H	N	A	Y	B	P	T	A	T	P	R	E	O	M
O	O	M	S	E	E	R	R	T	S	D	M	S	N	Y	N	R	Y	O	O	R	I	O	N	S
B	S	A	R	T	I	L	S	O	O	E	H	R	E	R	N	S	M	S	T	N	H	I	N	T
L	U	A	U	I	R	S	T	N	O	T	U	U	D	Y	T	S	L	I	E	L	E	E	A	A
T	R	N	O	R	N	D	N	L	N	T	I	S	E	R	E	N	Y	T	L	N	T	T	O	T
U	N	N	S	R	I	U	A	O	A	E	S	T	I	S	O	E	O	L	T	R	E	R	R	N
I	L	N	R	S	Y	N	M	T	U	X	U	E	T	N	S	A	O	I	T	A	B	T	T	E
P	I	A	M	S	M	P	H	O	O	O	I	O	N	O	T	H	U	E	T	I	T	U	R	R
M	L	P	O	A	N	S	Y	P	A	N	P	S	T	P	I	R	N	R	T	A	T	T	H	O
A	R	A	S	N	Y	A	S	S	N	S	N	H	P	T	T	P	S	O	Y	N	T	Y	I	L
S	Y	O	N	S	A	S	I	P	N	M	X	O	X	T	R	E	T	I	E	U	S	O	T	T
Y	Y	O	O	E	V	U	A	U	B	A	D	B	A	X	L	R	S	N	M	O	E	E	R	A
Y	N	O	A	S	T	E	S	T	R	N	R	E	I	R	Y	O	T	R	U	N	O	A	H	L
R	S	T	R	B	E	O	E	A	O	A	R	B	E	T	T	N	S	R	N	E	O	D	T	A

year	**day**	**lunar day**	**months**
sunspots	**revolution**	**rotation**	**axis**
Earth	**moon**	**sun**	**orbit**
planet	**Earth**		

Below is a graph showing the amount of days it takes for each of the terrestrial planets to revolve around the sun. Answer the questions below the graph.



1) Which of these four planets is closest to the sun?

2) Which of these four planets is farthest from the sun?

3) As the planets get farther away from the sun, what happens to their revolution around the sun?

CHAPTER 7

Okay…so far, you have learned that everything in the solar system is always moving around. Some objects (like the sun) are spinning around like a top, which is called rotation. Other objects are traveling in orbit around another object in space. This is called revolution.

…and some objects, like the Earth and the moon, are doing both!

All of this motion is measured by our scientists to give us our days, weeks, months and years!

This week, you are going to explore a way to measure the revolution of the moon around the Earth! No matter where you are on Earth, the moon looks like a bright **disk** (a round-shaped object). The moon may be bright, but it does not give off any light! It **reflects** light from the sun. This means that light is bouncing off of the moon and into our eyes!

If the moon did not orbit the Earth, and we did not rotate on an axis, the moon would look the same every night.

But that doesn't happen, does it?!?

Throughout the month, the moon looks different. Sometimes it looks like a completely round disk in the night sky. At other times, the moon looks like a round disk that has been either cut in half or almost totally gone! How does it do this?

Like the Earth, the shape of the moon is a **sphere** (this is a fancy word that means "ball"). So there is one side of the moon that is facing the sun and, there is a far side that is not reflecting any light from the sun.

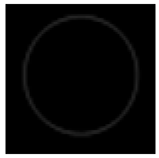
The moon looks different throughout the month because of the way the earth is moving around the sun! If you watched the moon every night for a few months, you would see that the different ways the moon appears follow a cycle. This cycle is known as the **Lunar orbit**, because it takes the moon a little over 29 days to orbit the earth!

Don't forget...

The moon is not really changing its shape! It is only reflecting light from the sun. The different shapes we see are due to the different locations of the moon during its lunar orbit. The lunar orbit shows us eight stages of the moon which are each known as **phases**.

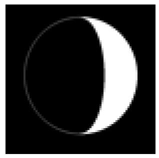
The eight phases of the moon are:

New moon



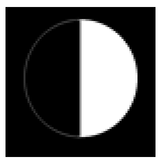
When the moon is between the earth and the sun, it appears dark.

Waxing crescent



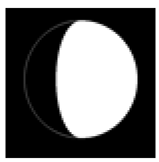
The amount of light reflected off of the moon appears to grow.

First quarter



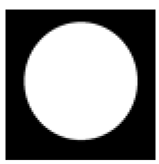
As the amount of light grows, one half of the moon's face can be seen.

Waxing gibbous



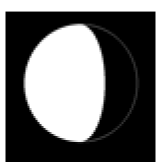
More than one half of the moon's face is reflecting light, but it still does not look like a disk yet...

Full moon



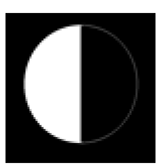
When the sun and the moon are on opposite sides of the earth, the moon, it looks like a "full" bright disk.

Waning gibbous



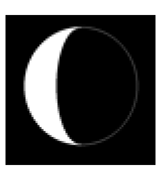
The amount of light reflecting off of the moon is getting smaller...but we can still see more than one-half of the disk.

Last quarter



The amount of light is still getting smaller as you can only see one half of the moon's face.

Waning crescent



Less than one half of the moon's face can be seen now...and the reflected light is still getting smaller.

The words **waxing** and **waning** are used to describe different phases of the moon. The moon is **waxing** when the amount of light the moon is reflecting to our eyes is growing. When the amount of reflected light is getting smaller, the moon is **waning**.

The word **crescent** means "curved shape" or "c"-shaped. You can see the waxing crescent phase of the moon the day after the new moon! Over the next seven nights, the "crescent" gets larger until it reaches the first quarter phase. At this time, one side of the moon seems to swell as more light reflects off of its surface. The word **gibbous** ("gib-us") means "to swell" and it takes about seven nights for the moon to reach the waxing gibbous phase.

Once a full moon has taken place, it takes another seven days for the moon to pass through its waning gibbous phase. At the end of this phase, the moon has reached the last quarter phase and looks like a disk that has been cut in half! Over the next seven days, the amount of reflected light still gets smaller as it passes through its waning crescent phase. At the end of this phase, the moon looks very dark and is known as the new moon.

The very next night, this cycle continues again.

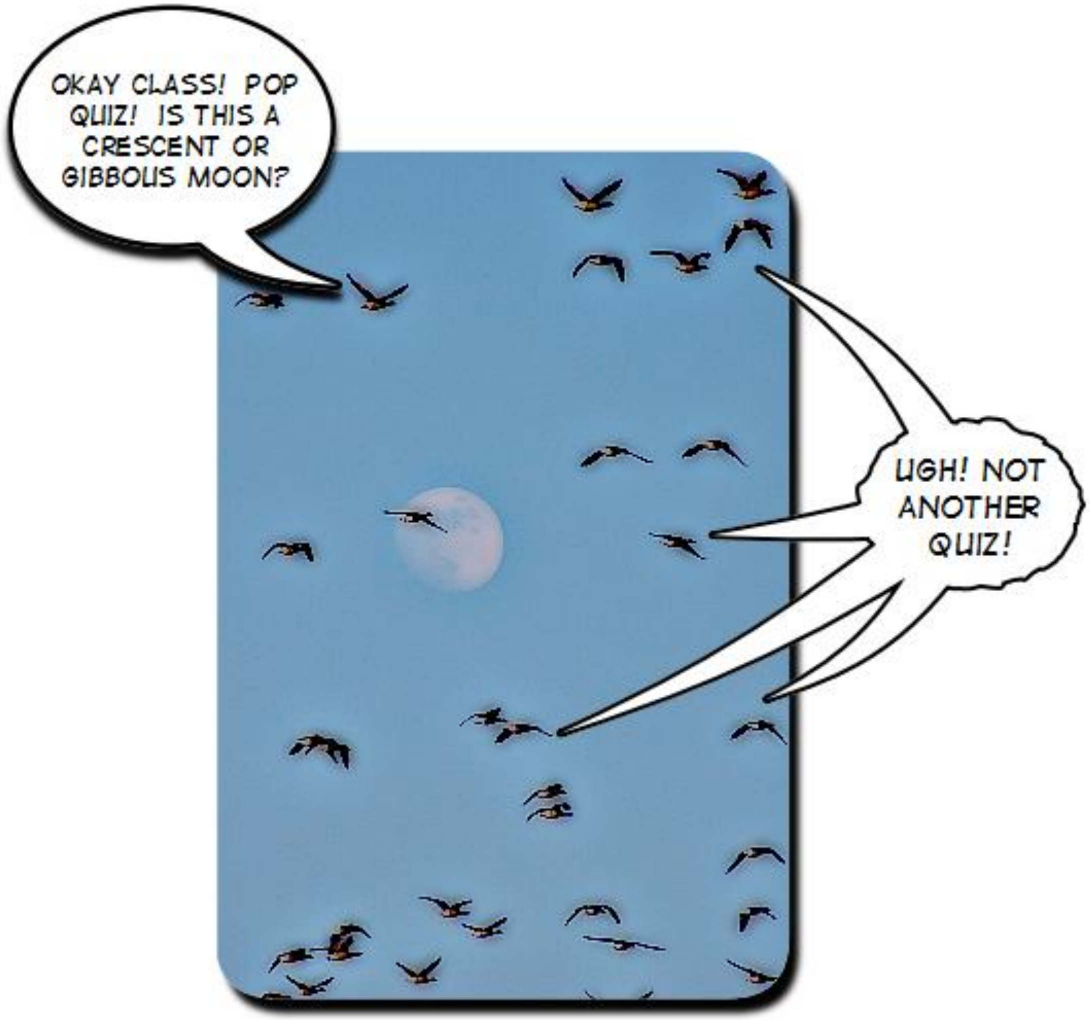
It takes the moon 29 ½ days go through all of these eight phases. This is the amount of time it takes for the moon to make one complete orbit around earth!

The cycle of these phases (29 ½ days) is shorter than most of our months. Therefore, it is possible to have two full moons in one month. When this happens, the second full moon is called a **blue moon**. Blue moons only happen once in every 2 ½ years.

Like the sun, the moon rises in the east and sets in the west. As the moon travels through its lunar orbit, it rises and sets at different times. Every day the moon rises about 50 minutes later than the day before...

Remember, the phases of the moon are caused by the position of the sun, earth and the moon in space.

There are only two times when the earth or the moon creates a shadow on each other...



This is what you will be exploring next week as we wrap up our study of space!

Match the words in the first column to the best available answer in the second column.

__ blue moon	1)	occurs when the amount of light reflecting off of the moon is getting smaller
__ crescent	2)	a round-shaped object
__ disk	3)	the occurrence of two full moons in one month
__ gibbous	4)	a (3D) ball-shaped object
__ lunar orbit	5)	occurs when the amount of light reflecting off of the moon is growing
__ sphere	6)	to swell
__ waning	7)	"curved shape"
__ waxing	8)	one complete revolution of the moon around the earth; approximately 29.5 days; contains all of the lunar phases

Which one is right? Circle the correct answer.

1. **The true shape of the moon is a?**
   a) disk
   b) crescent
   c) sphere

2. **A lunar orbit takes how many days?**
   a) 29.5 days
   b) 27 days
   c) 365 days

3. **How many different phases of the moon are there?**
   a) 27
   b) 8
   c) 12

4. **Which of the following is in correct order?**
   a) New moon, waxing crescent, first quarter, waxing gibbous, full moon, waning gibbous, last quarter, waning crescent
   b) New moon, waning crescent, first quarter, waning gibbous, full moon, waxing gibbous, last quarter, waxing crescent
   c) Full moon, waxing crescent, first quarter, waxing gibbous, new moon, waning gibbous, last quarter, waning crescent

5. **Which of the following is true?**
   a) The phases of the moon are caused by shadows
   b) The phases of the moon are caused by the positions of the earth and the moon
   c) The phases of the moon are caused by different amounts of sunlight hitting the moon

Unscramble the words below:

(Hint: check out the bold-faced words in your reading!!!)

1. boomnlue ______________________________
2. nixawg ______________________________
3. ninwag ______________________________
4. scecreent ______________________________

Write the definitions for each word:

1.

2.

3.

4.

CHAPTER 8

So far, you have studied how the moon orbits the Earth and reflects light from the sun. The amount of light that is reflected off of the sun gives us the phases of the moon.

The shape of the moon's orbit around the Earth looks like a flattened circle or oval. And, the path of the moon is not lined up perfectly with Earth's orbit around the sun. To help you with this, let's use an example...

Imagine placing a salt shaker on a round dinner plate. The salt shaker would act as the sun. The round plate would be the path that Earth takes around the sun. Now, take a smaller second plate and lean it onto the larger plate. This second plate would show the path of the moon around the Earth. The two plates are not lined up, are they? **NO!**

The fact that the orbits of the Earth and the moon are not lined up with their orbit around the sun is very important because it gives us:

Solar eclipses and Lunar eclipses

Let's take a closer look at **lunar eclipses** ("ee-klip-sez") first...

A lunar eclipse takes place when the Earth gets in between the sun and the moon.

When the Earth blocks the sunlight, it creates a shadow that can be seen on the moon.

You can only see a lunar eclipse at night when the moon is full. As the Earth's shadow blocks the sunlight, the moon's face is slowly hidden from view. It can take longer than an hour for the Earth's shadow to pass all the way through the full moon!

But why don't we see a lunar eclipse every time the moon is full?

Remember the two plates from the first page in this chapter? The orbits of the Earth and moon are not lined up perfectly! The Earth's shadow cannot be seen on the moon if the sun, Earth and moon are not lined up!

However, several times a year, all three of three objects line up just right. When this happens, Earth's shadow falls on the moon and we get to see a lunar eclipse.

Lunar eclipses are not very rare. Most people have many chances to see a lunar eclipse in their lifetime. But it is not as easy to see the next eclipse you will be exploring…

the Solar eclipse

There is a big difference between a solar and a lunar eclipse!

A solar eclipse takes place when the moon gets in between the sun and the Earth.

A **solar eclipse** can only take place when the new moon's shadow (which is known as the "**umbra**") passes over the Earth.

Don't forget that the Earth is still rotating! The path of the umbra moves across our spinning planet. This path is known as the **Path of Totality**.

Anyone on the planet who is in this path of totality can see a total solar eclipse. When this happens, daytime turns into near darkness for a few minutes. A bright ring of light surrounds the moon, called a **corona**. It has been said that the corona is so beautiful, it is hard to describe in words!
Seeing a solar eclipse can be a once-in-a-lifetime event for most people! There are only about 70 total solar eclipses every 100 years! Plus, you have to be in the path of totality in order to see the total eclipse and the umbra is only about 200 miles across!

Oh yeah...and since the orbits of the Earth and the moon do not line up, total solar eclipses do not happen very often!

But how can our tiny moon cover up a huge star?

Good question! The umbra only reaches a very small portion of the Earth. A much larger shadow, called the "**penumbra**", surrounds the umbra. The penumbra is an incomplete shadow that passes over the Earth during a solar eclipse.

The best way to see how you can have an "incomplete shadow" is to try this:

Place your hand on any surface with some kind of light (like the sun or a lamp) shining on the back of your hand. Now move your hand about one inch from the surface and check out the shadow! It should have very sharp, clear lines...

Now move your hand as far away as you can from the surface. You will still need to be able to see your hand's shadow on the surface! How does your shadow look now?

Is it just like before, with sharp, clear lines? Or does it look a little fuzzy? **It should look fuzzy!**

The farther away you get from the light, the more your shadow becomes "incomplete". The moon's penumbra is like the fuzzy shadow of your hand...

If you are in the path of the penumbra, you can only see a **partial eclipse**. During a partial eclipse, a part of the sun's bright disk is covered up by the moon. However, a part of the sun can still be seen!

Now that you have explored how our universe is set up, it is time to start looking at our own little planet...

In the next unit, you are going to find out how our sun takes very good care of us...

Match the words in the first column to the best available answer in the second column.

__ lunar eclipse	1)	the path of the moon's shadow during a solar eclipse
__ solar eclipse	2)	an incomplete eclipse for all people within the penumbra during a solar eclipse
__ umbra	3)	an incomplete shadow that passes over the Earth during a solar eclipse.
__ Path of Totality	4)	a bright ring of light that encircles the moon when it is completely blocking the sun's light within the path of totality
__ corona	5)	an event in which the Earth gets in between the sun and the moon, causing a shadow that can be seen on the moon
__ penumbra	6)	the shadow caused by the moon during a solar eclipse
__ partial eclipse	7)	an event in which the moon gets in between the sun and the Earth causing a shadow that can be seen on the Earth over only part of the sun

Compare and Contrast

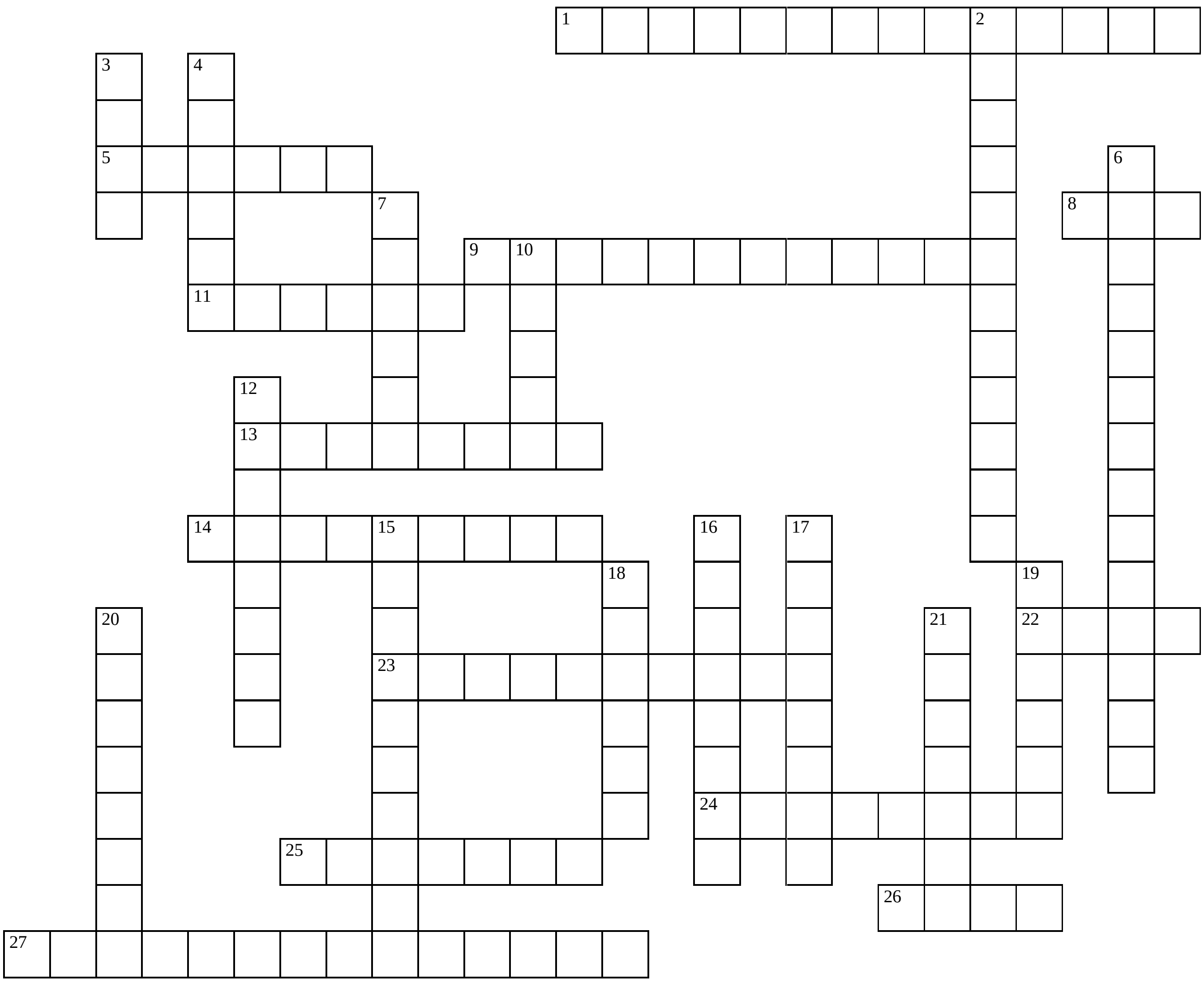
Lunar eclipse and Solar eclipse

Compare (things that are the **same** between these two)	Contrast (things that are **different** between these two)

Draw both a solar and lunar eclipse Label the sun, moon and Earth in both drawings.

Unit Two Review

Place the answers to the following clues in the boxes below. Each box should contain one letter.



ACROSS

1 Also known as microgravity
5 The time when the sun can no longer be seen at the end of the day
8 The time it takes for a planet to make one rotation on its axis
9 An event in which the Earth gets in between the sun and the moon
11 A ball-shaped object (3D)
13 The time it takes for the moon to rotate once on its axis; 27 days
14 When an object moves around another object
22 An imaginary line that connects the north and south poles through a planet
23 People who travel in outer space
24 When an object spins around, like a top
25 To swell
26 The time it takes for a planet to make one revolution around its sun
27 The path of the moon's shadow during a solar eclipse

DOWN

2 An event in which the moon gets in between the sun and the Earth
3 A round-shaped object
4 Measurement of time on Earth that is closely related to the lunar day
6 An incomplete eclipse for all people within the penumbra during a solar eclipse
7 A bright ring of light that encircles the moon when it is completely blocking the sun's light within the path of totality
10 The shadow caused by the moon during a solar eclipse
12 The occurrence of two full moons in one month
15 One complete revolution of the moon around the Earth; approximately 29.5 days
16 An incomplete shadow that passes over the Earth during a solar eclipse
17 Small, cooler areas on the sun that appear darker in color
18 Occurs when the amount of light reflecting off of the moon is getting smaller
19 Occurs when the amount of light reflecting off of the moon is growing
20 "curved shape"
21 The time when the sun can be seen for the first time in the morning

Be certain to go over your definitions for the test!

CHAPTER 9

In the past two units, you looked at a tiny bit of how our universe works! Astronomers study other stars and planets so that they may learn more about how our own sun affects our planet.

And scientists have learned a lot about how the sun works! In fact, without the sun, there would be no life on earth at all! The sun provides nearly all of the **energy** we need to survive! This energy is used to produce plants, cause wind, move the oceans and a huge amount of other things too!

This week, you are going to explore more about how this energy works. But first...

What is energy?

Well, **energy** is the ability to do **work**. Think of it this way... you are probably sitting down right now, relaxed, calmly reading this chapter. Even though you are not moving very much, you have a **massive** amount of energy inside you! In fact, you could probably jump up and down right now and run around the room as fast as you could!

Okay! Okay! Quit running around and jumping on the furniture! Let's get back to work!

Your body has the ability to do work! It has lots of energy stored up, ready to use! But it is not just your body that has energy...everything in the universe has the ability to do work!

Now before I confuse you...scientists use the word **"work"** a little differently than most people. To a scientist, **"work"** means "pushing or pulling something to make it move."

So... energy is the ability to push or pull something to make it move!

But the sun is so far away from us! How could it push or pull anything?

Good question...here's how it works:

You learned in chapter four that the sun is the major source of energy for our planet. You also learned that most of this energy is known as light (or radiant) energy. Some of this light is visible while other kinds of light energy, like infrared light, is invisible to humans.

Your body is not the only thing that is being warmed by the infrared light from the sun...

The entire earth is being warmed by the sun!

Scientists who study how the sun warms the earth are called **meteorologists** ("me-t-or-ol-o-gist"). You may have heard or seen a meterolorogist because they are the people who predict the weather on TV and the radio!

Meteorologists may not be able to predict the weather perfectly all the time. But they do know that...

The sun warms the ground and the ground warms the air!

The sun may be millions of miles away from us, but it is still able to keep our planet warm! That means it must transfer some of its heat to us! Scientists know of three ways that heat can be transferred on our planet:

Radiation ("raid-e-a-shun")
Conduction ("con-duck-shun")
and **Convection** ("con-veck-shun")

When your body is warmed by sunlight, it is because of the **radiation** from the sun. Radiation is the way that the sun's energy reaches the earth. Most of earth's energy comes from radiation. Once it reaches earth, everything on the planet can either reflect or absorb this radiation. Some objects (like water or light colors) will reflect more radiation than other objects (like the ground Or dark colors).

Have you ever been to a pool or a beach where the ground beneath you was very hot, but the water still felt pretty cool? That is because the ground absorbs more radiation and heats up much faster! The water reflects radiation and does not absorb the sun's energy as quickly as the ground!

Now if you wait a few days, and the weather stays hot outside, the pool or lake will warm up. It just takes longer for the water to heat up than the land!

Now think of this...do you ever go outside on a very hot, sunny day wearing clothes that are all black?

I hope not!

Darker colors absorb radiation very easily! If you have ever tried doing this, you probably got very hot very quickly! If you wore something white, I bet you wouldn't feel as hot. A lighter color reflects light easier and does not warm up as fast!

But if the sun warms the ground... how does it warm the air?!?

This is where **conduction** starts to work! Conduction is the transfer of heat between two objects that are touching each other.

Most people have touched something that was very hot. When this happens, the heat from the object is transferred into your hand! Sometimes, this causes a burn on your skin! Ouch!

When radiation heats the ground, the layer of air that is touching the planet warms up too! This is how conduction begins to warm our **atmosphere** ("at-mos-fear"). The atmosphere is all of the gases that make up our air.

Conduction is important in the warming of our planet. But, it is not nearly as important as the third way that heat can be transferred...**convection!**

Convection is the transfer of heat through gas or liquid that is in motion. In the atmosphere, convection takes place after a small amount of air has been warmed by the sun through conduction. Once this air has been warmed, it rises into the air. Since the earth is always rotating on an axis, areas of warm air rising from the surface (named **"convection currents"**) move around the earth.

Stay
tuned
to
next
week
when

you learn about certain patterns with all of this heat transfer...

Match the words in the first column to the best available answer in the second column.

__ atmosphere	1)	the ability to do work
__ conduction	2)	pushing or pulling something to make it move
__ convection	3)	scientists who study how the sun warms the earth which causes our weather
__ convection currents	4)	the main transfer of heat from the sun to the earth
__ energy	5)	the transfer of heat between two objects that are touching
__ meteorologists	6)	the transfer of heat through a gas or liquid that is in motion
__ radiation	7)	all the gases that make up our air
__ work	8)	areas of warm air rising from the surface of the earth

Circle the hidden words from below:

H	A	Y	E	O	S	A	N	K	T	S	S	E	G	N	R	O	C	C	C	T	O	O	O	D
A	R	T	T	N	T	C	O	E	W	A	C	T	N	O	H	H	U	N	O	G	O	O	D	N
S	S	E	M	R	R	E	N	N	L	R	M	O	H	T	O	N	C	I	K	T	E	C	E	O
O	P	N	E	O	E	T	D	R	M	W	L	A	R	U	E	R	E	G	E	I	I	H	G	A
G	N	S	R	N	S	W	E	E	M	S	T	O	R	I	O	A	R	T	C	W	V	H	R	A
R	N	R	T	E	K	P	I	T	E	I	A	W	E	O	I	M	A	T	R	A	I	V	N	O
E	R	G	R	R	D	R	H	C	E	T	P	U	R	E	T	E	N	V	E	G	I	A	K	E
Y	N	C	O	A	A	E	T	E	Y	Y	C	A	V	A	E	E	D	T	S	A	A	O	T	A
A	O	W	N	A	A	G	N	E	R	D	E	I	O	O	O	O	S	G	T	I	R	I	O	H
C	T	M	C	N	O	T	P	S	P	E	E	T	P	E	O	R	O	R	A	N	E	Y	W	T
P	A	E	N	R	E	T	C	O	H	R	S	C	T	P	Y	E	E	C	O	C	O	T	E	O
E	O	I	E	M	T	S	S	D	L	N	M	T	A	G	T	M	T	H	P	T	R	T	O	E
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O	E	D	N	E	N	N	R	R	E	T	D	D	C	O	O	O	G	O	O	O	N	N	O	T
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O	N	O	D	L	H	G	D	T	K	M	O	A	E	I	A	O	C	H	E	S	A	S	I	M
N	H	R	N	T	T	N	I	I	E	W	T	N	M	E	O	O	S	I	E	W	P	R	R	O

energy
work
meteorologists
radiation
conduction
convection
atmosphere
heat
weather

Describe two ways that radiation, conduction and convection are similar.

1. ______________________________

____

2. ______________________________

____

Describe two ways that radiation, conduction and convection are different.

1. ______________________________

____

2. ______________________________

____

CHAPTER 10

Okay...now you know that the sun transfers its heat to us! And you know that this heat is moved around the world in three different ways! But you can't see heat, can you? No! So how can you tell that heat is being moved around the Earth? That's easy! All you have to do is to check out the...

Seasons !

A **season** is one of four parts of the year that have (roughly) the same temperature and amount of daylight and nighttime. The four seasons we have on earth are fall, winter, spring and summer...in that order! Each one of these seasons lasts about three months.

Now before we get too far into the seasons, let's make sure you understand something...

Our seasons have nothing to do with how far our planet is from the sun!

Yes we do revolve around the sun. And, our orbit is not a perfect circle! In fact, there are times when the earth is farther away from the sun than other times of the year! If the seasons were caused by the distance of the earth from the sun, then everyone on the planet would have the same season at the same time! **But this is not what happens!**

Do you remember learning about hemispheres in chapter three? The equator divides our ball-shaped earth into two equal sides. Each of these sides is called a hemisphere. Earth has two hemispheres which are called the northern hemisphere (this is where you and I live here in the United States) and the southern hemisphere.

Well, if you living in the northern hemisphere (if you live anywhere in North America, you are in the northern hemisphere!) and it is summertime...the people who are living in the southern hemisphere are going through winter right now!

And when it is wintertime in the northern hemisphere, it will be summer for people living in the southern hemisphere!

How can this happen?

Well, it is not the distance of the earth from the sun that causes our seasons. But it is something else you have learned about...**our axis!**

When you imagine the earth rotating, you may be thinking that the axis is completely straight-just like a top! But this is not true!

Earth's axis is tilted just a little bit! It is this tilt that gives earth its seasons!

Let me explain...

Imagine shining a flashlight straight down onto a piece of paper. You should see a circle of light on the paper, right?

This is what happens when the sun shines its light on the northern hemisphere in the summer months. Our hemisphere is pointed directly towards the sun and its light is able to reach us very easily!

Now imagine tilting the paper **without** changing the flashlight! (Imagine moving one side of the paper in the air, making a ramp!) Now, if you shine the light straight down onto the paper the circle of light will spread out into an oval shape, right?

When you tilt the paper, the light is spread out over a greater area! Even though the same amount of light energy is hitting the paper, it is not hitting the same place on the paper. The energy is being spread out!

This is what happens on the northern hemisphere in the winter months. Our hemisphere is not pointing towards the sun! However, at this same time, the southern hemisphere is facing the sun! So... people in the southern hemisphere are enjoying a cool drink on the beach while we are shoveling the snow off of our sidewalks!

Still confused? Maybe this will help...

Imagine there are 1,000 baseballs hanging in a net (that is as big as your house) right over your head! At first, try to picture the baseballs being spread out evenly all over the net. Now if you stand still, right under the middle of this net, and let the net go how many balls do you think will hit you? Ten, maybe twenty? That may hurt a bit! But let's imagine that you take all 1,000 of those baseballs, and stack them on top of each other in that net. Now, think about how much it would hurt to have all 1,000 of those baseballs crashing down on you all at once!

The same is true for the earth! When the sunlight is spread out in wintertime, it acts just like the balls that are spread out in the net. Our planet still gets the same amount of energy, but it doesn't hit us all at once!

When the sunlight is directly hitting us in summer, it is like all of those 1,000 baseballs smacking on you at once.

If more radiation is directly reaching the earth, the ground can absorb more heat. If the ground can absorb more heat, it can conduct more heat to the air. And, if the air can be warmed easier, the convection can cause this warmed air to rise and heat up the atmosphere!

It is also true that...

The hemisphere that is tilted towards the sun has longer days and shorter nights!

That is why it seems like the days in summertime are so long! Our orbit around the sun points the northern hemisphere most towards the sun every year around June 21st. This is known as the **summer solstice** ("soul-stiss"). Six months later, on December 21st, the northern hemisphere is pointed the farthest away from the sun and is known as the **winter solstice**. Both the summer and winter solstices tell us when we are in the middle of summer and winter!

But what if I lived in other parts of the world?

That's a good question! If you lived near the equator, you would not have all four seasons. Light energy from the sun is not spread out around the equator. It is always facing the sun!

The farther away you move from the equator, the cooler things get for you! In fact, if you lived on either the north or south poles, you would never have summer! This is because the north and south poles are never pointed directly towards the sun! All of the light energy is always spread out at these two areas of the earth! That is why they are always cold!

Understanding that our planet is tilted and how this affects our seasons is very important for our study of earth science...

Next week, you are going to take a closer look at how these seasons control our weather!

Match the words in the first column to the best available answer in the second column.

___	summer solstice	1)	one of four parts of the year that have (roughly) the same temperature and amount of daylight and nighttime
___	winter solstice	2)	the day of the year in the Northern Hemisphere where we receive the most light in one day; this occurs when our orbit around the sun points the northern hemisphere most towards the sun on June 21st
___	season	3)	the day of the year in the Northern Hemisphere where we receive the least amount of light in one day; this occurs when our orbit around the sun points the northern hemisphere farthest away from the sun on December 21st

Compare and Contrast

the

Summer solstice and the Winter solstice

Compare (things that are the **same** between these two)	Contrast (things that are **different** between these two)

Which one is right? Circle the correct answer.

1. Which of the following dates is not a solstice?
   a) June 21st
   b) July 21st
   c) December 21st

2. Which of the following areas does not experience summer?
   a) The northern hemisphere
   b) The southern hemisphere
   c) The north pole

3. Which of the following statements is true:
   a) The northern hemisphere is farther away from the sun in the summertime than the southern hemisphere
   b) The northern hemisphere is closer to the sun in the summertime than the southern hemisphere
   c) Both the northern and southern hemispheres are equally close to the sun because our orbit is a perfect circle

4. If more radiation can strike the surface of the earth,
   a) The earth can absorb more heat
   b) The earth can absorb less heat
   c) The earth cannot absorb heat at all

5. The hemisphere that is tilted closer to the sun...
   a) Has longer nights and shorter days
   b) Has longer days and shorter nights
   c) Has an equal amount of day and night hours

CHAPTER 11

Before we get into our study of weather, let's review a couple of things first...

You have learned that the sun warms the ground (as well as the oceans) and the ground warms the air! You have also learned that some objects (like the ground) will absorb radiation faster than other objects (water). So, the ground gets warmer and colder much faster than water!

This week, you are going to explore how...

The uneven heating of the Earth causes weather

This is the #1 rule for all meteorologists! The sun blasts us with radiation every single day and different parts of the planet warm up at different times. In addition, we live on a planet that is always rotating and mixing these warmer and cooler areas all over our atmosphere!

There is a lot of information that meteorologist use to help us understand our atmosphere. one of the most important things to understand is the difference between...

Climate and Weather

Climate is the normal weather for an area over a long period of time (like 30 years!) An example of a climate would be a desert. This is an area that has a dry climate because it does not get much rain in 30 years!

Weather is what happens every day... rain, snow, windy days. All of this is our day-to-day weather! Think of it this way, if you stuck your head outside and recorded how hot it was outside, if it was raining and if there was any wind – you are looking at the weather. If you stick your head outside every day for 30 years and record these same things, you are studying the climate of your area!

Meteorologists record the weather everyday. Their data gives us a definition of our climate!

Remember:

1) The farther away you move from the equator, the cooler your climate is going to be!
2) And, the Earth does not heat up the same everywhere at the same time.

Both of these things affect our weather and climate a great deal! The different temperatures on the earth cause a change in something called **air pressure**. Air pressure is what meteorologists call the "weight of the air pressing down on the Earth."

Changes in temperature cause some areas of the Earth to have **high air pressure** and other areas to have **low air pressure**. Areas of high air pressure have much more air crammed into a small part of the atmosphere. Since there is more air in these areas, the weight of the air is higher!

(These "small parts of the atmosphere can be several hundreds of miles long!)

Areas that have low air pressure do not have nearly as much air squished into the small part of the atmosphere! A smaller amount of air in low air pressure areas causes the weight of the air to be lower!

So what does air pressure have to do with our weather?

Well, if you could actually see the air moving around in the atmosphere, you would see a large pattern...

The air from a high air pressure area is always moving towards a low air pressure area!

Imagine filling up your bedroom with dozens and dozens of people and shutting your door...are you feeling a little bit of pressure? You should! There are many more people packed into your room than normal. This is just like high air pressure!

Now, before you get too squished, imagine what is going on outside of your bedroom... there probably isn't very many people out there, right? This is similar to low pressure areas.

Now for the fun part! What would happen if you opened your bedroom door?!?

Everyone would start falling out of your room, right!
You bet!

The people in your room would move from an area of high "pressure" to an area of low "pressure". This is what happens in our atmosphere every single day! The air from a high pressure area is moving towards, and filling up, an area of low pressure.

And I am certain that you have felt this happen before! Do you know why? Because when the air moves from high to low pressure areas, you get...

Wind!

The **wind** is nothing more than air in motion. And, the greater the difference between the high and low pressure areas, the stronger the wind!

Once the wind starts to move, the rotation of the earth causes it to curve across our planet. The curving motion of our wind is known as the **Coriolis Effect** ("core-ee-o-liss").

But I've never seen the wind "curve" before! How do we know this is happening?

Good question...maybe this will help:

I'm sure many of you have tried to draw a straight line before. But have you ever tried drawing a straight line on a piece of paper that is rotating? If you have, you should have made a curved, spiral shape on your paper! This is what happens with our winds! They move in a straight line, but the rotation of the earth causes them to curve as they move!

If you pay close attention to a meteorologist, you can see that most of our weather (here in the United States) comes from the west and moves east! The Coriolis Effect curves our winds and weather across our country in this direction!

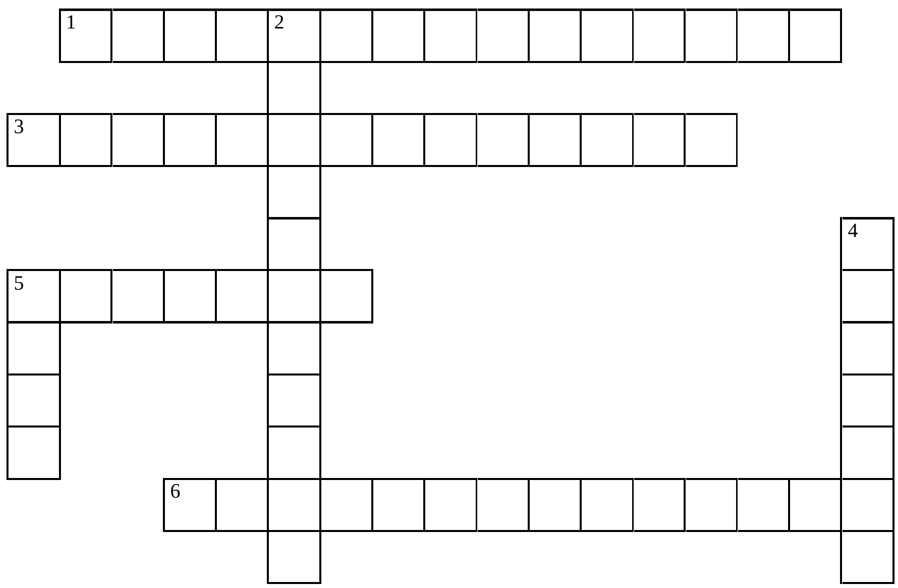
You might not be able to see the wind moving in our atmosphere very easily. But next week, you are going to learn how water affects all of our weather and climate!

Don't forget that it is the uneven heating of the earth which causes our weather! We'll be looking at this again next week!

Match the words in the first column to the best available answer in the second column.

___ air pressure	1) the normal weather for an area over a long period of time (like 30 years!)
___ climate	2) our day-to-day patterns of temperature, wind, precipitation, etc.
___ coriolis effect	3) weight of the air pressing down on the earth
___ high air pressure	4) areas where there is very little air crammed into a small part of the atmosphere
___ low air pressure	5) areas where there is much more air crammed into a small part of the atmosphere
___ weather	6) air in motion; affected by differences in air pressure as air moves from high pressure areas to low pressure areas
___ wind	7) the curving motion of our wind around the Earth as it rotates on its axis

Place the answers to the following clues in the boxes below. Each box should contain one letter.



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1 Areas where there is much more air crammed into a small part of the atmosphere

3 Areas where there is very little air crammed into a small part of the atmosphere

5 Our day-to-day patterns of temperature, wind, precipitation, etc.

6 The curving motion of our wind around the Earth as it rotates on its axis

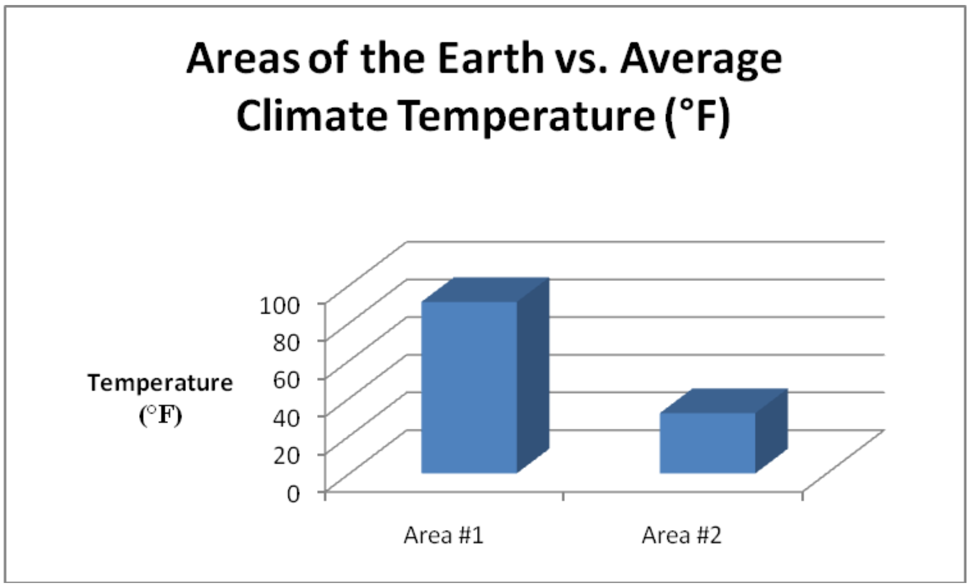
DOWN

2 Weight of the air pressing down on the earth

4 The normal weather for an area over a long period of time (like 30 years!)

5 Air in motion; affected by differences in air pressure as air moves from high pressure areas to low pressure areas

While studying the climate of two different areas in the world, I forgot to label my graph! Can you help me?



Should area #1 be labeled "North Pole" or "equator"?

____

Why do you think this is true?

____

____

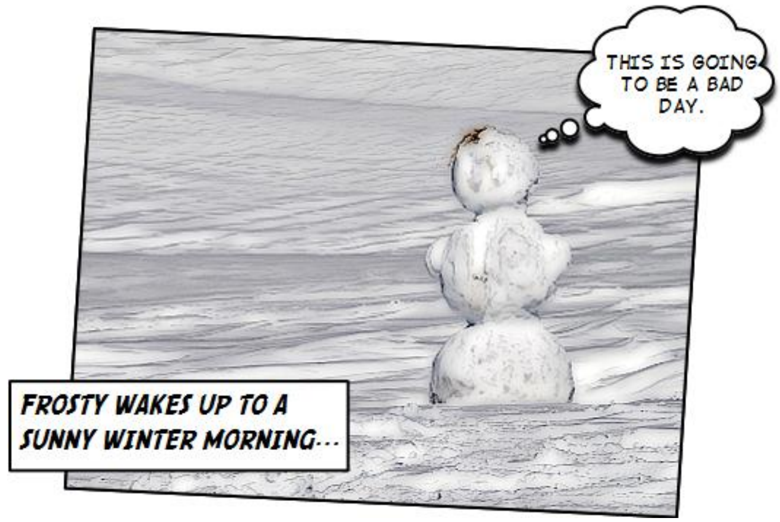
Should area #2 be labeled "North Pole" or "equator"?

Why do you think this is true?

CHAPTER 12

In the past three chapters, you have explored how the sun provides the energy to our planet. You have also learned that this energy is used to give us our seasons, climate and weather.

This week, you are going to start looking into what all of this energy does to our little planet. In fact, if you are going to understand how the weather works, you will need to know as much as you can about...



Water

You probably see some kind of water every day in your life! In fact, you see this chemical so much, it's easy to forget how important it really is!

But what is water? Sometimes you see it as ice, other times it is pouring out of your faucet. It even jumps out of a pan if you heat it up! Well, water is the only substance on Earth that can be found in nature in the three **states of matter**. These three states are:

Liquid, Solid (ice) And **Gas** (water vapor or steam)

Scientists have another name for water: **H_2O**. Weird, huh? There is a reason for putting the number "2" between an "H" and an "O". Water is called H_2O because is it made up of hydrogen (the "H") and oxygen (the "O"). When two hydrogen **atoms** and one oxygen **atom** join together, we get water! An atom is the smallest part of everything in the world! When you join atoms together, you get a **molecule** ("maul-ee-koo-el").

Perhaps this will help you to understand what is going on with water.

Imagine having a large bucket full of tennis balls. Now imagine that every one of these tennis balls is a single molecule of water. If you set the bucket down on the ground, all of the tennis balls stay next to each other, don't they? This is what happens with water too!

Water molecules tend to stick to each other very well. But they can be separated if you add enough energy!

The tennis balls sitting at the bottom of your bucket are acting like water molecules when they are **freezing**! When you freeze water, the molecules stick to each other and stay the same shape... you have never seen an ice cube start to move around on its own, have you?! (If you have...run for your life!)

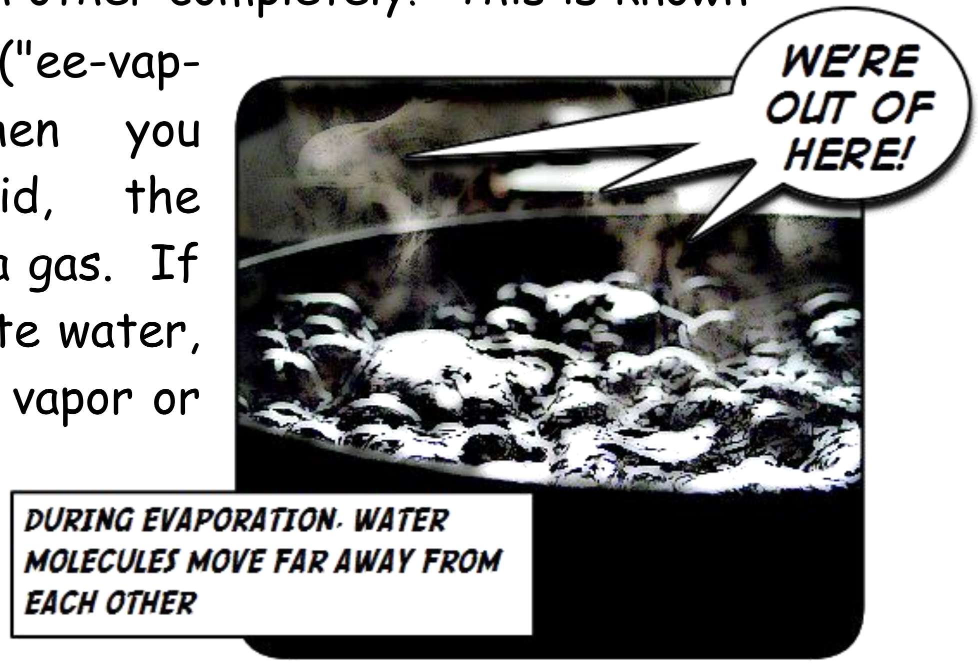
Now, what would happen if you take your bucket and add a little energy to it by shaking it around? The tennis balls would start to move around, wouldn't they? You bet they would! When you add energy to a solid (like ice), the molecules are not stuck to each other anymore! When you add enough energy to move these molecules apart from each other, you are **melting** the solid! The molecules are still touching each other, but they are rolling around each other pretty easily! Remember, if you melt ice, you get liquid water!

Now, unless you have tipped your bucket over and the tennis balls are rolling all over the floor, let's add a lot more energy to your bucket!

If you start to shake your bucket really, really hard...what do you think is going to happen to all of those tennis balls?

They are going to be flying all over the place!

When you add enough energy to a liquid, the molecules to move away from each other completely! This is known as **evaporation** ("ee-vap-or-a-shun"). When you evaporate a liquid, the molecules turn into a gas. If you were to evaporate water, you would get water vapor or steam!



The cool thing about water is...you can use it over and over again!

If you take energy away from water vapor, you get liquid water. This is known as condensation ("con-den-sa-shun"). And you should know that liquid water can always be frozen again and again and again...

In order to really understand our weather, you need to know how important water is...

Definitions	What they mean...
Freezing	Liquid to solid
Melting	Solid to liquid
Evaporation	Liquid to gas
condensation	Gas to liquid

Water also has another very important trick...

Water can absorb a lot of heat before it begins to get hot! If you have ever boiled water before, it takes a while for the water to get hot enough for it to boil. When it is boiling, all of those little bubbles are filled with *(you guessed it)* water vapor! When the water vapor reaches the top of the boiling water, it escapes into the air!

If you remember from chapter nine, the sun's radiation warms the water much slower than the solid Earth! But, once the water is warmed up, it does not lose its heat very easily. So it stays warm for a long period of time!

Now what does this have to do with the Earth and our weather?

If you remember, The sun heats the Earth and the Earth heats the air. And, it is the uneven heating of the Earth that causes our weather! Let's take a quick look at what is going on here...

The solid parts of the Earth are quickly absorbing and releasing heat into the air.

The liquid parts of the Earth (mostly our oceans) are slowly absorbing and releasing heat into the air.

The sun is constantly warming one side of the planet every day while it is rotating on an axis!

And the rotation of the Earth mixes all of the warm and cool air in our atmosphere all the time!

In the next unit, you are going to learn more about how meteorologists measure the weather. And, you are going to learn how all of this water moves around to give us our weather!

Match the words in the first column to the best available answer in the second column.

___ atom

___ condensation

___ evaporation

___ freezing

___ H20

___ melting

___ molecule

___ states of matter

___ water vapor (steam)

1) different forms of matter; a solid, liquid or gas
2) the gaseous state of matter for water
3) the chemical formula for water
4) smallest part of everything in the world
5) two or more atoms joined together
6) ability of molecules to stick to each other to turn a liquid into a solid by removing heat
7) the ability to make molecules slide around each other to make a fluid from a solid by adding heat
8) the complete separation of molecules from each other from a liquid into a gas
9) the ability to turn a gas into a liquid by removing heat

Which one is right? Circle the correct answer.

1. When molecules change from solid to liquid, it is called...
   a) freezing
   b) melting
   c) evaporating

2. When molecules change from liquid to solid, It is called...
   a) evaporation
   b) freezing
   c) melting

3. When molecules change from gas to liquid, it is called...
   a) condensation
   b) freezing
   c) melting

4. Which of the following is true?
   a) A molecule is two or more atoms stuck together
   b) An atom is two or more molecules stuck together
   c) H2o is an atom of water

5. The three states of matter are...
   a) Freezing, melting and evaporating
   b) Solid, liquid and gas
   c) Solid, melting and liquid

6. When molecules change from a liquid to a gas, it is called...
   a) condensation
   b) freezing
   c) evaporation

Circle the hidden words from below:

T A S T L V A V E S I R E O W O T A T T S D O O T
T Z A A S O W F T N T R T I T E T O A M E O I O R
E L V M T A T A R N T N T R T O R S L D A S T N M
P P C T T O T E F E T T O M U S O O S S E E M N V
E E E O P E A N F A E E S S A S E N E M L E T N O
E P M O I L I I O P E Z E F T A E M E A L A A S T
T W V S C Z T E E M A O I G I A N S A T A N O A S
U E V L O W I W T A E R N N O T T T I T E O R O V
T S A S O M A L N I V R T F G M T N T A R L A R V
O V S N T T R A T E L N E O R R G E T S T E T M L
I L G V E N L A R T I N O T T E M E T E A A G E C
A T D R T T A W T O O M E R T R V T T T L M R O T
E A R T A G M R T I A L R F S A O E M T R F N E N
N S E L T R F E T O U R T M E T M E F I T D N E E
O O A I R F M A P C O M I T T L M F R U E E M L M
S T I T E N R L E P S O E T E T R E O N F R Z L P
L A M A T O N L A E I T N Z R E R L S S I N E C T
O F U N P E O V T T N E E O R R E A A N E E P C C
I N M A O M R S E N A E S E O L T R W O E T T R N
E L V E C E G I T S P N O E S I E O L O S L A C W
L E R L T T N Z E N V T N O O O R S N M T V I T N
I T T A A G E S L L W N N N T O F E U I L E M E S
E O W N N E F N L R T L I N L T A M R T O N S F A
S O E O E T A T A U O N E E E T O A A E F E O U T
M R T A O A E P N R A A O E R Z R T Z I E E R T A

atom **condensation** **evaporation**

freezing **water** **melting**

molecule **states of matter** **water vapor**

steam

Unit Three Review

Fill in the blanks with the correct letters. The words in the list on the right provide a clue to the answer

S_ates of m_t_er	1) different forms of matter; a solid, liquid or gas
_ater _apo_ (steam)	2) the gaseous state of matter for water
H_O	3) the chemical formula for water
A_om	4) smallest part of everything in the world
_olecu_e	5) two or more atoms joined together
_ree_ing	6) ability of molecules to stick to each other to turn a liquid into a solid by removing heat
Me_ting	7) the ability to make molecules slide around each other to make a fluid from a solid by adding heat
E_ap_r_tion	8) the complete separation of molecules from each other from a liquid into a gas
Co_de_sa_ion	9) the ability to turn a gas into a liquid by removing heat
_lim_te	10) the normal weather for an area over a long period of time
_eat_er	11) our day-to-day patterns of temperature, wind, precipitation, etc.
_ir _ressure	12) weight of the air pressing down on the Earth
Hig_ ai_ _res_ure	13) areas where there is much more air crammed into a small part of the atmosphere
L_w air _ressu_e	14) areas where there is very little air crammed into a small part of the atmosphere

_ind	15) air in motion
Co_iolis _ffec_	16) the curving motion of our wind around the Earth as it rotates on its axis
Se_so_	17) one of four parts of the year that have (roughly) the same temperature and amount of daylight and nighttime
_um_er s_lstice	18) the day of the year in the Northern Hemisphere where we receive the most light in one day;
_in_er _ols_ice	19) the day of the year in the Northern Hemisphere where we receive the least amount of light in one day
_n_rgy	20) the ability to do work
Wo_k	21) pushing or pulling something to make it move
_eteo_ol_gists	22) scientists who study how the sun warms the Earth which causes our weather
Ra_iatio_	23) the main transfer of heat from the sun to the Earth
_ond_ction	24) the transfer of heat between two objects that are touching
onvectio	25) the transfer of heat through a gas or liquid that is in motion
At_osphe_e	26) all the gases that make up our air
Co_vect_on _urr_nts	27) areas of warm air rising from the surface of the Earth

Be certain to go over your definitions for the test!

CHAPTER 13

At the end of the last unit, you learned about the different states of matter for water:

Definitions	What they mean...
Freezing	Liquid to solid
Melting	Solid to liquid
Evaporation	Liquid to gas
condensation	Gas to liquid

I would guess that most of you have seen ice melt, or water boiling into a gas in your home before...right?!

These are two examples of water changing its state of matter! In this chapter, you are going to look at how water changes its state of matter in our environment and what this means for our weather!

First of all...

In nature, water is always changing its state of matter!

Liquid water is being evaporated right now! Most of this liquid water comes from our huge oceans, rivers and lakes!

But never forget that water is evaporating from every plant, animal, and puddle. Even the ground is evaporating water into the atmosphere! The amount of water vapor in the air is known as **humidity** ("hue-mid-a-tee").

(The humidity of the atmosphere is very important to our weather. We'll be exploring this a little later.)

Every time you exhale, you are breathing out water into the atmosphere! Plants give off water vapor too! And, in most areas, our ground is full of water! When the sun's energy hits the ground, liquid water is evaporated into the air!

As liquid water is evaporating, the wind moves this water vapor throughout the atmosphere. Some of this water vapor rises high into the air where the air is much cooler.

When water vapor is cooled, it condenses back into a liquid!

But how can there be liquid water floating around in the air?

If you have ever seen a cloud before, you have seen liquid water floating around in the atmosphere! That's right! Clouds are not made up of gas, they are made up of liquid water or ice (if the temperature is cold enough!)

As the sun's energy warms our planet, water is evaporated into the air and then condenses or freezes in the air. But all of this water in our atmosphere can't stay in the air forever. It has to fall back to Earth!

Whenever drops of liquid water or pieces of ice inside clouds get too heavy, they fall to Earth. This is known as **precipitation** ("pre-sip-eh-tay-shun"). Most of the time, meteorologists define Precipitation as rain, snow, sleet or hail.

This precipitation fills up our lakes, oceans and puddles once again!

As water is moved throughout the planet, it goes through a pattern that is known as **the water cycle!**

Let's review how this water cycle works:

- *Liquid water on the Earth evaporates into water vapor and floats in the air.*
- *Water vapor condenses into liquid water or freezes into ice while floating in the air.*
- *Liquid water or pieces of ice get too heavy and fall to Earth (precipitation).*
- *And the cycle continues again...*

All of this water evaporating into our atmosphere causes our humidity to change all over the planet!

If our planet did not have as much water vapor in the atmosphere, we would be in big trouble! In fact, Earth would start looking a lot like the planet Mars. There would be no clouds, no precipitation, no plants and no humans!

And, without water vapor, our planet would not be able to stay very warm...

So how does water vapor keep our planet warm?

Water vapor is one of many different **greenhouse gases** in our atmosphere. A greenhouse gas is able to absorb and reflect some of the heat that is given off from the Earth! If you remember from chapter nine...

The sun warms the ground and the ground warms the air!

After the sun warms the ground with radiation, some of this heat energy is reflected (bounced) back into the air.

The greenhouse gases absorb some of this heat energy and reflect it in all directions. Some of this heat energy is directed into space and some is bounced back towards Earth.

The heat energy that is bounced back to Earth help to keep our planet warm! Without water vapor, our atmosphere would not be able to absorb and reflect much of the energy that the Earth gives off! The ability of greenhouse gases like water vapor to absorb and reflect heat from Earth is called **the greenhouse effect**.

As you have read, this greenhouse effect is not such a bad thing! We need it in order to survive! Before we go on any further let me make one thing clear:

The Earth does not act like a greenhouse!

In a greenhouse, the sun's radiation is allowed to enter the building through its glass walls. Objects inside a greenhouse are warmed and start to heat the air through conduction. As large amounts of warmed air start to rise by convection, the heat is trapped by the glass walls! In a greenhouse, heat cannot escape.

This does not happen in the atmosphere! Our planet is not covered in glass walls!

Heat is allowed to escape into space because our greenhouse gases, like water vapor, absorb and reflect heat in all directions!

So why is it called the "greenhouse effect" ?!

Unfortunately, this is a mistake that has not been corrected. It may be confusing, but you can help others understand what you have learned. In fact, maybe someday you can help scientists rename the "greenhouse effect" to the "**atmospheric effect**". There are already many scientists who are trying to do this right now!

In the next chapter, you are going to explore what is going on inside all of that floating liquid water and ice crystals that make up...

Match the words in the first column to the best available answer in the second column.

___ greenhouse effect	1) amount of water vapor in the air
___ greenhouse gas	2) falling droplets of liquid water or frozen ice
___ humidity	3) pattern in which water travels throughout the environment
___ precipitation	4) a gas that is able to absorb and reflect some of the heat that is given off from the Earth
___ water cycle	5) the ability of greenhouse gases like water vapor to absorb and reflect heat from Earth

Draw what you believe the water cycle looks like. Be certain to include:

Evaporation
Condensation
Precipitation

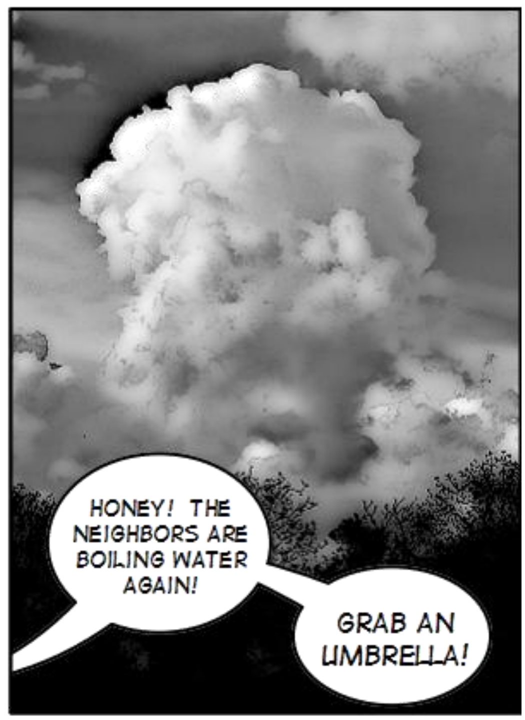
Why does our atmosphere not act like a greenhouse?

CHAPTER 14

In the last chapter, you learned that all of the water in our environment is always changing its phase from a solid, a liquid or a gas! You also learned that water goes through a cycle as it moves through our environment.

If you live near the ocean or a river, it is pretty easy to see a lot of water. But you don't have to live near these places to see large amounts of water. All you have to do is look up and search for...

Clouds!



A **cloud** is a collection of tiny water droplets or frozen ice pieces floating in the air. You can thank our sun for the clouds! It is the sun's heat energy that warms our planet. As you learned earlier, this energy causes warm air to rise into the atmosphere. As this rising air cools (and it always cools), a cloud can form!

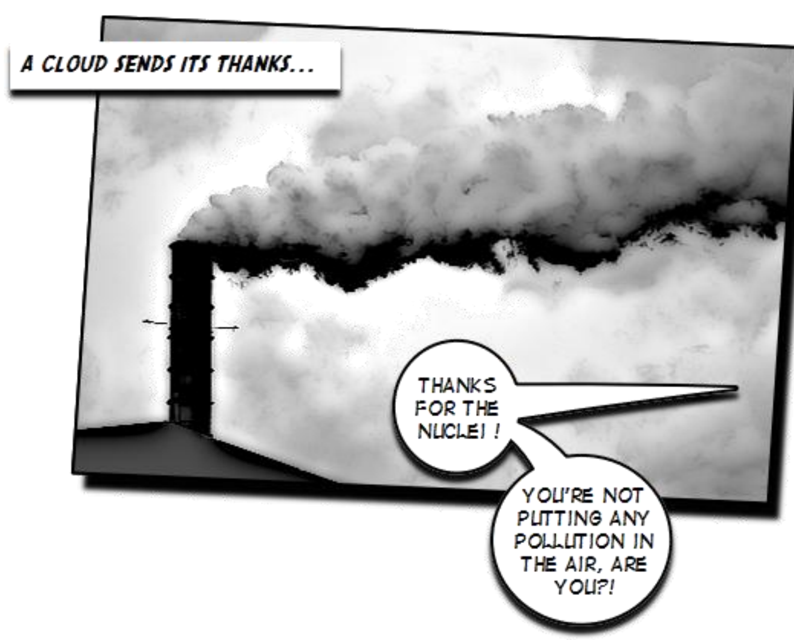
Of course, there are a lot of things that have to happen in order to form a cloud! You can't simply boil water under a large block of ice and build a thunderstorm cloud!

(But it would be pretty cool if we could. Wouldn't it?!)

To form a cloud, you first have to evaporate liquid water into a gas. This warm gas rises into the atmosphere and cools. When this gas cools to a temperature that allows it to condense it has reached its **dewpoint**. When the temperature of water vapor reaches its dewpoint, this gas condenses into a liquid. which is what makes up most of a cloud! A cloud is simply a very large collection of tiny liquid drops of water. Sometimes, these liquid drops can freeze into tiny ice crystals!

In order for water vapor to condense into liquid, the water molecules need something to hold onto. This can be dirt, dust or smoke that is floating in the air. Once water vapor comes in contact with these items, which are called **condensation nuclei** ("kon-den-sa-shun nuke-lee-eye"), the water vapor can begin to condense into a liquid.

If you remember from the last chapter, all of this water vapor helps to keep our planet warm! Clouds are no different! They help to reflect some of the heat energy that is escaping from the Earth back to the surface!



Without clouds, our little planet would not be nearly as warm as it is!

Ok. I see clouds all the time. But sometimes they look like large cotton balls and other times they look like large blankets in the sky…

Why do clouds look so different?

Clouds are classified (grouped) in two ways:

by height and by shape

The height of a cloud is measured by the distance between the Earth and the bottom of the cloud. If you watch the weather reports on TV or read about them in the news, this distance is also known as the **ceiling** ("see-ling"). People who fly airplanes are always aware of a cloud's ceiling. This is because it is very difficult to see very far when you are flying through a cloud! This could be a problem as you could not see another plane in the cloud, or a mountain or a radio tower. You get the idea!

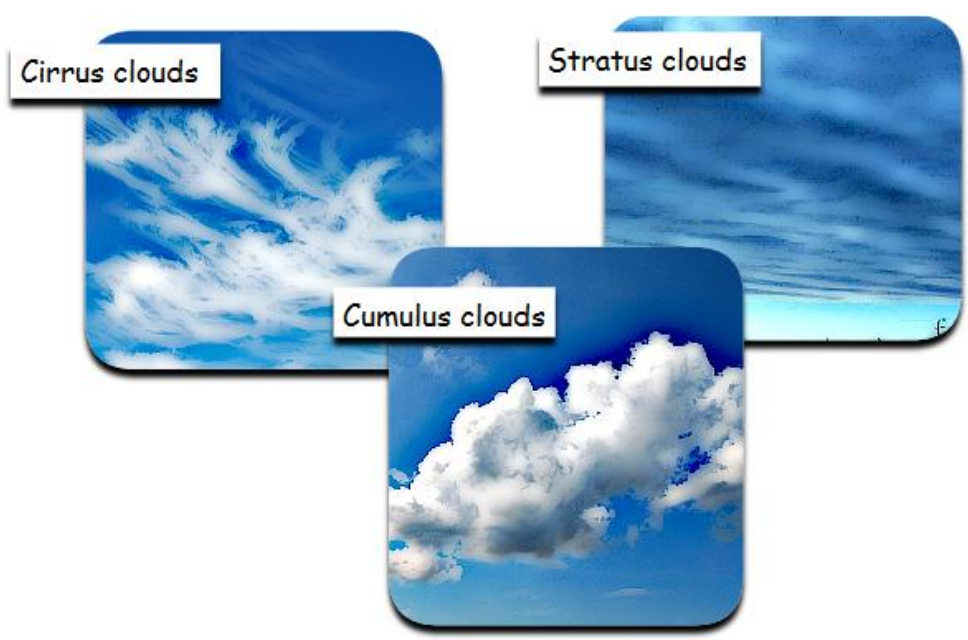
Clouds with ceilings that are at least 20,000 feet into the air (which is taller than most mountains in the world) are known as **high clouds**. Clouds with ceilings between 6,500 and 20,000 feet are known as **middle clouds**. All clouds that have a ceiling under 6,500 feet are called **low clouds**.

Meteorologists can classify clouds by their shape too! For example...

Clouds that are very high, thin and see-through are known as **cirrus** clouds. You would mostly find ice crystals inside a cirrus cloud!

Clouds that have flat bottoms and large, puffy shapes (almost like cotton balls) are called **cumulus** clouds. These kinds of clouds usually mean that there is a good chance that rain is coming!

Stratus clouds are long, flat and seem to fill up the sky like a large sheet. Sometimes, stratus clouds are not found very high above the ground.



When stratus clouds are not found very far off the ground you get what is called.

Fog

That's right! When the air temperature at the surface cools to the dewpoint temperature, it is possible for a cloud to form near the ground. This is known as **fog**! Most of the time, fog is formed at night or early mornings when the air is cooling.

Meteorologists sometimes say that the sun can **"burn off"** fog! This does not mean that the sun is setting a cloud on fire! What they mean to say is that the heat from the sun causes the top of the fog to evaporate. Remember, since fog is nothing more than a cloud, it is made up of condensed (liquid) water droplets. When the sun's heat evaporates these droplets, they turn into invisible water vapor (a gas)!

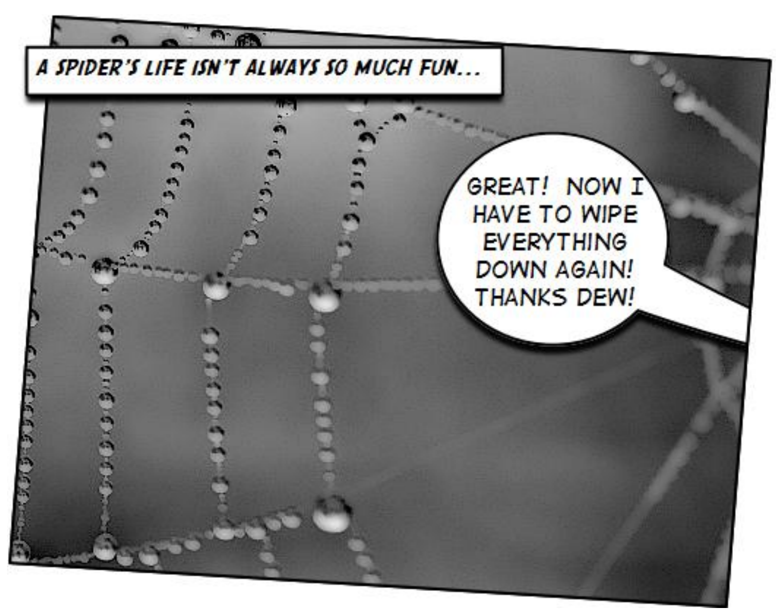
So what is dew ?

Remember! In order for water vapor to condense, you need something for the gas to hold onto (condensation nuclei). But condensation nuclei are not only found in the air. Sometimes, when the temperature of objects on the surface of the Earth (like grass, trees and buildings) fall below the dew point, water vapor can condense on these objects too! When water vapor touches these cooled objects, they have something to hold onto and start condensing into a liquid!

Grass tends to have a large amount of dew because plants "breathe" out water vapor too! Once the temperature of grass falls below the dewpoint, the water vapor it is "breathing" out can condense very quickly!

But what about frost ?!

If the dew point temperature is below freezing, water vapor can freeze onto a surface instead of first condensing into a liquid. This is known as **deposition**.



There are so many things that affect our weather! And you have not explored them all yet! In the next chapter, you are going to look at how large amounts of moving air can bring thunderstorms, sunny days and everything in-between into our lives!

Match the words in the first column to the best available answer in the second column.

___ burn off	1)	a visible collection of tiny water droplets or frozen ice pieces floating in the air
___ ceiling	2)	the temperature in which a gas is able to condense
___ cirrus	3)	tiny particles of dust, dirt, smoke, etc. that allow water vapor to hold onto before it can condense to form a cloud
___ clouds	4)	the distance between the Earth and the bottom of a cloud
___ condensation nuclei	5)	clouds with ceilings that are at least 20,000 feet
___ cumulus	6)	clouds with ceilings between 6,500 and 20,000 feet
___ deposition	7)	clouds with ceilings under 6,500 feet
___ dew	8)	clouds that are very high, thin and see-through
___ dewpoint	9)	clouds that have flat bottoms and large, puffy shapes (almost like cotton balls)

___ fog

___ high clouds

___ low clouds

___ middle clouds

___ stratus

10) clouds that are long, flat and seem to fill up the sky like a large sheet

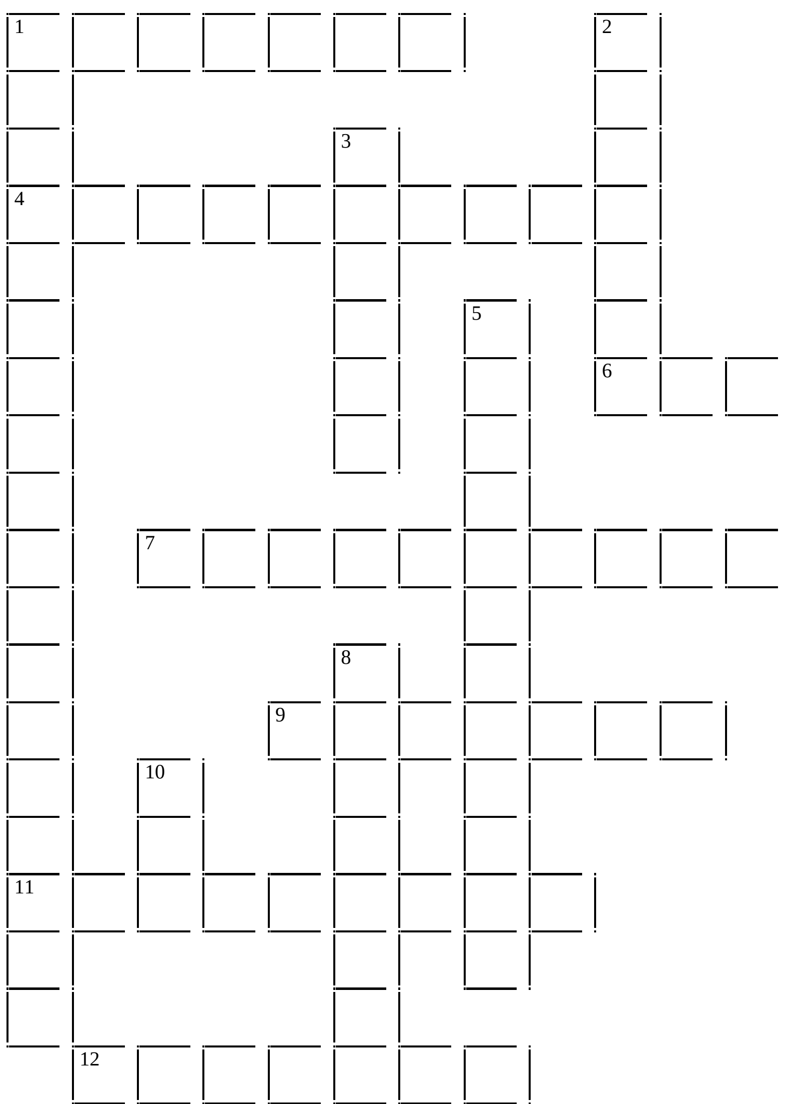
11) a cloud that forms near the ground as the air temperature at the surface cools to the dewpoint temperature

12) when the heat from the sun causes the top of a batch of fog to evaporate

13) condensed water on objects on the surface of the Earth whose temperature has reached the dewpoint temperature

14) the change of state of a gas directly into a solid; frost is a product of deposition which occurs when the dewpoint falls below the freezing point of water

Place the answers to the following clues in the boxes below. Each box should contain one letter.



ACROSS

1 Clouds that have flat bottoms and large, puffy shapes (almost like cotton balls)

4 The change of state of a gas directly into a solid; frost is a product of deposition which occurs when the dewpoint falls below the freezing point of water

6 A cloud that forms near the ground as the air temperature at the surface cools to the dewpoint temperature

7 Clouds with ceilings that are at least 20,000 feet

9 The distance between the Earth and the bottom of a cloud

11 Clouds with ceilings under 6,500 feet

12 Clouds that are long, flat and seem to fill up the sky like a large sheet

DOWN

1 Tiny particles of dust, dirt, smoke, etc. that allow water vapor to hold onto before it can condense to form a cloud

2 When the heat from the sun causes the top of a batch of fog to evaporate

3 Clouds that are very high, thin and see-through

5 Clouds with ceilings between 6,500 and 20,000 feet

8 The temperature in which a gas is able to condense

10 Condensed water on objects on the surface of the Earth whose temperature has reached the dewpoint temperature

Why is conduction so important in the forming of dew?

CHAPTER 15

Up until now, you have explored many different pieces that make up our weather:

Clouds
Fog
Precipitation
Water
Air pressure
and Wind

In this chapter, we are going to start pulling all of these four pieces together:

#1 The uneven heating of the Earth from the sun causes the changes in our weather. In addition to the sun's warming of our planet, air pressure is also very important. Air pressure is what meteorologists call the "weight of the air pressing down on the Earth."

#2 Areas on the Earth with High air pressure have more air squished into a smaller area than other places on the Earth. Areas of Low air pressure have less air squished into an area of the Earth.

#3 Air inside the High pressure areas fill up the low pressure areas… as these areas fill up, we get wind.

#4 Once the wind starts to move, the rotation of the Earth causes it to curve across our planet. The curving motion of our wind is known as the Coriolis effect.

Let's go back to the first sentence in this review:

The uneven heating of the Earth from the sun causes the changes in our weather.

Since the Earth is warmed unevenly by the sun throughout the day, the air above the surface of the planet is warmed unevenly too! This means that you can find large areas of air with similar temperatures all over the planet. These large areas of air are known as **air masses**.

These air masses are always on the move, just like the wind! The Coriolis force causes these air masses to move across the Earth in patterns that meteorologists can measure!

***REMEMBER...** IT IS THE MOVEMENT OF AIR FROM A HIGH PRESSURE AREA INTO A LOW PRESSURE AREA THAT GIVES US OUR WINDS!*

Sometimes these air masses run into each other. If you live in the United States, you have probably seen this happen many times in your life! In fact, most of our rain, snow and thunderstorms take place when this happens! The area where a cooler air mass and a warmer air mass join is known as a **front**.

You will be exploring four different kinds of fronts:

Cold fronts
Warm fronts
Occluded fronts ("oh-klu-dead")
Stationary fronts

Cold fronts take place when cold air mass runs into a warmer air mass. As this cold air moves in, the warmer air rises above the cold air mass. As this warmer air rises and cools in the atmosphere, it condenses into clouds and precipitation! The warmer air tends to move quickly into the atmosphere, which can help to make very strong thunderstorms!

Luckily, these fronts are usually very small and move very quickly. This is why most thunderstorms do not last very long! After the cold front moves on, the sky tends to clear up and the air behind it is usually cooler than it was before the front arrived!

Warm fronts are the opposite of cold fronts. A warm front is the area where a warm air mass is moving into a cold air mass. As the warmer air moves into an area with a cooler air mass, the warmer air slowly rises above the cooler air! As this warmer air rises into the atmosphere, it cools and makes clouds and precipitation. However, because the warmer air does not move very quickly into the atmosphere, you tend to have a small amount of precipitation when a warm front passes over you! Behind the front, the skies tend to clear up and the air is usually warmer than it was before the front arrived!

Sometimes, cold fronts catch up with warm fronts. When this happens, you get an **occluded front.** In an occluded front, the cooler air mass from the cold front runs into the cooler air mass inside the warm front. This causes the air temperatures to get much colder as the occluded front passes by!

Before we go on... please understand that warm fronts do not only happen in the summertime! And cold fronts do not only happen in the winter!

Warm and cold fronts give us rain, snow, sleet and hail throughout the entire year!

Don't forget! Warm and cold fronts are only the areas where cooler air masses and warmer air masses meet! Most of the time, these fronts are moving across the United States. However, there are times when this does not happen...

Stationary fronts are fronts that are not moving. The weather we get from a stationary front depends on many different things, including air pressure!

Sometimes an area of low pressure moves along a stationary front. When this happens, you tend to have heavy amounts of precipitation! Meteorologists have a special name for these areas of low air pressure:

Cyclones

("sigh-clones")

You will find a low pressure area at the center of all storms! These areas are called cyclones because the air inside these low pressure areas are spiraling upwards...into its center! Because of the Coriolis effect, the air that spirals into a cyclone is always moving **counterclockwise** (the opposite direction of a clock!)

Remember! It is the movement of air from a high pressure area into a low pressure area that gives us our winds! As the air spirals into a cyclone, it cools and forms clouds and precipitation.

The winds that spiral around these cyclones cause warm, cold and occluded fronts to form. Most of the time, each cyclone has:

1) **a low pressure area in its center;**
2) **a warm front spiraling counterclockwise around this center;**
3) **and a cold front following the warm front!**

Meteorologists study the movement of cyclones across the United States to be able to predict dangerous weather like heavy rains and thunderstorms!

There are so many things that work together to form the weather! In the next chapter, we are going to bring it all together for you! Hang in there!

Match the words in the first column to the best available answer in the second column.

___ air masses

___ cold front

___ cyclone

___ front

___ occluded front

___ stationary front

___ warm front

1) large areas of air with similar temperatures
2) the area where a cooler air mass and a warmer air mass join
3) type of front that take place when cold air mass runs into a warmer air mass
4) type of front where a warm air mass is moving into a cold air mass.
5) type of front in which the cooler air mass from a cold front runs into the cooler air mass inside a warm front
6) a front that is not moving
7) low pressure area at the center of all storms; the air inside these low pressure areas are spiraling upwards into its center

Circle the hidden words from below:

T	O	L	L	N	E	D	R	C	D	Y	R	C	O	S	N	O	O	M	D	M	W	I	T	R
T	N	O	O	D	R	F	Y	U	O	Y	O	A	S	R	R	C	T	O	U	I	N	C	W	O
N	A	W	S	T	O	T	C	D	U	S	T	R	A	L	C	A	C	R	O	M	O	A	D	F
Y	O	N	S	N	E	E	T	A	D	T	S	A	S	L	O	S	T	I	R	S	R	Y	D	N
M	T	A	S	R	D	D	W	C	T	O	M	O	U	O	S	C	L	R	O	M	T	L	L	A
O	S	N	D	O	A	S	L	O	M	N	D	D	N	E	F	F	R	U	F	T	C	N	S	L
S	T	D	C	O	L	D	R	R	C	T	E	F	F	N	T	A	O	R	T	I	Y	N	O	O
T	A	L	N	I	C	W	R	T	O	D	D	Y	L	N	W	E	O	C	O	N	M	R	D	D
S	R	I	L	O	S	S	F	T	F	R	L	D	T	W	T	N	O	C	S	C	O	N	O	R
S	C	F	R	M	N	C	T	R	O	R	L	N	F	N	T	E	I	D	E	N	A	R	C	F
R	R	Y	T	M	N	A	O	N	L	T	T	N	R	S	O	S	O	C	R	Y	O	O	F	O
W	E	D	T	W	A	N	E	E	O	A	C	I	O	E	S	O	O	E	O	R	E	E	I	R
I	R	N	W	C	T	S	E	O	S	R	R	R	T	A	O	C	E	R	R	C	N	T	I	O
C	E	L	T	N	L	C	S	T	C	F	F	U	R	Y	T	F	O	Y	O	A	A	E	S	A
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F	R	R	O	R	T	O	E	E	L	F	T	A	T	N	N	F	T	M	R	T	E	C	R	N
L	E	A	N	E	F	E	N	T	R	M	R	A	W	E	N	O	L	O	O	F	Y	C	O	O
O	R	F	D	Y	N	O	C	R	S	E	N	O	O	N	R	C	I	O	O	C	A	T	N	C
C	E	R	N	O	C	O	R	O	E	N	F	C	N	T	F	S	T	T	R	O	C	N	O	O
N	R	I	L	S	T	R	R	U	L	I	N	L	O	T	R	C	D	I	A	A	D	T	C	F
C	O	C	F	U	F	N	F	U	S	Y	D	C	R	W	R	R	T	N	R	T	E	O	T	O
L	Y	I	N	L	A	L	A	A	C	L	D	C	C	I	O	R	A	C	T	C	S	A	O	O
C	C	N	C	E	F	I	F	D	C	R	F	O	S	N	A	R	N	D	N	S	A	S	O	R

air masses **cyclone** **front** **cold front**

warm front **stationary front** **occluded front**

Compare and Contrast Cold front and Warm front

Compare (things that are the **same** between these two)	Contrast (things that are **different** between these two)

CHAPTER 16

You have spent a lot of time exploring the different parts that make up our weather. In this chapter, we are going to bring it all together for you! You should have learned by now that…

Energy is the ability to move something by pushing or pulling an object.

This means that every time you turn the page on this book or eat a candy bar, or catch a fish you are using energy!

The Earth uses a lot of energy to move things too. Think about how the sun warms our planet! When radiation from the sun reaches our oceans, it warms them up! This means that the molecules inside our oceans are speeding up and moving around much faster! This happens when the sun's radiation hits the ground too!

Does all of this warmth stay in the land and water?

No!

As the sun warms the ground and the water, the air that is touching these parts of the Earth get warmed too! This is because the cooler air molecules get warmed by touching the warmer molecules in the ground and the water! This is called conduction! But it doesn't stop there! Convection allows the warmer air to rise and warm the atmosphere!

There are two very important facts that we should review next:

First. The sun warms the Earth unevenly!

and

Second. Our planet is always rotating!

The solid parts of the Earth (like mountains and fields and islands) can quickly absorb and release heat into the air. However, the liquid parts of the Earth (like the oceans and rivers) cannot move heat around as quickly. This causes the Earth to heat up unevenly! But Why?! Since the Earth is warmed up unevenly, the air above these different areas are warmed unevenly too!

These areas of air with different temperatures, also known as air masses, cause changes in air pressure too! In fact, the air from a high air pressure area is always moving towards a low pressure area.

If you remember, this is how we get our wind! Our winds move across the Earth as air moves from high pressure areas to low pressure areas.

These large air masses and high/low pressure areas do not sit still! They are always moving because our planet is spinning (rotating) on its axis!

It is our rotation that mixes all of our air masses and different air pressures around the Earth!

Since only one half of the planet is facing the sun at any time of the day, our rotation causes the mixing of warm and cool temperatures and different pressures every day!

As cooler air masses and warm air masses move across the Earth, they sometimes mix with each other. The areas where these air masses join, called fronts, cause all kinds of nasty weather!

Sometimes cooler air masses will run into warmer air masses. Other times, a warm air mass will run into a cooler air mass. Whenever these fronts pass over your house, you can expect a quick change in temperature and air pressure! You may even see lots of rain or snow when a front passes over you!

There are different kinds of fronts that exist which you have already explored. Meteorologists spend a lot of time studying these areas. Most of the time, it is one chemical they are watching very carefully inside these fronts…

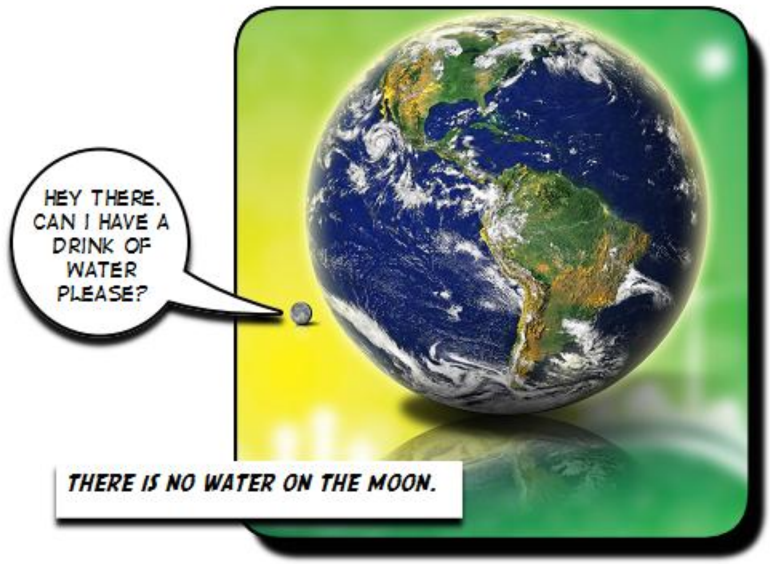
Meteorologists are always looking for water in our atmosphere! Sometimes, they are studying clouds which you have learned are made up of tiny water drops! Other times, they are looking at fronts which can cause dangerous thunderstorms and floods!

All of this has to do with the study of water!

In nature, water is always changing its shape from a solid (ice), a liquid (water) and a gas (water vapor)!

In fact, water is always being recycled in our environment! This is because water can be frozen into ice, melted to a liquid, and frozen again! Water can be used over and over again! This is happening every day on our planet!

The sun warms the liquid water on the Earth, which causes it to evaporate into water vapor - a gas. This gas rises into the atmosphere where it cools and condenses back into liquid water!



Every cloud you see is a group of tiny liquid water droplets floating in the atmosphere! Sometimes, the air temperature gets so cold that these water drops freeze into ice!

When these water drops or ice gets too heavy, they fall back to Earth. This is known as **precipitation** ("pree-sip-eh-tay-shun"). Once the water is back on the ground, the cycle can begin all over again when the sun warms the Earth!

Whenever air masses mix together and fronts move over us, we usually see clouds forming and have lots of precipitation! And remember, since our planet is rotating, these fronts are moving too! They follow the winds that form as air is moved from high pressure areas to low pressure areas!

Rain and snow are very important to all of us on Earth! Water is used by all living creatures to survive! In fact, we owe water a big **"Thank you"** for what it does in our atmosphere.

The water vapor in our atmosphere is a very important greenhouse gas! After the sun warms the Earth, some of this heat is reflected back into the atmosphere! Water vapor does a great job of absorbing some of this heat and reflecting it back towards the Earth!

This keeps our planet nice and warm as heat is always being bounced back towards the ground! Without water in our atmosphere, Earth would be a very cold place!

So there you have it! The last few chapters have given you the information to be able to understand how our weather works! Meteorologists spend a lot of time in school learning about how all of these parts come together to give us our weather. And there is a lot more information out there that you have not yet learned! I hope you will spend some more time on your own, learning about how the weather on our planet works!

True or false? Write "true" next to all of the following statements that are true. Write "false" next to all those which are false. If false, change the statement to make it true.

____ Energy is the ability to move something by pushing or pulling an object

____

____

____ The solid parts of the Earth (like mountains and fields and islands) cannot absorb and release heat into the air. However, The liquid parts of the Earth (like the oceans and rivers) moves heat much faster.

____

____

____ It is our rotation that mixes all of our air masses and different air pressure around the Earth!

____

____

____ In nature, water is always changing its shape from a solid (water vapor), a liquid (water) and a gas (ice)!

____

____

____ The sun warms the liquid water on the Earth, which causes it to evaporate into water vapor, a gas. This gas rises into the atmosphere where it cools and condenses back into liquid water!

____

____

Which one is right? Circle the correct answer.

1. Which of the following helps to mix air masses together?
   a) the sun's radiation
   b) Earth's rotation
   c) greenhouse gases

2. Condensation is the process where...
   a) liquid water turns into water vapor
   b) liquid water turns into ice
   c) water vapor turns into a liquid

3. Which of the following is true about air pressure?
   a) high air pressure follows more high air pressure
   b) low air pressure follows high air pressure
   c) high air pressure follows low air pressure

4. Wind is caused by...
   a) convection
   b) the movement of high pressure areas into low pressure areas
   c) the uneven heating of the Earth

5. Precipitation is usually found in which area?
   a) the side of the planet facing the sun
   b) only over oceans
   c) around fronts

Unit Four Review

What does it mean to say, **"Everything on the Earth is connected to each other?"**

Be certain to go over your definitions for the test!

CHAPTER 17

Okay! Quickly! Make as many different faces as you can! Go on!

I would guess you just made all kinds of faces – happy faces, sad faces, silly faces. And I am guessing you did it very quickly too! So why did I ask you to do that? Well, this unit is going to show you that...

The Earth has a changing face too !

That's right! The surface of the Earth is always changing. Sometimes, these changes are fast and other times they are very slow.

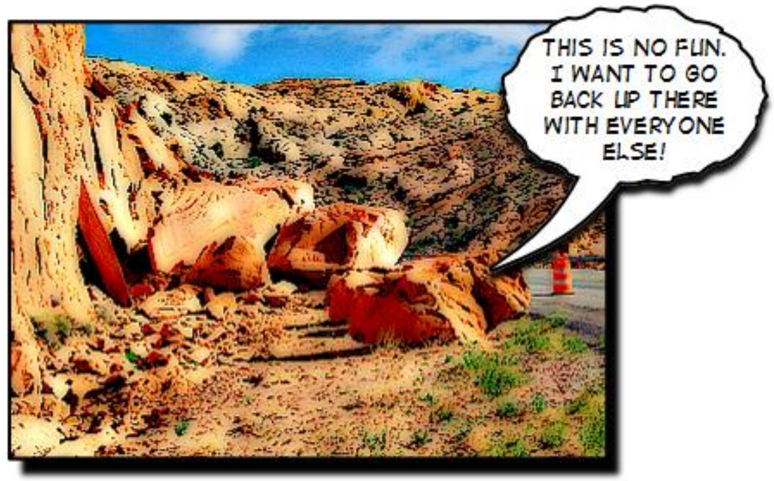
In this chapter, you are going to look at three very slow ways that the Earth can change its face:

Weathering
Erosion
and Deposition

Weathering is a natural method that breaks apart large rocks into smaller rocks! And if you think that it has something to do with the weather, you are correct!

In fact, there are two ways that nature breaks apart rocks by weathering:

Physical weathering
and
Chemical weathering



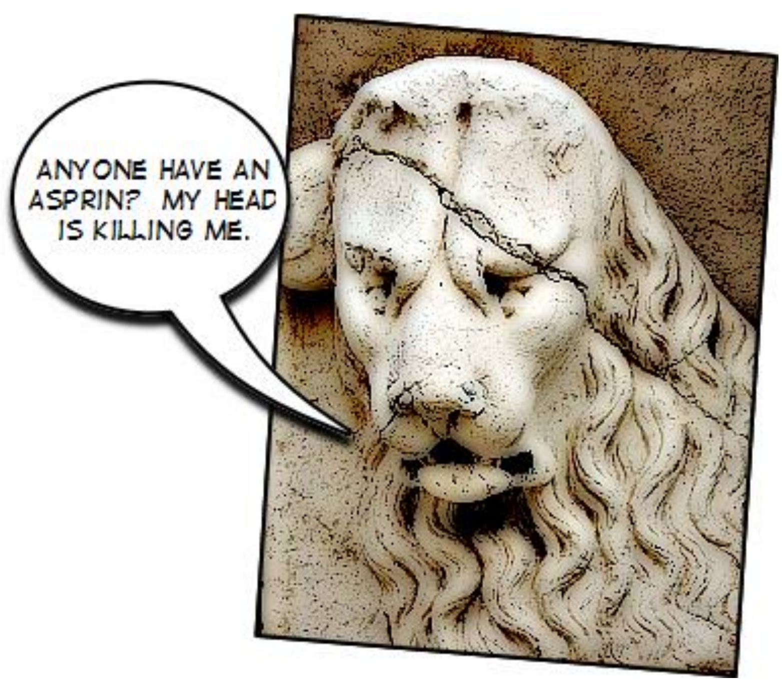
Physical weathering takes place when the weather causes rocks to be worn down, cracked or broken! Let's look at some things you explored in the last unit. How about wind? As the winds move across the Earth, they can move sand and small rocks very quickly through the air. When these items smash into larger rocks or other surfaces, they break them apart! Remember, this takes a long time! A breezy summer day will not move enough sand and small rocks to break apart a mountain in a few hours! NO way! It takes a long, long, long time!

What about rain or snow? Do these things cause physical weathering? You bet they do! Water and ice flowing in a river is always moving rocks around, breaking them apart or wearing them down into smooth stones! The ocean does the same thing as its waves crash into a beach or a rocky cliff!

Go outside and look on your sidewalk or driveway. Can you find any cracks in the concrete? You probably can! Temperature changes during the winter months can cause rocks (like your sidewalk) to shrink! When the morning sun rises, it warms the rocks and causes them to get larger or expand! All of this shrinking and expanding causes rocks to split!

If water fills all of those cracks in your sidewalk and it freezes you could have a problem! You see, when water freezes it expands. And if the water in those cracks freezes and expands, it will make the crack much larger as the ice moves the pieces of rock apart! After the ice melts away and water fills up the larger crack the same problem could start all over again! If this happens for too long... **say goodbye to your sidewalk!**

Animals and plants also cause physical weathering. Did you see any plants growing out of the cracks in your sidewalk?



If you did, the roots from these plants are causing the same problems as the freezing water! Plant roots are very strong and they can cause small cracks in rocks to split and get very large! As some animals dig into the ground, they sometimes move small rocks to the surface. This is bad news for a rock because wind, rain, snow and temperature changes can break it apart!

Chemical weathering is a little more difficult to understand. This kind of weathering takes place when certain chemicals, called **acids**, cause small parts of the rock to dissolve ("melt away"). These acids are usually found mixed together with water. As the water flows over the rocks, the acid causes chemical weathering to take place. The water that slowly drips into many caves changes the shape of its rocks over a long period of time! Where does the acid come from? Well, many plants give off tiny amounts of acid into the soil. And when water passes through the soil, it can dissolve the acid and move it very easily!

Okay…once weathering breaks down rocks into smaller pieces, erosion and deposition start to work!

The moving of rocks and soil to another place is known as **erosion**. The same things that cause weathering to take place (mostly wind and moving water), are responsible for causing erosion.

One example of erosion is caused by wind. The wind carries sand, dust and other small objects all over the planet. When the wind stops, these items fall to the ground. Another example is found in rain. During heavy rains, water can move rocks and soil a great distance! New streams can be created when heavy rains move enough rock and soil away.

As water moves through streams and rivers, it carries soil, sand and rocks. At times, these objects can be dropped off at different places. This is known as **deposition**. At times, there is enough sand, soil and rocks to form new land where deposition is taking place!

In some areas of the world, large sheets of ice and snow can cause a huge amount of erosion. When these large sheets of ice and snow get heavy enough, they begin to move down the sides of mountains. These large chunks of ice are known as **glaciers!** Glaciers tear through the land as it moves down the mountain.

Many glaciers are huge! Sometimes, the entire side of a mountain can be carved by a single glacier to create a valley. As glaciers carve through rock and soil, it carries these objects down the mountain too! As glaciers melt away, they drop off rocks and soil, which creates a great deal of deposition!

If you get a chance to see a glacier, don't expect to see it sliding down the mountain very quickly! It takes a lot of time for them to carve through a mountain!

Most of the time, we only hear about the bad things that happen because of Weathering, erosion and deposition. But they are not all that bad. For example, the physical weathering of rocks by the ocean gives us a large amount of sand. We use sand a great deal in our buildings, homes and other objects! Moving water and wind move soil around the planet, but deposition creates areas that have plenty of good soil that can be used for farming! Even the large glaciers that carve through the land create thousands of lakes from melting blocks of ice!

Match the words in the first column to the best available answer in the second column.

___ chemical weathering	1) a natural method that breaks apart large rocks into smaller rocks
___ deposition	2) takes place when the weather causes rocks to be worn down, cracked or broken
___ dissolve	3) takes place when acids cause small parts of rock to dissolve
___ erosion	4) melt away
___ glaciers	5) The moving of rocks and soil to another place
___ physical weathering	6) deposits of soil, sand and rocks that have been dropped off by moving water
___ weathering	7) large sheets of ice that slowly slide down a mountain, causing large amounts of erosion

Compare and Contrast

Erosion and Deposition

Compare (things that are the **same** between these two)	Contrast (things that are **different** between these two)

Circle the hidden words from below:

```
S H I R C D L L E L S T N I S N I T T P T N S I E
L D E E R O G R M A T O S I I E S D L H S E E N P
H E N P R C O L C C O R E A L I N E I O I C G H G
S S I P I S P S D I L L E R A L O A E I D A S E I
A Y C T I R R I I I C V S W A A L E N E O L E W O
P C S O L E H M Y A L L H D V O S I N I T M E E I
L E N E I C T S R O S H L H W S H P H A E E W H Y
S H O C L E E S S C O H D A A C G E E L S E I O P
O A A H D M L S I E O S I N Y R S A R E A S R C A
A L T S E H I L H G M P H I G L A V M T T L C S T
G S R S O D W C C D R I C E H I S E H E L C S E H
E O S R V I S O G L E N O C I N E E H S L I A W G
N R W I E S N C E I S G E S I E R I P I I T O I A
E H C L P C A I H N O I I P D I N S R G R A R I O
W L S P S N D S O E O I A N N E H N I I C T T E E
L Y I G G S O I I I M H A G O N A C L R I E E I E
D O I T P E T V R E G I S L C L L I I E T H A C H
E H P I O I V R S I N A C L S R N P I L A O I T R
Y I S H S N E A D C Y I D A I L E Y I I E L S R I
R T E O Y N R O I A O H E E L I O C N I N S N I C
A H P T R S S H C A C E C H R E O P I C M H I S P
R E E S Y S I N H S E W W T E O L R M P E T L Y E
D I I S R D L C R D N I O I L C L A I R R R D N C
I L L I A N T C A M H I T M O C G N P E E T T O O
S E R T H H H I S L H T I A S H S C H E N E T P L
```

chemical **physical** **weathering** **erosion**

deposition **glaciers** **dissolve**

CHAPTER 18

In the last chapter, you learned that.

The Earth has a changing face!

These changes take place when different areas of the Earth go through **destructive forces** ("dee-struck-tiv"), like weathering or erosion or **constructive forces** ("kon-struck-tiv"), like deposition. Destructive forces break things down, just like weathering can wear down a mountain over a great deal of time! Constructive forces are the opposite of destructive forces. Constructive forces act to build (or "construct") new land forms.

Never forget! All of these processes take a great deal of time! You would never find a glacier sliding down a mountain like a race car driver. It does not work this way!

Weathering, erosion and deposition can take several years to notice any changes!

These are three examples of how the Earth's face is always changing. But they are not the only examples of how the Earth is always changing. This week, you are going to explore another **huge** way the Earth is changing!

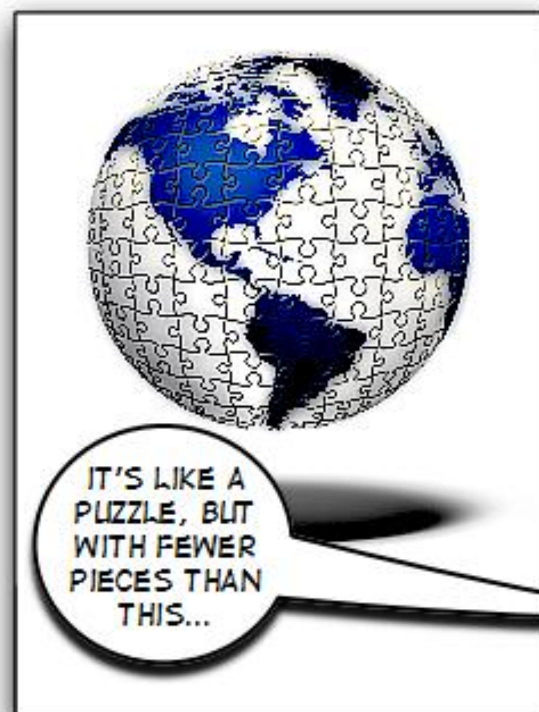
Now is the time to bring together a couple of things you have learned about so far:

You should remember that the Earth has three different layers: the crust, the mantle and a core. The deeper parts of the mantle (where you would find melted rocks) is always moving around very slowly! So, the Earth's crust floats on top of the mantle just like a boat floats on the top of water.

Look around you. Do you see the ground moving around all the time? Hopefully not! But the Earth's crust is always moving around! Remember, this outer layer of the Earth is always floating on top of a layer of melted rock, which is also known as **magma**!

Most scientists agree that the melted rocks in the mantle move like the heat that warms the atmosphere, by convection!

(You learned in chapter 9 that convection means "the transfer of heat through a gas or liquid that is in motion").



This means that this hot liquid inside the mantle is always swirling around. However, this liquid is not moving nearly as fast as the heat in our atmosphere. Remember, we are learning about how the Earth's face changes very, very slowly!

The Earth's crust is broken up into many large pieces that are called **tectonic plates**. All of these plates fit together like a puzzle. But remember, all of these plates are floating on the hot, liquid mantle. And they are all floating in different directions!

Since the liquid part of the mantle is not moving very quickly, the tectonic plates are not moving quickly either! In fact, most of these plates are only moving a few inches every year!

Okay... Let me get this straight. The crust of the Earth is broken up into several large plates that are always moving around.

What keeps them moving?

Most scientists agree that not only is the Earth's "face" changing, but so is the mantle and the core! The magma within Earth's mantle can flow, very slowly, over a long period of time! This movement of magma under the tectonic plates is believed to cause them to move on the surface of the Earth!

The heat from the core of the Earth keeps melting the rock inside the mantle. It is also agreed by many scientists that the magma within the mantle moves just like warmed air moves in the atmosphere - **by convection!** The hot magma moves upwards, away from the core until it reaches the tectonic plates. It is much cooler here, so the magma cools down and sinks back deeper into the magma where it can be reheated! This causes the magma to always be in motion, like a cycle.

When the edges of these huge plates get near each other, different things can take place on the crust. These areas are called:

Convergent boundaries
Divergent boundaries
and Transform boundaries

Areas where two tectonic plates are crashing together are known as **convergent boundaries** (“kon-vur-gent”). When this happens, you can get all kinds of changes to the Earth’s face! First of all, try to imagine what a car looks like after it has been in an accident. It is bent and folded all over the place, right?! Well, that is what is happening to the Earth where you would find a convergent boundary! When two plates run into each other, the surface of the Earth bends and folds very slowly (remember, tectonic plates are only moving a few inches every year!)

All of this bending and folding can push the land up very slowly. This is another example of a constructive force. After many, many years of the land pushing upwards, a mountain is formed!

Although the creation of a mountain may take a very long time, there are some results of convergent boundaries that happen very quickly:

Earthquakes and **volcanoes** take place when the crust bends and grinds too much against itself and breaks! You will be exploring both of these forces in future chapters.

When two plates begin to move away from each other, you have a **divergent boundary** ("die-vur-gent"). When both plates move away from each other, the land that remains in between begins to crack. These cracks are filled up by the hot magma underneath!

You could say that new crust is being formed where divergent boundaries exist! Again, don't forget that these plates are only moving a few inches each year! The amount of new crust that is formed every year is not very much. But over many years, the amount of land becomes larger and larger!

Remember! The surface of the Earth may be changing slowly around a divergent boundary, but you would also find earthquakes, mountains and volcanoes in these areas too! Both of these forces occur can occur very quickly and change the Earth's surface a great deal!

Places on the Earth where the plates slide past each other are known as **transform boundaries**. In these areas, you typically do not find large mountains and volcanoes. This is because the plates are not grinding together or tearing apart! In fact, no land is being moved upwards in a transform boundary at all!

Even though you may not find mountains and volcanoes in these areas, you would still find a lot of earthquakes! The grinding motion between the two plates causes many earthquakes to take place along transform boundaries.

Match the words in the first column to the best available answer in the second column.

___ constructive forces

___ convergent boundaries

___ destructive forces

___ divergent boundaries

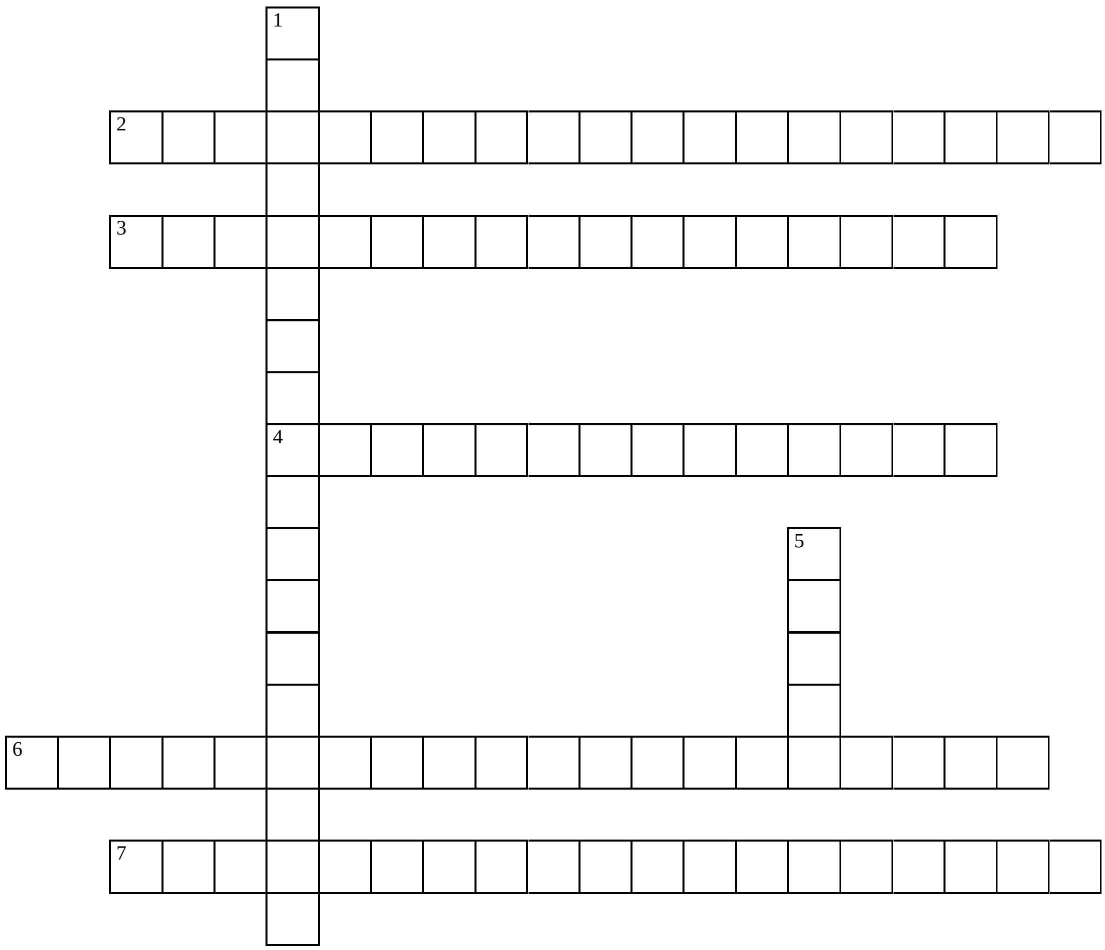
___ magma

___ tectonic plates

___ transform boundaries

1) forces like weathering and erosion which break things down
2) forces like deposition that act to build new land forms
3) molten rock
4) large pieces of the Earth's crust that fit together like a jigsaw puzzle and float on top of our mantle
5) areas where two tectonic plates are crashing together
6) areas where two tectonic plates begin to move away from each other
7) places on the Earth where tectonic plates slide past each other

Place the answers to the following clues in the boxes below. Each box should contain one letter.



ACROSS

2 Places on the Earth where tectonic plates slide past each other
3 Forces like weathering and erosion which break things down
4 Large pieces of the Earth's crust that fit together like a jigsaw puzzle
6 Areas where two tectonic plates are crashing together
7 Areas where two tectonic plates begin to move away from each other

DOWN

1   Forces like deposition that act to build new land forms
5 Molten rock

How does convection work inside the Earth?

CHAPTER 19

The huge tectonic plates that make up Earth's crust may only move a few inches every year.

But the largest and most dangerous natural events take place from these small movements!

This week, you are going to explore one fast and dangerous way that the Earth's face can change by looking at.

Earthquakes

Most earthquakes and volcanoes take place where the edges of Earth's tectonic plates are close to each other. The plates may only move a few inches each year, but that is more than enough to create dangerous events very quickly on the surface of the Earth!

Let's look at how an earthquake is formed!

An **earthquake** is a **vibration** ("vi-bray-shun"; think of a vibration as a "shaking") that moves through the Earth's crust. If you have ever felt your house shake as a big truck drives by your home, you have felt your house vibrating!

However, with an earthquake, we are talking about an entire city shaking, not just your home!

You have already learned that areas where two tectonic plates meet (convergent, divergent and transform boundaries) can create an earthquake. This is because these areas make huge cracks in the Earth's crust. These cracks in the Earth's crust are called **faults**.

SCIENTIST STUDYING LAVA

Seismologists, ("size-maul-o-jists") the scientists who study earthquakes, have discovered that earthquakes usually take place near these faults! When the walls inside these faults move in different directions, they tend to rub against each other.

However, we are talking about very, very, very large chunks of rock rubbing against each other! And, the walls of a fault are never perfectly smooth! If you have ever tried to rub two rocks together, you learned that it is not easy to do! Sometimes, the huge walls of these faults cannot slide against each other because they get stuck together.

But the tectonic plates keep moving! Sooner or later, the fault that is stuck together will be forced to move again! Only this time, it will be snapped back into place very quickly! When this happens, there is a large amount of energy released from the fault! Imagine trying to move one rock against another rock really hard. It will not take much time until you can break one of the rocks as you try to slide it against each other!

Remember the large truck that was shaking your house?! That truck was releasing a great deal of energy into the ground as it drove by. In fact, the vibrations from that truck was creating a tiny earthquake in your home!

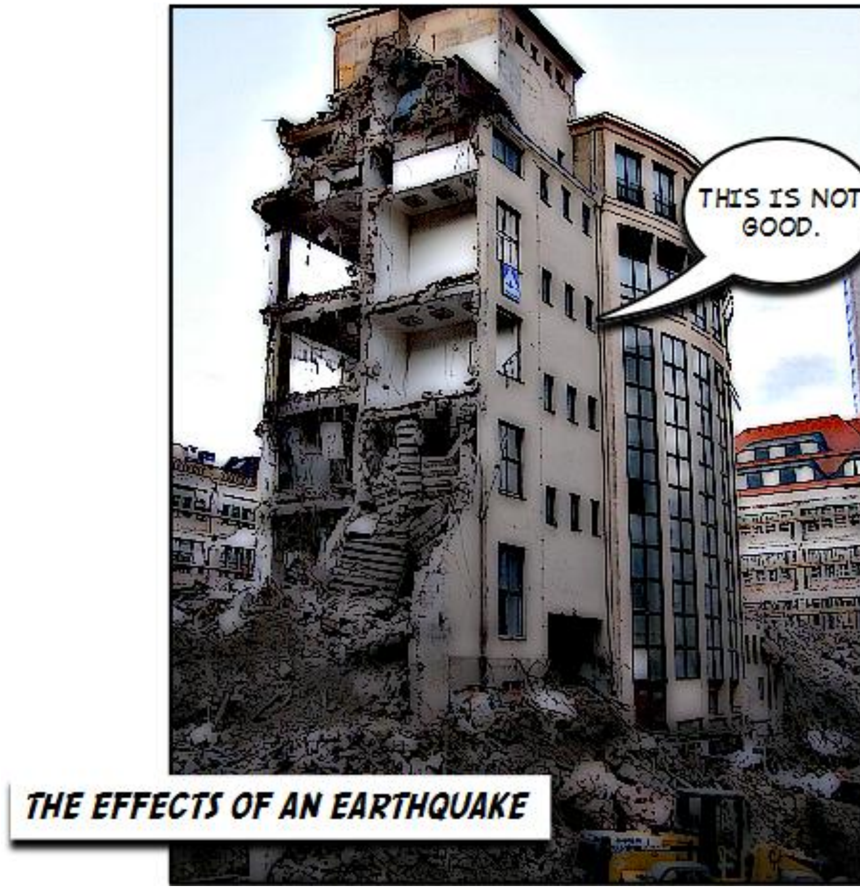
When a fault snaps back into place, the energy that is given off is much more dangerous! The energy that spreads through the Earth's crust during an earthquake is known as **seismic waves** ("sigh-z-mick"). It is called a wave because this energy moves through the Earth's crust just like waves in a body of water. In fact, some of these waves are so powerful, they can move the surface of the Earth up and down just like waves in a pool of water! These waves cause the ground to shake.

There are over three million Earthquakes every year! That means the Earth is shaking every eleven seconds!

Don't worry!

Most of the time, earthquakes are not very strong and they take place in areas where there are not many people living. In fact, it is possible that there was at least one earthquake somewhere in the world by the time you finish reading this paragraph!

The danger of an earthquake is not with the movement of the land beneath our feet. Most people are hurt by buildings or other structures that fall down when the ground begins to shake. If you live in an area where you feel earthquakes all the time...**Don't Panic!** Cities that have been built along faults have special ways to make their homes and buildings safe from earthquakes.



Seismologists have learned how earthquakes form. They have also built tools that can measure how strong an earthquake is and where it begins. However, they have not yet found a way to predict when an earthquake is going to happen. Many seismologists around the world are trying to solve this problem right now!

Sometimes, earthquakes can take place in the middle of tectonic plates. The most powerful earthquakes that have been recorded in the United States took place in the middle of the tectonic plate under the state of Missouri. The vibrations from this chain of Earthquakes that took place in 1811 and 1812 made church bells ring hundreds of miles away!

So far, you have looked at what happens when seismic waves move through land. Sometimes, faults cause Earthquakes to take place under the ocean. When a tectonic plate snaps back into place, most of its energy is sent through the water! This can be very dangerous because the energy that is given off can cause large and very fast waves in the ocean! These waves are known as a **tsunami** ("soo-nam-ee").

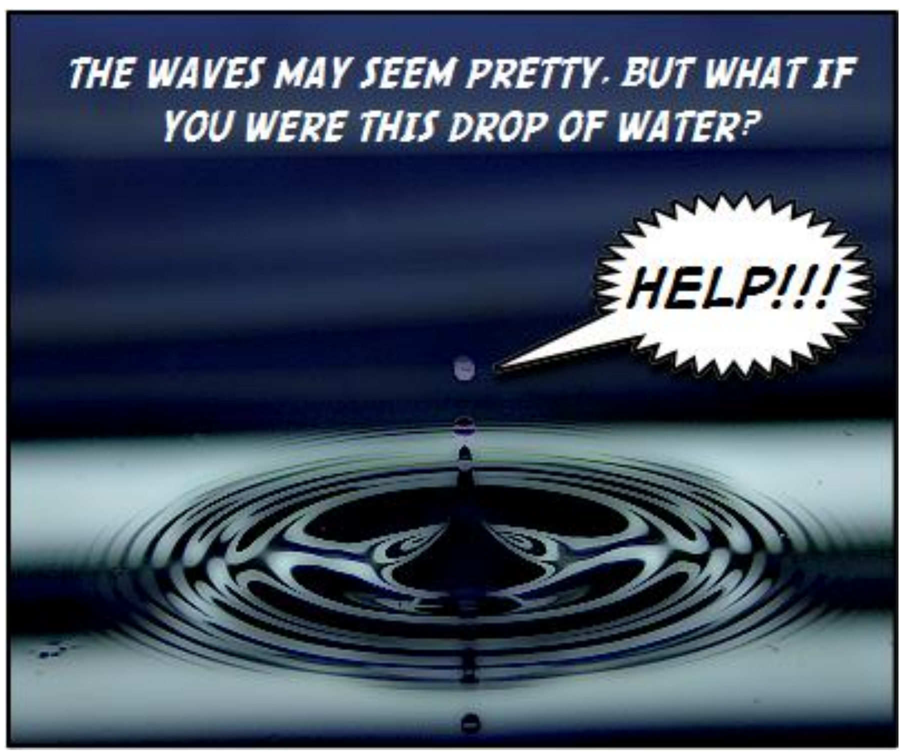
You would not want to be on the beach if one of these waves is heading towards you!

The size and speed of normal waves in the ocean are caused by the strength of the wind. Most of the energy in a normal wave can be found on the surface of the ocean. This is where the energy from the wind is creating the waves.

However, the wave that is made by a tsunami is caused by a much more powerful source of energy. **An underwater earthquake!** The waves caused by these earthquakes can be hundreds of miles long and can reach the height of 34 feet! Try to imagine this. If you were sitting in the third floor of a building, this wave would easily pass through your window and quickly fill up your room!

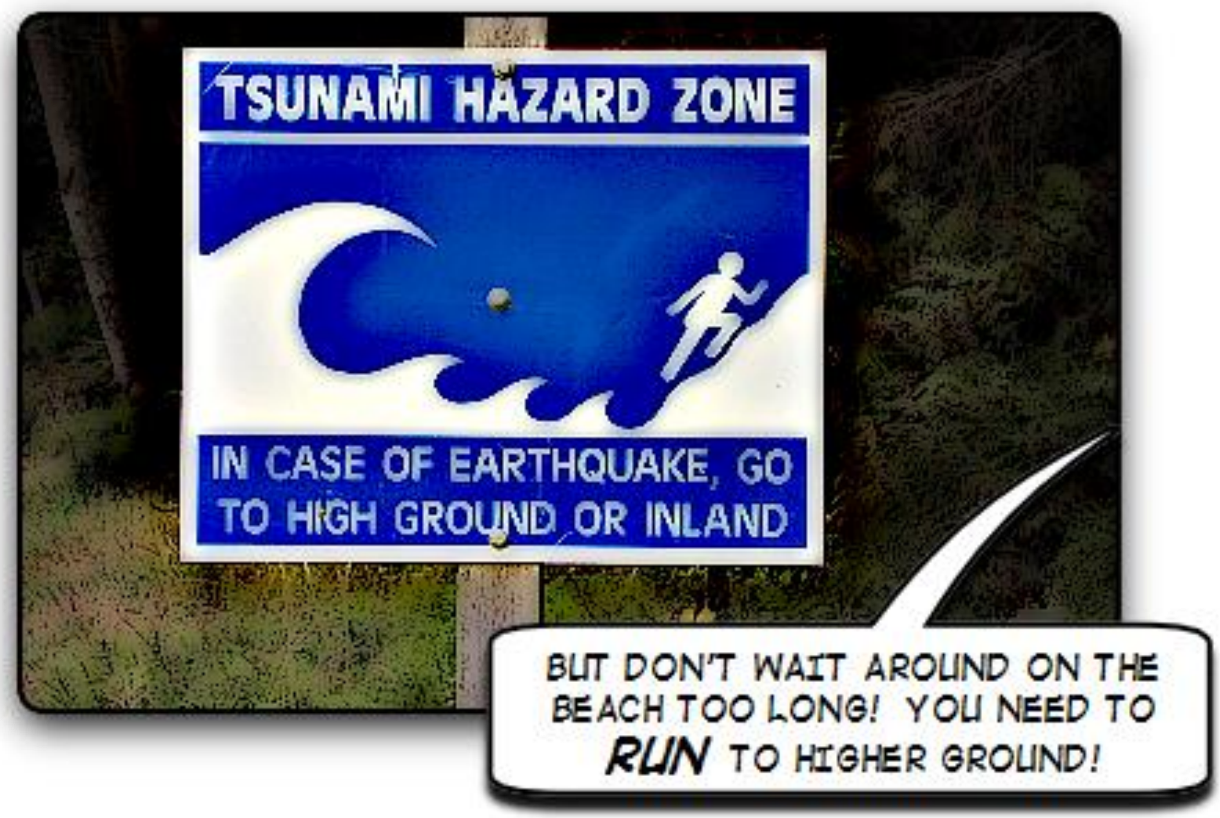
But that is not the only problem with these huge waves. The energy they get from an underwater earthquake move them through the water very quickly! Some of the largest tsunami's can move as fast as 300 miles per hour. That is faster than a jet airplane!

Now try to imagine a 34 foot wall of water hitting your third-floor room. You would not need to worry about your room filling with water because your entire house would be swept away!



Most of the time, tsunamis are not one single wave that crashes into the land. They are usually a series of strong and large floods that hit the land over and over.

It does not matter if a tsunami arrives as a single wave or several waves. Tsunamis are very dangerous as they can slam into a beach without much warning! One sign that a tsunami is about to take place can be found the water level around a beach. Sometimes, the water on the beach will be drawn into the approaching wave of water. If you were standing on the beach when this happens, it would look like the water is moving away from you! This may look very cool.



An earthquake is a destructive force that changes the face of the Earth very fast! However, it is not the only force that can do this. Next week, you are going to look at another fast moving force on Earth:

Volcanoes

Fill in the blanks with the correct letters. The words in the list on the right provide a clue to the answer.

1) _arth_uake	a vibration that moves through the Earth's crust.
2) _i_ration	a shaking motion
3) _ault_	huge cracks in the Earth's crust
4) _eism_logis_s	scientists who study Earthquakes
5) _eismi_ waves	the energy that spreads through the Earth's crust during an Earthquake
6) _suna_i	very large and fast waves in the ocean caused by underwater Earthquakes

Which one is right? Circle the correct answer.

1. What is the name of a scientist who studies earthquakes?
   a) meteorologist
   b) astronomers
   c) seismologists

2. Why do scientists say that energy travels in waves?
   a) energy can only be transferred through the water
   b) energy moves like waves in water
   c) energy can only be transferred through the Earth

3. What hurts more people during an earthquake?
   a) seismic waves
   b) large and fast waves from the ocean
   c) falling buildings and other structures

4. Tsunamis are created from...
   a) earthquakes under the ocean
   b) earthquakes on land
   c) divergent boundaries

5. An earthquake takes place every...
   a) once a year
   b) once every 11 seconds
   c) once a day

6. Which of the following is false?
   a) seismologists know when earthquakes will happen
   b) seismologists know how earthquakes form
   c) seismologists can measure the strength of an earthquake

Circle the hidden words from below:

S	O	R	S	A	R	S	T	H	S	B	R	S	G	C	N	O	S	N	E	N	A	T	R	A
C	E	F	S	U	S	M	O	H	N	A	V	M	A	A	T	T	L	I	N	T	A	S	S	W
V	T	H	A	I	I	R	V	A	E	S	K	R	I	O	V	S	A	V	A	M	I	A	E	B
T	S	A	E	U	E	I	I	I	N	C	E	E	S	Q	A	I	V	R	N	I	T	T	A	T
A	S	I	S	E	L	N	L	N	B	E	I	T	V	A	N	U	S	T	U	V	H	U	L	I
L	N	I	L	I	A	T	V	S	T	R	S	T	E	S	O	S	M	I	E	M	I	R	E	T
F	A	W	L	S	A	V	S	M	L	I	A	T	S	L	I	O	N	S	I	L	M	S	S	A
O	E	L	N	T	E	R	S	R	G	I	S	T	T	S	S	L	S	S	S	S	N	S	S	S
T	T	T	I	I	N	I	V	O	R	U	W	O	I	E	A	E	O	O	I	A	E	I	S	I
S	C	S	E	L	S	S	L	U	I	E	S	I	N	O	V	S	O	S	E	R	T	S	H	B
O	U	I	A	I	S	O	A	E	I	F	S	S	V	A	N	Q	T	I	M	L	I	V	E	S
T	I	S	I	S	M	E	A	I	I	K	T	L	W	R	A	S	N	M	C	O	L	E	M	S
O	I	T	S	S	H	L	T	S	I	T	S	C	A	E	O	I	S	W	S	A	T	A	G	M
A	A	I	I	I	R	I	T	V	I	S	I	I	S	S	N	U	M	S	O	M	A	E	R	S
R	S	E	A	O	S	R	O	S	U	M	A	M	L	U	E	B	S	A	R	M	A	M	N	T
U	S	E	A	L	R	A	A	R	S	I	T	S	C	T	M	U	E	E	N	R	B	E	E	L
I	E	S	S	H	U	R	R	I	O	N	S	V	S	R	U	A	I	M	T	U	S	V	E	F
E	O	O	B	W	S	O	E	A	E	R	K	A	L	N	A	E	M	H	A	G	S	O	A	T
S	I	I	S	S	L	S	T	T	I	R	U	B	S	R	A	L	Q	L	T	E	Q	T	S	S
L	K	U	T	M	N	T	R	S	G	S	E	S	M	W	N	U	N	S	C	R	E	A	N	T
M	O	V	S	T	I	C	M	M	E	S	U	S	T	S	A	S	N	E	E	S	R	B	S	A
S	M	S	O	A	L	A	Q	U	E	I	S	S	T	K	U	I	E	H	O	T	R	O	U	I
E	M	T	E	R	T	S	Q	U	S	U	L	K	E	E	S	M	E	O	S	S	V	V	T	S
W	A	M	A	S	E	A	W	R	E	V	V	O	S	S	R	E	L	R	S	E	W	A	W	S
I	S	M	E	N	F	M	A	S	T	O	S	A	I	E	H	N	U	G	A	T	V	O	K	M

earthquake **tsunami** **seismic waves** **faults**

vibrations **seismologists**

CHAPTER 20

If I asked you to draw a picture of a volcano, what would it look like? Would it look like an upside-down ice cream cone with fire and smoke coming out of its top?

Most people would say this is true. But volcanoes do not always look like this! In fact, a **volcano** is any place on a planet where magma from the inside of the planet is moving through its crust.

On Earth, we would call a volcano any crack in the crust where magma (melted rock) is flowing through.

You have already learned that magma can flow through cracks in the crust in diverging boundaries. If you remember, a diverging boundary is a place where the edges of two tectonic plates are moving away from each other. As the plates move farther away from each other, the ground between them cracks apart. Magma then flows into the cracks from under the diverging boundary. Once magma reaches the Earth's surface, it is called **lava**. As this lava cools, it hardens into solid rock and forms new crust!

But wait a minute! Most of these diverging boundaries are found under the ocean! Are you saying that volcanoes exist under the ocean?

Yes I am!

I'm not kidding! Most volcanoes are found under the ocean! In fact, most of these volcanoes are so far under the ocean we do not see the see the steam or bubbles on the surface of the water!

As the lava oozes out of the cracks on the bottom of the ocean, it quickly hardens into solid rock. As more lava flows through the cracks, the amount of solid rock grows and grows. If an underwater volcano oozes lava long enough, the layers of hardened lava can form **volcanic islands**. An example of a volcanic island is Hawaii!

Okay! Now let's take a look at volcanoes that form over the land!

When two tectonic plates crash into each other, volcanoes can form around these convergent boundaries.

All the magma needs is a path to the surface of the Earth. This path is known as a **pipe**. Unfortunately, this "pipe" is blocked at the surface. So, heat and pressure increase as magma fills the pipe. This pressure continues to rise until it forces an opening to the surface. This opening is known as a **vent**.

When volcanoes erupt through a vent, lava can pour out in gentle streams or explode with great force! The difference in these two eruptions is caused by the kind of magma that is trapped in the pipe.

Magma that is very thin flows easily out of the vent. This lava can flow very quickly. Other kinds of magma are very thick. When this kind of magma is trapped inside a pipe, there is much more pressure that is built up.

When this thick magma builds up enough pressure...

Imagine shaking up a can of pop. don't get any ideas, okay?! Just imagine shaking a can of pop and opening the lid. All of the pressure inside the can starts to rise as you shake it! When you make an opening in the can by removing the lid, this pressure forces the pop through the small opening and (hopefully) not all over your face!

This is what can happen when magma blows through a vent!

Lava is not the only thing that comes out of a volcano. Rocks can be ripped from the volcano's vent and blown very far away! Sometimes, these rocks can be broken down into dust and ash during the explosion.

The dust that is forced into the air from an erupting volcano can get caught in the winds of the atmosphere. This means that the dust can be carried around the Earth several times before it rests on the ground!

As layers of lava, rocks, dust and ash fall around the vent of a volcano, a cone-shaped mountain can begin to form! If you have ever poured sand or salt slowly into a pile, you should have seen that you are making the pile grow into a cone shape! This is what happens with some volcanoes! If lava keeps flowing out of the vent, the volcano with keep growing!

Not all volcanoes have lava pouring out of them. Some volcanoes are called **extinct**. Extinct volcanoes have never erupted since the beginning of recorded history. Other volcanoes are called **dormant** because they have not erupted for a very long time! Some volcanoes, like those on the islands of Hawaii, are called **active**! Active volcanoes erupt all the time!

PALM TREES BEING COVERED BY LAVA

Who would want to live next to a volcano?! It sounds dangerous!

It is possible that an erupting volcano can destroy all life around itself. However, millions of people around the world choose to live near active volcanoes. There are many reasons for this. Let's look at one of them.

The ash that a volcano gives off may hurt the environment at first; however, a thick layer of ash contains many nutrients that can be used to make good soil for plants!

Nearly everywhere volcanoes are found, people use this good soil for farming! Even after a volcano erupts, people return because of this good soil!

So, volcanoes are not all that bad! But I would still be very careful around them!

In this unit you have learned many things about how the Earth is always changing. Don't forget that these changes are a mixture of constructive forces (like convergent and divergent boundaries, volcanic eruptions and deposition) and destructive forces (like weathering and erosion).

It does not matter if these changes take place very slowly (like weathering and erosion) or very fast (like volcanic eruptions and earthquakes). The truth is:

The Earth has a changing face !

Match the words in the first column to the best available answer in the second column.

___ **active volcano**

___ **dormant volcano**

___ **extinct volcano**

___ **lava**

___ **pipe**

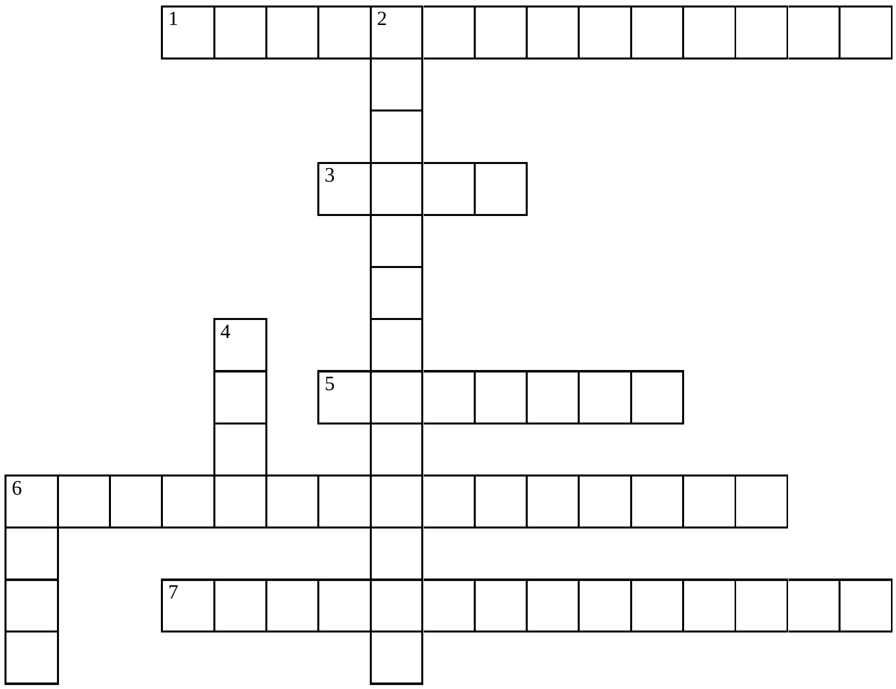
___ **vent**

___ **volcanic islands**

___ **volcano**

1) any place on a planet where something from the inside of the planet is moving through its crust
2) magma that has reached the Earth's surface
3) layers of hardened lava from underwater volcanoes that are sticking out of the ocean
4) the path that magma takes from the mantle through the crust
5) an opening at the end of a pipe that allows magma to reach the surface of the Earth
6) a volcano that has not erupted in recorded history
7) a volcano that has erupted a long time ago
8) a volcano that erupts all the time

Place the answers to the following clues in the boxes below. Each box should contain one letter.



ACROSS

1 A volcano that has erupted a long time ago

3 Path that magma takes through the crust

5 Any place on a planet where something from the inside of the planet is moving through its crust

6 Layers of hardened lava from underwater volcanoes that are sticking out of the ocean

7 A volcano that has not erupted in recorded history

DOWN

2 A volcano that erupts all the time

4 Magma that has reached the Earth's surface

6 An opening at the end of a pipe that allows magma to reach the surface of the Earth

Unscramble the words below:

(Hint: check out the bold-faced words in your reading!!!)

1. vodocartmnoanl ______________________________

2. xinecooltvtcan ______________________________

3. nacvevootilca ______________________________

Write the definitions for each word:

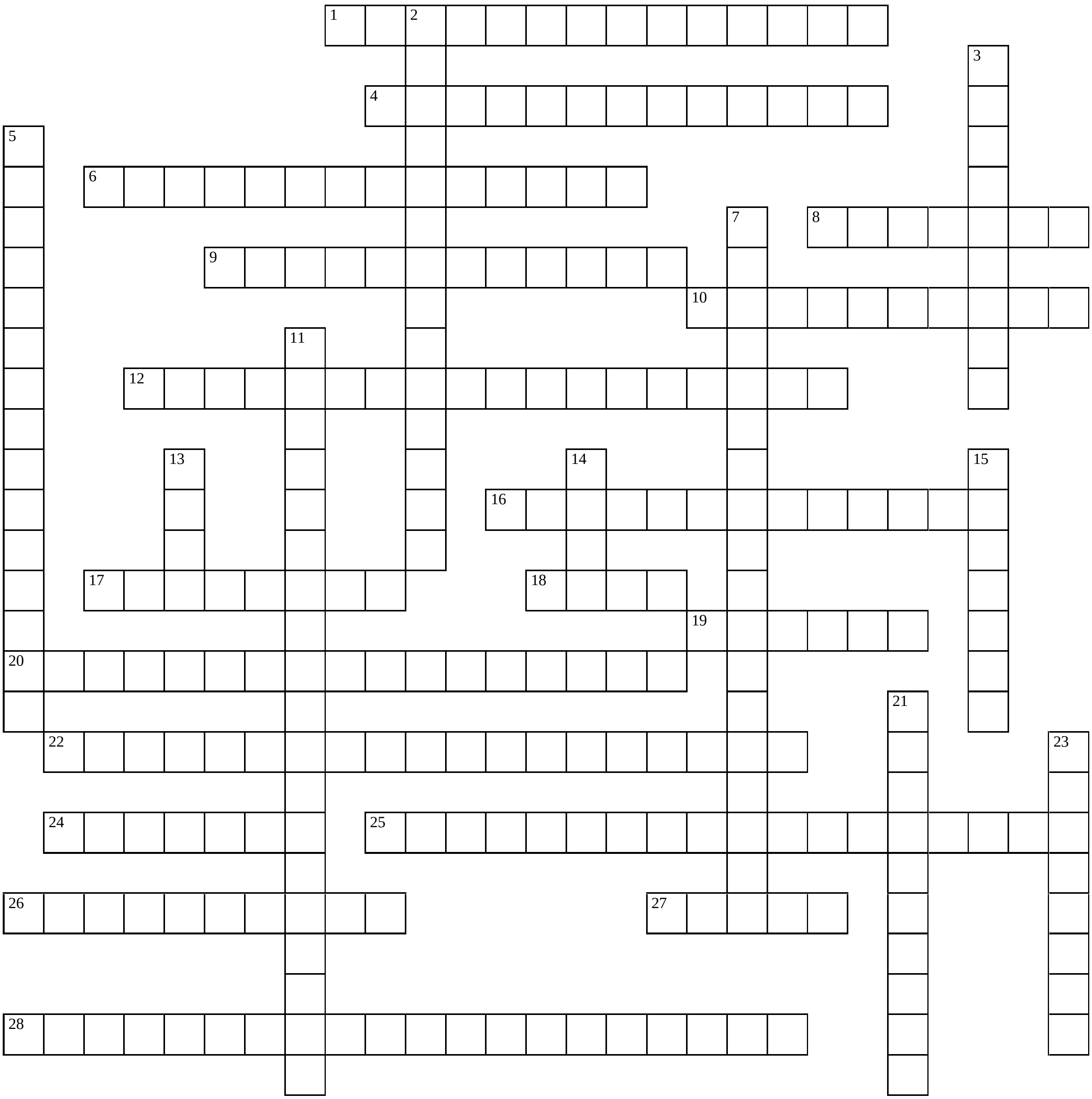
1.

2.

3.

Unit Five Review

Place the answers to the following clues in the boxes below. Each box should contain one letter.



ACROSS

1 A volcano that has not erupted in recorded history
4 A volcano that erupts all the time
6 A volcano that has erupted a long time ago
8 Any place on a planet where something from the inside of the planet is moving through its crust
9 The energy that spreads through the Earth's crust during an earthquake
10 A natural method that breaks apart large rocks into smaller rocks
12 Takes place when weather causes rocks to be worn down, cracked or broken
16 Scientists who study earthquakes
17 Large sheets of ice that slowly slide down a mountain, causing large amounts of erosion
18 An opening at the end of a pipe that allows magma to reach the surface of the Earth
19 Huge cracks in the Earth's crust
20 Forces like weathering and erosion which break things down
22 Places on the Earth where tectonic plates slide past each other
24 The moving of rocks and soil to another place
25 Forces like deposition that act to build new land forms
26 A vibration that moves through the Earth's crust
27 Molten rock
28 Areas where two tectonic plates are crashing together

DOWN

2 Large pieces of the Earth's crust that fit together like a jigsaw puzzle and float on top of our mantle
3 A shaking motion
5 Layers of hardened lava from underwater volcanoes that are sticking out of the ocean
7 Takes place when acids cause small parts of rock to dissolve
11 Areas where two tectonic plates begin to move away from each other
13 Magma that has reached the Earth's surface
14 The path that magma takes from the mantle through the crust
15 Very large and fast waves in the ocean caused by underwater earthquakes
21 Deposits of soil, sand and rocks that have been dropped off by moving water
23 Melt away

CHAPTER 21

In the last unit, you learned how large processes can change the face of the Earth. These processes include:

The movement of tectonic plates to form volcanoes

and

Weathering and erosion of the land

These things do much more than change the face of the Earth. They affect everything in our lives! This is because...

...everything in our lives is either grown or mined!

Think about it. all of the plants and animals we eat are grown. And many of the clothes we wear come from plants (like cotton) or animals (like wool from sheep)!

But where do all of the metals, glass and chemicals come from?

Everything we use in our life that is not grown is taken out of the Earth! But in order to get some of these resources from the Earth, we have to dig for them! This is what it means when resources are **mined** out of the Earth.

If you think that everything we use in our life comes from the grocery store or Wal-mart, you are very wrong! All things come from the Earth. This means our toothpaste, pop cans, light bulbs and even the electricity we use to make the light bulbs work. All of these things come from resources that are mined from the Earth!

Okay! What are these resources you are talking about?!

Nearly every non-living thing that you use in your life comes from two things in the Earth:

Rocks and Minerals

In fact, the core, mantle and crust of the Earth are made up of rocks and minerals. Most of the crust is covered by water, soil and ice. However, if you dig deep enough, you will always find a layer of solid rock. This layer of solid rock is known as **bedrock**.

You probably have seen rocks all over the place! The concrete you walk on is made of rocks, so are the bricks that are used to build buildings. Entire mountains are made of rocks!

So what is a rock made of? Good question!

A **rock** is a mixture of two or more **minerals**. A **mineral** is a solid that is made up of a group of the same atoms or molecules.

(Remember from chapter 12 that a molecule is a group of very small building blocks called atoms that make up everything in the universe!)

This means that if you had a large chunk of mineral sitting in front of you, and you break it in half, both halves would have the same kinds of atoms or molecules in them!

But if you split a rock in half you may get all kinds of minerals in both of the halves!

Think of it this way....

A rock is like a chocolate chip cookie. The chocolate chips, and butter and sugar that you use to make the cookie are the minerals. You cannot make a rock without a group of minerals! But you can make a mineral without any rocks!

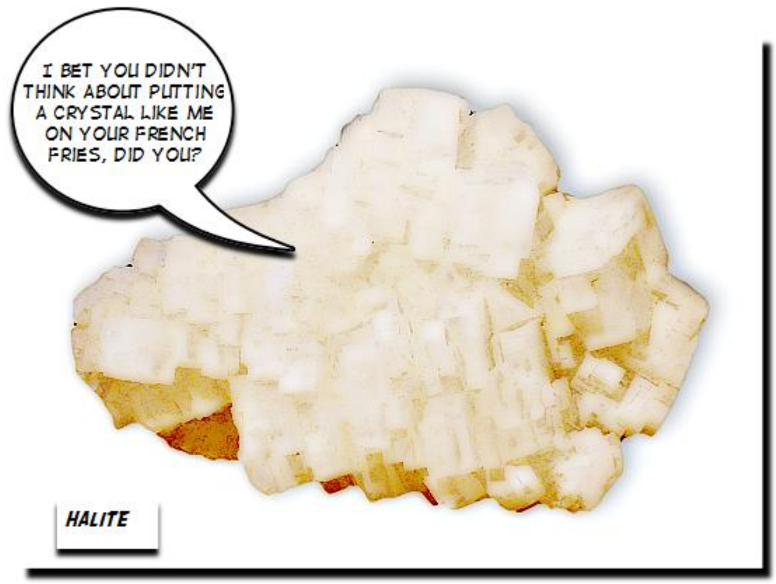
There are many different ways that minerals can be created.

Minerals can be formed:

- when lava erupts out of a volcano and cools;
- when water evaporates and it leaves everything (including minerals) behind; and,
- deep inside the Earth's crust with a lot of heat and pressure

If a mineral is given plenty of room and time to grow, it will begin to look very much like crystals. A **crystal** is a solid material that has all of its molecules lined up, in a pattern. Sometimes, minerals grow in areas where there is not a lot of room. When this happens, the molecules of the mineral cannot line up very easily. So, the mineral does not end up looking like a crystal.

There are about 3,000 different minerals in the world. A few of them can be formed into a crystal shape much faster than the others. Salt is one of these minerals. The mineral name for salt is **halite** ("hal-ite"). With a little salt and water, you can make salt (halite) crystals in just a few days!



Every mineral has its own properties that make it one of a kind! Let's say you had a large chunk of mineral and you wanted to figure out what it was. To do this, you would need to be a student of **geology** ("gee-aul-o-gee"; the study the Earth and its rocks and minerals). Here is what you would look for on your mineral:

The crystal's shape	Color
Cleavage	Streak
Fracture	Luster
Hardness	

The **shape of the crystal** can make out the kind of mineral.

When your mineral is broken, the sides that used to be together can look flat and smooth which is known as **cleavage** ("klee-vuh-j") or they can look rough and jagged which is known as **fracture** ("frak-chur".)

To test the **hardness** of your mineral you would see how hard it is to scratch its surface with a metal nail!

It is easy to figure out some minerals by their own **color!**

Some minerals can be used like chalk and rubbed against a white object. The color of the **streak** ("streek") it leaves on the object will show what kind of mineral you have!

The way the surface of the mineral shines, which is known as **luster**, can show you which mineral you are studying.

All of this sounds neat, but I don't see how I use all of these rocks and minerals everyday! Where are they?!

You use all kinds of rocks and minerals every day of your life! In the next chapter, you are going to look at…

…the geology of your home!

Match the words in the first column to the best available answer in the second column

___ mined	1)	process by which natural resources are removed from the Earth
___ streak	2)	top layer of solid rock beneath the soil
___ luster	3)	a mixture of two or more minerals
___ bedrock	4)	a solid that is made up of a group of the same atoms or molecules
___ rock	5)	a solid material that has all of its molecules lined up, in a pattern
___ mineral	6)	the mineral name for salt
___ crystal	7)	the study of the Earth and its rocks and minerals
___ halite	8)	flat and smooth sides of a mineral
___ geology	9)	rough and jagged sides of a mineral
___ cleavage	10)	colored line that remains after a mineral is rubbed against a white object
___ fracture	11)	the ability of a mineral to shine

Compare and Contrast Rocks and Minerals

Compare (things that are the **same** between these two)	Contrast (things that are **different** between these two)

Circle the hidden words from below:

A	H	L	L	O	S	S	L	C	E	K	R	O	M	T	E	R	A	T	K	R	T	R	A	S
E	V	O	D	O	E	R	R	G	T	E	L	M	G	E	C	L	D	E	M	A	E	N	S	K
I	F	Y	R	C	M	N	G	E	K	A	B	C	E	L	H	L	E	C	M	A	L	R	E	S
R	S	S	T	R	M	H	A	A	R	N	C	E	S	U	R	O	A	O	C	A	H	R	D	C
G	S	U	O	S	E	K	A	E	S	O	O	N	D	F	R	O	K	T	A	V	R	R	R	A
L	S	L	E	R	E	T	N	R	U	D	T	G	M	R	C	M	O	C	S	E	L	G	A	A
V	O	C	E	L	K	I	C	O	D	T	H	U	E	N	O	L	M	R	R	Y	G	E	E	R
C	A	I	E	T	M	A	M	S	I	N	E	N	M	S	S	C	E	L	E	G	R	U	R	C
T	H	E	R	R	I	L	C	U	L	I	E	O	O	Y	Y	L	K	A	L	H	Y	C	S	E
I	L	E	E	R	E	E	A	N	A	L	P	S	K	O	L	R	T	L	V	L	L	C	S	O
R	R	A	L	P	T	A	E	T	R	A	B	T	S	A	K	O	E	L	R	A	N	E	E	K
L	S	A	A	N	L	N	S	A	S	N	R	A	Y	H	E	O	L	A	A	S	G	O	S	E
S	G	H	L	U	K	C	K	E	S	A	R	A	T	A	E	R	Y	T	R	O	H	E	A	N
S	S	S	N	N	G	Y	L	R	N	P	D	O	O	R	A	T	T	L	L	A	R	A	L	A
H	L	I	E	O	L	U	U	S	N	R	G	E	E	V	S	T	C	S	L	T	G	E	C	H
R	R	C	E	T	C	R	C	L	T	M	L	E	N	C	U	R	O	I	G	O	A	A	H	N
C	E	E	L	E	L	S	S	S	E	A	U	M	L	I	A	E	T	M	L	G	E	E	E	E
C	L	L	L	R	R	I	T	E	T	R	E	S	T	T	M	E	D	S	S	S	A	S	E	E
O	L	O	S	L	S	S	T	R	S	S	E	S	T	M	G	R	N	Y	E	G	C	O	R	E
N	M	T	U	E	M	U	R	I	E	K	K	T	O	O	E	E	L	V	G	S	G	U	O	E
E	L	U	O	A	E	A	I	S	R	C	E	E	S	S	S	R	A	U	P	O	T	M	O	R
C	Y	E	S	S	T	T	A	E	O	O	C	E	H	U	S	R	S	S	R	C	L	R	R	Y
S	R	C	Y	T	R	R	S	R	E	R	A	T	I	R	L	B	C	N	A	R	A	O	R	E
M	L	U	S	L	S	L	E	S	N	A	I	S	R	L	E	M	O	R	M	G	N	C	E	R
F	L	E	A	D	O	A	M	M	L	U	T	C	S	O	D	L	F	E	D	T	E	O	D	G

mined	**bedrock**	**rock**	**mineral**
crystal	**halite**	**geology**	**cleavage**
fracture	**streak**	**luster**	**hardness**
color	**shape**	**atoms**	**molecules**

CHAPTER 22

In the last chapter, you learned about the difference between rocks and minerals. This week, you are going to see where these materials are found in your life. You could look anywhere to see rocks and minerals. This week, you are going to explore…

…the geology of your home!

FOR SALE:
SMALL AMOUNT OF WORK NEEDED FOR THIS BEAUTIFUL HOME. CHEAP OFFERS WELCOME! SOLD AS IS!

That's right! This week, you are going to study the rocks and minerals that you can find in your home!

Let's start by looking at the outside of your home. I know that everyone's home is different, but there are some things that are the same.

For example, I would guess that everyone has a door to their home, right?! That door is not just leaning against your home, is it? I don't think so. Your door is probably attached to your home with metal nails or screws that have been made out of **iron**, **lead** or **zinc**. All of these materials are minerals!

As you walk inside your home you remember that it is time to make some lunch! So, you head into the kitchen.

It sure is dark in the kitchen. you better turn on some lights! As you turn on the switch, the light bulbs in your kitchen begin to glow! You can thank the minerals of **copper**, **beryllium** ("bur-ill-e-um") and **tungsten** ("tung-stin") for all of this light! The switch you turned on is connected to wires made out of copper! These wires are connected to your light bulbs to give them the energy they need to glow! And, if you have every looked inside a light bulb before, you probably saw little pieces of metal inside them! These small pieces of metal are what make your light bulb glow and are made up of either beryllium or tungsten!

Now that you can see what you are doing, let's start to make a sandwich. **Oh no! All of the dishes are dirty! They need to be washed!**

You had better get the soap and turn on the water! The soap is a mixture of all kinds of minerals! You can find **silica** ("cil-ih-kah") or **titanium** ("tie-tane-e-um") in almost every soap!

These minerals are used to help scrape food and dirt off of our plates, hands and even our teeth! That's right, silica and titanium can be found inside your toothpaste too!

As you turn the handle on the water faucet and start to wash your forks and spoons, you are using the mineral **chromium** ("kro-me-um"). Chromium is a mineral you can find in most shiny metal objects on our cars, bicycles, kitchens. this includes kitchen faucets and inside your forks and spoons! In fact, why do you think your forks, knives and spoons are called "silverware"? It is because the most expensive forks, knives and spoons are made out of the mineral called **silver**!

Okay! The dishes are washed and it's time to find the last piece of pizza in the refrigerator! You move the milk jug out of the way and the bottle of ketchup and there it is! The last piece of pizza wrapped up in a shiny metal foil made from **aluminum** ("a-loom-eh-num")! That's right! Aluminum is another mineral!

Mmmm! That pizza takes good! But not as good as dinner tasted last night! Last night you ate steak, potatoes and a big salad! You may remember that you put a little salt on your baked potato to make it taste a little better, right?

What you may not know is. you just ate all kinds of minerals in your dinner last night!

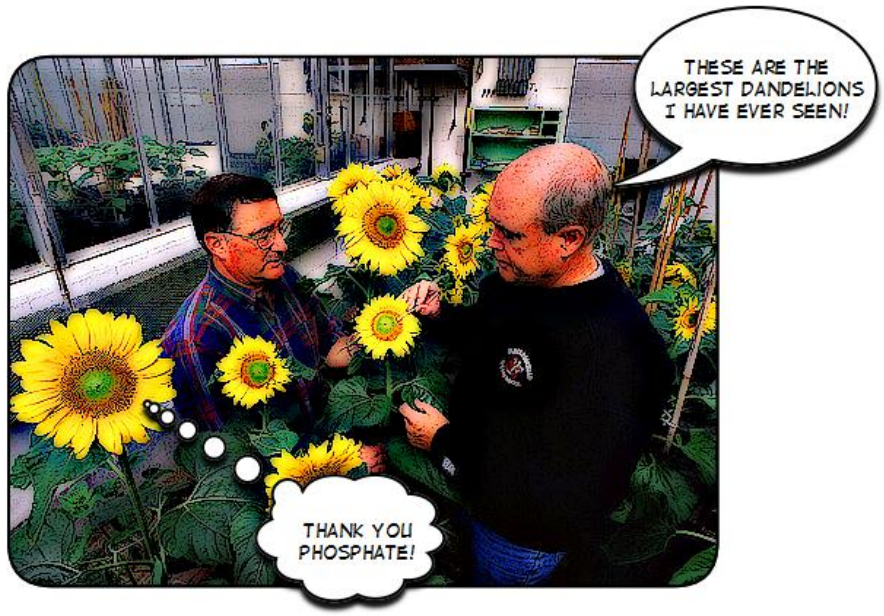
Don't panic!!

For example, the steak you ate is a good source of **iron** and **zinc** ("zing-k"). Both of these are minerals your body uses every day! Zinc is used by your immune system to help you stay healthy. Iron is used by your blood to carry oxygen all over your body!

If you remember from earlier in this chapter, zinc is a mineral that is used to make nails and screws. There are many minerals that have more than one use! In fact, there are so many of them, we would not have time to list them all here! Okay… back to last night's dinner.

Your baked potato and salad are good sources for the minerals **calcium** ("kal-see-um") and **potassium** ("po-tass-e-um"). The potassium in your potato helps keep your muscles strong and the calcium in the salad helps to build strong bones in your body! In fact, the cold glass of milk you had with your dinner was a huge source of calcium for your body!

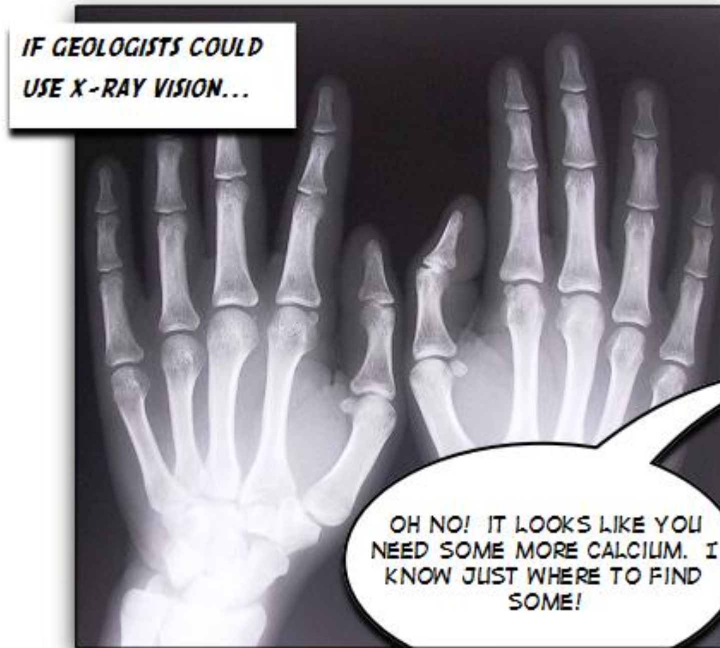
You learned from the last chapter that Even the small amount of salt you put on your food comes from the mineral **halite.** Just be certain not to eat too much of this mineral! That is not good for you!



And you can thank the mineral **phosphate** ("foz-fate") for helping to grow your potato and the vegetables in your salad! Phosphate is an important nutrient that plants use to grow! These are just a few of the minerals that you use every day! Remember…

…everything in our lives is either grown or mined!

We use each of the 3,000 minerals that can be mined from the Earth! Finding these minerals is not very easy! This is because most minerals are found inside of rocks within the Earth!



Unfortunately, geologists do not have super powers. They cannot look through a mountain to see what minerals exist inside the rock! It takes a lot of time to find an area where a geologist thinks they can find a lot of minerals. Many times their guesses are wrong!

But when a geologist is correct, a large source of minerals can be found inside the rocks they are studying. This is when a company must mine the rock out of the ground.

Once this rock is taken out of the ground, it must be **processed**. This means that the minerals are taken out of the rock. This can be done many different ways. Most of the time, the processing of rocks begins with them being crushed and ground into smaller pieces! This makes it easier to separate the minerals inside the rock!

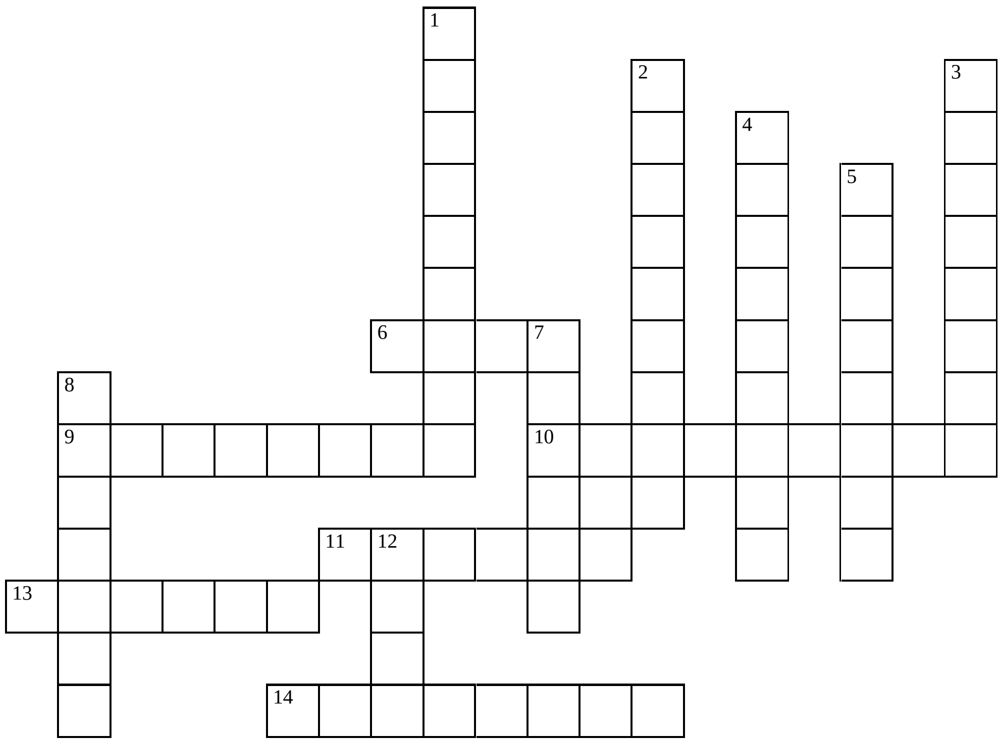
After a mineral is processed out of the rock, it can be used to make silverware, or salt, or screws, or salads!

So far, you have only explored a few of the minerals that are used every day. In the next chapter, you are going to dig deep into the Earth to see how these minerals get stuck together to make up rocks!

Fill in the blanks with the correct letters. The words in the list on the right provide a clue to the answer

1)	_rocess_ed	method of taking minerals out of a rock
2)	co_per	mineral that can be used in wires
3)	_eryllium_	mineral that can be used within a lightbulb to help make it glow
4)	-ung_ten	mineral that can be used within a lightbulb to help make it glow
5)	si_ic_	mineral that can be used in soap and toothpaste
6)	ti_a_ium	mineral that can be used in soap and toothpaste
7)	_hromiu_	a mineral you can find in most shiny metal objects
8)	s_l_er	mineral that can be used in expensive forks, knives and spoons
9)	alu_i_um	mineral that can be used to make foil
10)	_ron	a mineral used by your blood to carry oxygen all over your body
11)	_inc	a mineral used by your immune system to help you stay healthy
12)	ca_cium	a mineral that helps to build strong bones in your body
13)	po_as_ium	a mineral that helps keep your muscles strong
14)	_hospha_e	an important mineral that plants use to grow!

Place the answers to the following clues in the boxes below. Each box should contain one letter.



ACROSS

6 A mineral used by your immune system to help you stay healthy
9 Mineral that can be used to make foil
10 A mineral that helps keep your muscles strong
11 Mineral that can be used in expensive forks, knives and spoons
13 Mineral that can be used in soap and toothpaste
14 Mineral that can be used within a lightbulb to help make it glow

DOWN

1 Mineral that can be used within a lightbulb to help make it glow
2 An important mineral that plants use to grow!
3 A mineral you can find in most shiny metal objects
4 Method of taking minerals out of a rock
5 Mineral that can be used in soap and toothpaste
7 Mineral that can be used in wires
8 A mineral that helps to build strong bones in your body
12 A mineral used by your blood to carry oxygen all over your body

Circle the hidden words from below:

P M I M N Y A E C I A I S S N I E A I E U S P B U
N T E C O L U N C M U R O C U R L E M E C I E L C
T P N M C E P I M L C L L P M U L R I A U R I I I
G R S N R P R N E U M E S R M U N M L N Y R R T V
S U I I C T T H U E I O E I L O I C L L Z O E A A
I Z S R P I U S S C I M N E R P I S L U N L Y P V
T N I D P C E P C N I U O E I U O I S O O U U R I
O U T I H L H R N M M R T R M D U L P A S E G C T
E T T M I E A O I S O M E U H M M N I E T T S S L
E N C P I C I R S M S O I V R C U O B N H O A M R
P A P P A E C A A M S T C I L M T I S S U V P B M
R I I L U O L R I P E I S U E I U C L U T T N E M
N T L I I R I S A V M A V I C T S I N V O L Z M I
N S U T C T S M S U P M H T S H A L N U S E M M T
O M C N E I D T S G H U L O E R N H S A U N E C C
N O L C G P S E D P P U V R E N L E P E T E I E U
R E O N L S T O S O N O O P N E P P C S E I R A S
P M T M I A T P N S L S P T C E N L U R O N T N M
E C N L U L U E P E E O I T U U L M I I M H U E M
B N P S S I C T N H C C S T A P N R E Y M U P R O
I N S S E S C U U T E N O C N L Y T C I S R T A L
L N E M R R I O E R O E I R O O I G L U P N R M S
B C C E O E M E S C U L U U P C E N T R S I I S E
I E U S C P I S O R I O M S L Y I C E P H I I T M
N U S S B C V I A S D U H M H B P T I N P Z L E H

processed	**copper**	**beryllium**	**tungsten**
silica	**titanium**	**chromium**	**silver**
aluminum	**iron**	**zinc**	**calcium**
potassium	**phosphate**		

CHAPTER 23

You know that a rock is a mixture of two or more minerals.

You know that everything we use in our lives is either grown or mined.

You know that minerals are found in our food, our homes and our bodies.

And you know that most minerals are found inside of rocks within the Earth!

But if you want to learn about how these minerals are grown, you have to study how rocks are formed! That is what you are going to explore this week!

There are three different kinds of rock:

Igneous
Metamorphic
and **Sedimentary**

Each of these kinds of rocks are named for the way in which they are made!

Igneous rock ("ig-nee-us") is formed when molten rock (magma) is cooled and hardened. This can take place in two different ways:

Magma can cool down while it is moving inside the Earth's mantle.

or

As magma passes through the Earth's crust and becomes lava, it can cool very quickly and harden into rock.

In any case, when melted rock cools and hardens, a mixture of minerals hardens together to make igneous rock !

Geologists have placed many different kinds of igneous rocks into groups. A rock that is made up of the minerals quartz, feldspar and mica is called **granite** ("gran-it"). Most mountains in the world are made up of granite which is a very hard rock!

Not all rocks are very hard! Sometimes when lava erupts out of a volcano, this melted rock can be filled with pockets of gas. When this lava cools and hardens, the air pockets stay inside the rock just like a loaf of bread! This kind of rock is called **pumice** ("pum-iss") and it is the only rock that can float on top of of water!

Sedimentary rock ("said-eh-men-tary") is formed in a much different way than igneous rock. This kind of rock is formed from weathering, erosion and deposition of the Earth's crust. If you remember from an earlier unit:

Weathering is a natural method that breaks apart large rocks into smaller rocks! The movement of these smaller pieces (erosion) can be dropped off at different places (deposition).

As water erodes the Earth's crust, it carries tiny rocks and mud (also known as **sediments**) to areas where they settle down and sink to the bottom. As deposition continues, layers of sediments begin to grow - one on top of each other!

Over time, the layers of sand and mud at the bottom of the water are turned into sedimentary rocks.

But how does this happen?

Think of each layer of sediments as a page in a telephone book. One single page is not very heavy, is it? **No!** But several telephone books stacked on top of you would start to get very heavy! You could get squished very easily!

This is what happens with layers of sediment. All of the layers stacked on top of each other are so heavy they easily squash the bottom layers together into the form of a rock!

A type of sedimentary rock that is found all over the world is called limestone! Limestone is used for many different things because of the way its atoms are stuck together. Some of these include the making of concrete, toothpaste, soap, paper, clay, glass, paint and thousands of other things we use every day!

In fact, there is probably a few tons of limestone surrounding you right now! It is in your walls, and floor and sidewalks and driveways! You use a lot of limestone in your everyday life!

The third type of rock you are going to explore, **metamorphic rock** ("met-a-morf-ick"), has a special relationship with the other two kinds of rocks you have explored.

Metamorphic rocks come from igneous and sedimentary rocks !

In order to change a rock, you need a lot of energy. This energy is found inside the Earth! Sometimes, the huge amount of heat and pressure inside the Earth can change igneous and sedimentary rocks a great deal! These rocks can be baked, squeezed and folded many times.

When this happens, the sedimentary or igneous rocks can go through a **metamorphosis** ("met-a-morf-o-sis"; which means, "a change") into a different kind of rock.

There are not as many metamorphic rocks in the Earth as there are sedimentary or igneous. However, many metamorphic rocks are found near areas where the edges of tectonic plates meet. In these places, the movement of the Earth's plates causes the huge pressure needed to create a metamorphic rock!

When limestone is changed in this way, it forms a kind of metamorphic rock called **marble**. Marble is used to create beautiful buildings and statues. Some of the tiles that you may have in your bathrooms or kitchens may be made of marble too!

Some metamorphic rocks can also be changed into different metamorphic rocks with enough pressure. For example… a sedimentary rock, called **shale**, can be squeezed into a metamorphic rock called **slate!** Squeezing slate will make another metamorphic rock called **phylite** ("fi-light"). Squeezing phylite can make **schist** (That's right! another metamorphic rock!) And squeezing schist can make another metamorphic rock called **gneiss** ("neese")!

It may sound like all of these rocks are constantly changing forms because they are!

And in the next chapter, you are going to explore how this works!

Match the words in the first column to the best available answer in the second column.

___	igneous rock	1)	a type of rock that is formed when molten rock is cooled and hardened
___	shale	2)	a type of igneous rock that is made up of the minerals quartz, feldspar and mica
___	slate	3)	an igneous rock that can float on top of a container of water
___	phylite	4)	a type of rock that is formed from the weathering, erosion and deposition of the Earth's crust
___	schist	5)	tiny rocks, mud and sand that is eroded from the Earth's crust; used to form sedimentary rocks
___	gneiss	6)	a type of sedimentary rock used for making concrete, toothpaste and thousands of other items
___	granite	7)	type of rock that is formed from heat and pressure within the Earth
___	pumice	8)	a change
___	sedimentary rock	9)	a type of metamorphic rock formed from limestone

___ sediments	10)	a type of sedimentary rock that can be turned into slate (a metamorphic rock) under a lot of heat and pressure
___ limestone	11)	a type of metamorphic rock formed from shale that can be turned into phylite (a metamorphic rock) under a lot of heat and pressure
___ metamorphic rock	12)	a type of metamorphic rock that can be turned into schist (a metamorphic rock) under a lot of heat and pressure
___ metamorphosis	13)	a type of metamorphc rock that can be turned into gneiss (a metamorphic rock) under a lot of heat and pressure
___ marble	14)	a type of metamorphic rock that is formed from schist

Which one is right? Circle the correct answer.

1. Which type of rock needs both heat and pressure to be formed?
   a) sedimentary
   b) igneous
   c) metamorphic

2. Which type of rock does not need heat or pressure to be formed?
   a) sedimentary
   b) igneous
   c) metamorphic

3. Which of the following rocks is not a metamorphic rock?
   a) schist
   b) shale
   c) slate

4. Which of the following rocks can be made from limestone?
   a) marble
   b) granite
   c) schist

5. Metamorphic rocks are formed from.
   a) only igneous rocks
   b) only other metamorphic rocks
   c) igneous, sedimentary and other metamorphic rocks

Place the following in the order of their metamorphosis:

shale	**schist**
gneiss	**slate**
phylite	

1) ______________________________

2) ______________________________

3) ______________________________

4) ______________________________

5) ______________________________

CHAPTER 24

In this unit, you have explored...

Different kinds rocks and minerals

How they are used in your life

and

How they control volcanoes, earthquakes and the creation of mountains

But does the Earth ever run out of rocks and minerals?

No way !

It is true that the Earth has a changing face, but this is because:

The Earth is always recycling its rocks and minerals!

Remember... the Earth is always changing. Right now, volcanoes are erupting, earthquakes are shaking the ground, rivers are eroding the land, and mountains are not only being formed. They are also being worn down!

All of this activity is used to recycle the rocks and minerals on our planet. The recycling of rocks (and the minerals inside them) is called the **rock cycle**!

The **rock cycle** shows us how rocks are recycled on the Earth. In this cycle...

1) Igneous rock can change into sedimentary rock or into metamorphic rock
2) Sedimentary rock can change into metamorphic rock or into igneous rock
3) Metamorphic rock can change into igneous or sedimentary rock

Let's look at #1 first...

How can igneous rock change into sedimentary or metamorphic rock?

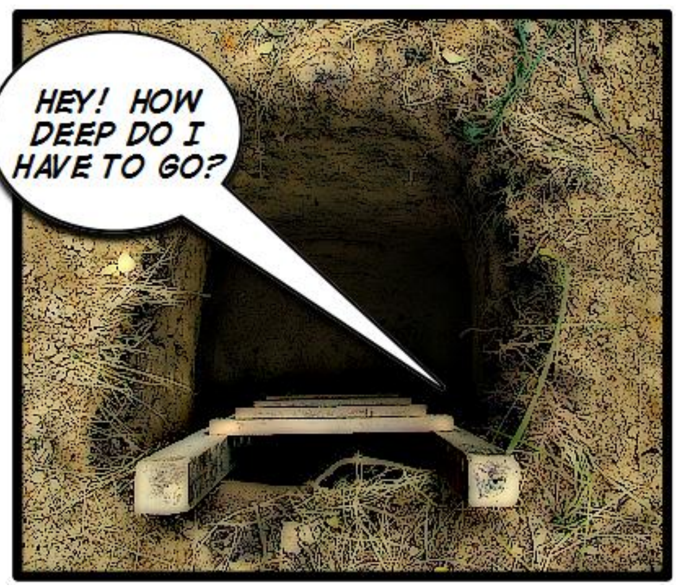
When melted rock cools, it hardens into a mixture of minerals which makes igneous rock. When igneous rock is on the surface of the Earth, it can be broken into smaller pieces by weathering.

As these pieces get smaller and smaller, it becomes easier for them to be carried away by moving water and wind. If you remember, these small pieces of rock are known as sediments and they can be carried away through erosion.

As nature erodes the small pieces of igneous rocks, it deposits them in layers on the surface of the Earth. Over time, the layers of these sediments at the bottom of the water are turned into sedimentary rocks.

But... sometimes, igneous rocks do not reach the surface of the Earth!

Igneous rock can be formed deep inside the Earth where a huge amount of heat and pressure can bake, squeeze and fold this rock. When this happens, the igneous rock can be changed into a metamorphic rock.



Does this sound familiar? It should! You learned this in the last chapter!

Okay! Now let's look at #2...

How can sedimentary rock change into metamorphic or igneous rock?

You have already learned that sedimentary rock can be changed into metamorphic rock. This can happen the same way an igneous rock can be changed into a metamorphic rock.

As the layers of sediments are pressed deeper into the Earth, they can be baked, squeezed and folded into metamorphic rock!

But how can a sedimentary rock be changed into an igneous rock?

In order for this change to take place, the sedimentary rock must be melted inside the Earth. When this happens, magma can be squeezed into a metamorphic rock or it can cool and harden into igneous rock!

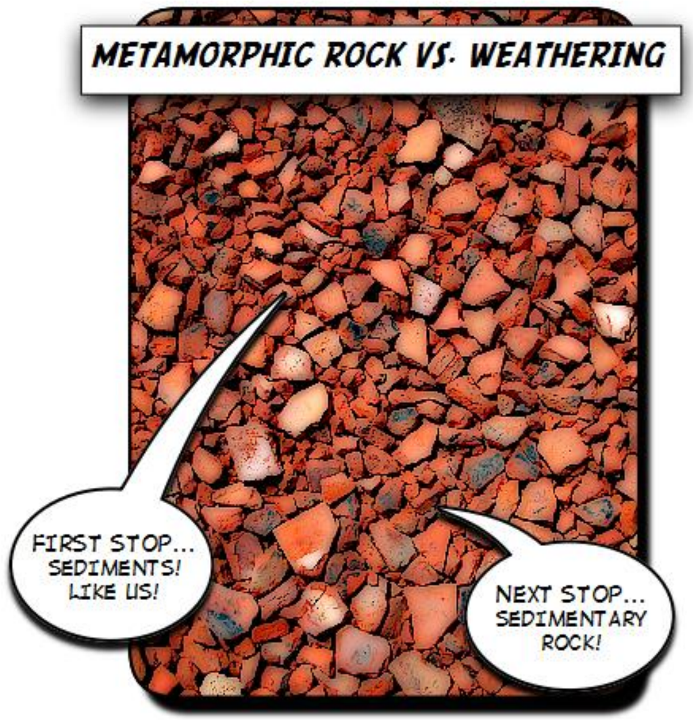
(Remember that rock is nothing more than a mixture of at least two different minerals. Once this rock is melted, it can mix with other melted minerals inside the mantle!)

Now let's take a look at #3...

How can metamorphic rock change into igneous or sedimentary rock?

If a metamorphic rock stays buried inside the Earth, it can be melted once again into magma. If magma mixes with the right minerals and cools, it can harden into an igneous rock!

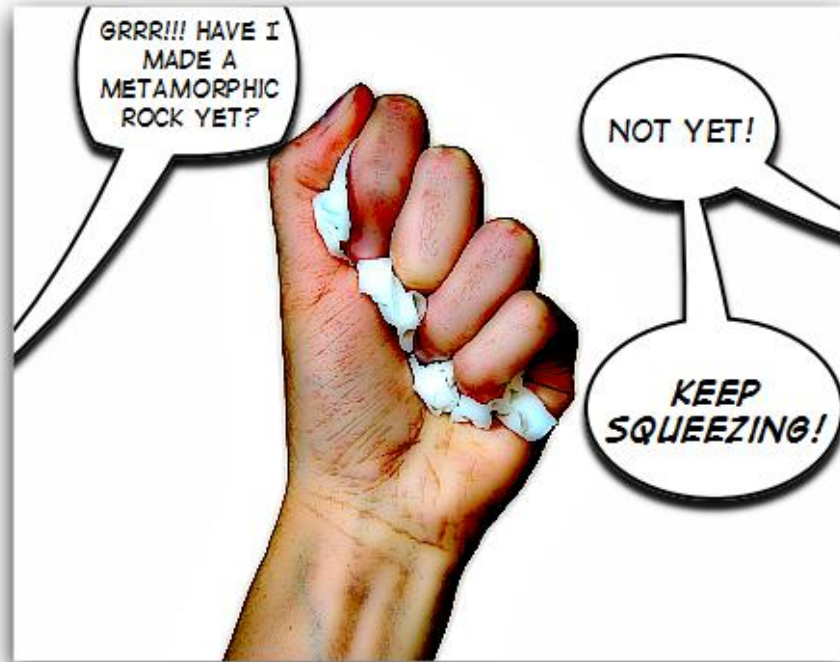
But...



If a metamorphic rock is pushed up through the crust, weathering and erosion can go to work! A metamorphic rock can be broken down into sediments by nature, carried away by erosion and deposited into layers. After a long period of time, these layers of sediments can harden into sedimentary rock.

It should be clear that...

The rock cycle never stops and it takes a very long time!



The recycling of rocks does not always end with the creation of igneous, metamorphic or sedimentary rocks.

As these rocks are broken down into sediments, another very important object on our planet is formed...

Soil

In the next unit, you are going to "dig" into this helpful resource!

The Rock Cycle shows us how rocks are recycled on the Earth. Describe how the following changes can be made:

1) Igneous rock changing into sedimentary rock

____

____

____

____

____

____

____

2) Sedimentary rock changing into metamorphic rock

3) Metamorphic rock changing into igneous rock

Unit Six Review

Fill in the blanks with the correct letters. The words in the list on the right provide a clue to the answer.

1) mi_ed	process by which rocks and minerals are removed from the Earth
2) _edroc_	top layer of solid rock beneath the soil
3) roc_	a mixture of two or more minerals
4) m_ner_l	a solid that is made up of a group of the same atoms or molecules
5) crys_al	a solid material that has all of its molecules lined up, in a pattern
6) _eol_gy	the study of the Earth and its rocks and minerals
7) _leav_ge	flat and smooth sides of a mineral
8) f_a_ture	rough and jagged sides of a mineral
9) s_rea_	colored line that remains after a mineral is rubbed against a white object
10) lu_t_r	the ability of a mineral to shine
11) _g_eous ro_k	a type of rock that is formed when molten rock (magma) is cooled and hardened
12) se_ime_tary roc_	a type of rock that is formed from the weathering, erosion and deposition of the Earth's crust
13) se_ime_ts	tiny rocks, mud and sand that is eroded from the Earth's crust; used to form sedimentary rocks
14) _etamo_phic rock	type of rock that is formed from heat and pressure within the Earth
15) p_oc_ssed	method of taking minerals out of a rock
16) r_ck cy_le	The recycling of rocks (and the minerals inside them)

CHAPTER 25

How often have you thanked soil for helping you out? I doubt you ever have!

Think about it - we are always forgetting about soil (unless you are trying to wash it off of your body or your clothes!)

Now we are not talking about dirt here. Dirt is what you find under your fingernails after a long day of playing or working. What we are going to explore this week is the "stuff" you find under your feet...

Soil

Soil is vital to all life on Earth! It provides nutrients to plants which keeps all of us alive!

There are thousands of different kinds of soil in the world. But each of them contains a mixture of:

Minerals

and

Biotic resources

You learned about minerals in the last unit. As minerals are broken down (by weathering), they can be moved to another location (by erosion) until they come to rest at a different location (deposition).

But we would not have any soil if we did not have living organisms **(biotic resources)** on our planet! As living organisms die, they are broken down into smaller pieces too. This is because of many organisms that live in the soil which are called **decomposers**. You will be exploring these wonderful creatures in another chapter.

But now... back to soil!

There are five factors that work together to make our soil:

Parent material

Climate

Organisms

Topography ("toe-pog-gra-fee")

Time

Parent material

Soil may not have a mom or a dad, but it does have **parent material.** Parent material is the original layer of bedrock in an area. Over large amounts of time, this bedrock goes through weathering and erosion. This weathering provides most of the minerals that are found within the layers of sediment that form on top of itself.

Since soil is a mixture of minerals and biotic material, and there are thousands of different minerals in the Earth...

...there are many different kinds of soil around our planet!

Climate

Some of these soils are made in different ways because of the **climate** of the area. If you remember, climate is the normal weather for an area over a long period of time. Weathering and erosion is different all over the Earth.

For example, wind causes most of the erosion that takes place in deserts. However, water moves more sediment in areas like grasslands or forests!

When parent material goes through weathering and erosion it affects the kind of soil in that area! This means the different seasons, changes in temperature every day and the amount of rain and snow all affect the kind of soil you can find in an area!

Organisms

Living organisms also affect the kinds of soil in an area. Some organisms mix soil together as they dig holes in the soil. Leaves from trees fall to the ground where decomposers mix the dead biotic material with the soil. The roots of plants move soil around too! Even small plants, like grass, move a huge amount of soil!

Since there are many different climates all over the Earth, you find different living organisms in each area! As these living organisms die, they are broken down (decomposed) into the soil.

Humans change the soil too! Every time you dig into the ground you are changing the soil in that area!

Topography

Topography means "the shape of the land". As you know, the Earth is not flat! There are many hills and mountains on our planet. The shape of the land affects the kinds of soil you find in these areas.

For example, let's look at the soil on the side of a mountain. As soil is being formed on the side of a mountain, it has a greater chance of being moved around by erosion! Everything tends to roll downhill, doesn't it?! Well, this happens to soil too! Moving water erodes the sides of mountains very quickly. This means that the soil on the sides of mountains is very thin.

But at the bottom of the mountain, you should find much deeper soil. This is because the layers of soil and sediments are eroded downhill and are deposited in the valley below!

Time

Why does it takes a great deal of time for soil to form? Well...

- ...the weathering of parent material does not happen very fast;
- ...the climates of areas can change over long periods of time; and,
- ...the organisms living in an area are determined by the changes in its topography and climate!

It may seem like there is a lot of soil on the Earth, but this is not true. Most good soil that farmers use to grow plants is only about a foot or so deep! And it is always changing...

...just like the face of the Earth!

Over time, soils can become buried under water, volcanic ash, lava and many other things! If a flood takes place in an area, it can deposit huge amounts of sediments on top of the soil. When this happens, the process of creating soil has to begin all over again! This is because the previous soil in that area has been either washed away or buried under new sediments!

To make soil easier to study, scientists place different kinds of soil into groups. In the next chapter, you are going to explore what these groups are and how scientists study this "living skin" around our planet.

Match the words in the first column to the best available answer in the second column

___ biotic resources	1)	a mixture of minerals and biotic material found on the outside of our crust which is responsible for all plants to grow
___ decomposers	2)	living or dead organisms
___ parent material	3)	organisms that break down dead organisms into smaller pieces
___ soil	4)	Original layer of bedrock in an area; responsible for providing most of the minerals within the soil
___ topography	5)	the shape of the land

Circle the hidden words from below:

E R I O I L B E O C O M D R A P R R E A S A I E I
P L Y O G C E O C T R E S L E I S I A S A T L E C
C A A S T S M Y N S T O R M I L U S S R M R T H C
I A R T I O A I I N E A I L E O S E A R P I I A O
M A T E M O A I O T C S A C R P T E C O C S P G M
I R E O N E M A L P E A E G T C T I O D B O E H T
E O I Y L T T T R T C N A I S T E M M R T I I E I
R I A D S A M T O N M N O R R L P A R E T U C R C
E S S S A M M A E I I A L O P T T A R R S I M O P
P T L M T O S C T S I P P R A A N E M D C P A G M
M S A T I T A I M E P S I I T E R S E M D M M L E
I I E S N L O S O B R S I O L M E C U I M N D M R
O R E C O T A I H N M I C L L P O C C M L T P C O
R T T E R E I O L I E C A M T M I R T I E P I A R
E N T O E U M A I T R T L L P I T E M O O I O E U
M T R A P O O A A R A S A O N E E E M R O R T L I
P S R M M O T S R E E P S M M S M E O E E R T M N
D Y E M L M G G E I T E E T N H O E H T S E P S R
T E S C C L I R S R R A L I S M S C I S O I R T L
A E I U L M E A A S C M M Y E I P L H E A R T E U
B A L S M I R T N P R I A I M E I I H M L P I D L
S H A T R L O E C E H E T S L E T R E R E L E A O
C L I S P P E S T E T Y C O C C E S S M E R R S B
C A E S R H E O O S R L L R I A P T T N C O A P E
A T P L A Y O T T C E E M I S B E P O S R O S E O

soil	**biotic resources**	**decomposers**	**parent material**
topography	**climate**	**time**	**organisms**

How do the following items work together to make soil?

Parent material
Climate
Organisms

Topography
Time

CHAPTER 26

Now that you know how soil can be formed, this week you can begin "digging into" this valuable resource.

There are many different kinds of soil in the world. Some soil is very good for growing plants. Other kinds of soil are used to make buildings and homes! You are going to explore what makes these different soils so important to us in this chapter.

But first...

I need you to imagine taking a shovel and digging straight down in your backyard until you reach bedrock!

Remember, you only need to use your imagination! I think your parents would be a little upset if they found a huge hole in their yard!

Okay! As you start digging your hole, you would start to see different layers in the soil stacked on top of each other. All these layers are known as **soil horizons**. All of the layers of soil horizons in your hole make up the **soil profile** for your area!

Soil profiles are different all over the world. Each soil horizon may be thicker or thinner or not even there at all! The soil horizons that make up soil profiles change with every hole you dig in every part of the planet!

Now, imagine you are looking at the soil profile in your hole. All of the layers of soil are stacked up in front of you. You may be looking at many layers of different kinds of soil. To make it easier for you to study, let's divide all of these soil horizons into two groups:

Topsoil and Subsoil

You can probably guess where you would find **topsoil**, right? You guessed it! The soil horizons on top of your soil profile make up the topsoil in your hole!

Topsoil is where you will find a huge amount of biotic resources. Remember, to be a biotic resource, you must have been alive at some point! So in the topsoil, you will find plants, bacteria and all kinds of animal life – both living and dead!

The "dead stuff" that is found inside topsoil is always decomposing ("broken down") into smaller pieces. Each layer of decomposing organisms make up what is known as **humus**.

Humus is very important to all life inside the topsoil. This is because future plants (and animals) get their nutrients from these decomposed organisms.

Subsoil would make up the soil horizons at the bottom of your hole.

You do not find many nutrients, humus or biotic resources in the subsoil. In fact, much of this area is filled with large pieces of rock. If you dug your hole deep enough, you would run into a solid sheet of bedrock under your feet!

Don't' ever forget that our soil is a mixture of minerals and biotic resources...

Does this mean that our soil is a biotic resource?

You would not say that all of the soil on the Earth is a biotic resource. However, the humus inside the soil **is** a biotic resource!

But what about the weathered rocks and minerals inside our soil?

Scientists study the size of the minerals in different kinds of soil. The size of these minerals makes soil feel different from each other. This is known as **soil texture** ("tecks-ture"). They use these different sizes to place soils into three groups:

Sandy Silty and Clay

The soil that contains the largest pieces of minerals is known as a **sandy** soil. It is named "sandy" because it contains a great deal of sand. In fact, if you have ever taken a look at a pinch of sand before, you probably saw tiny little rocks!

It is very difficult to grow plants in sandy soil. It does not contain many nutrients that a plant can use.

Silty soil is the best for growing plants. This kind of soil contains medium-size pieces of minerals. What is most important about silty soil is that it absorbs water and nutrients very well!

When silty soil is filled with humus, you have an excellent resource for growing plants!

Clay is made up of the smallest pieces of minerals. This kind of soil is not very good for plants at all! Clay is so hard that plant roots cannot move through it very easily! And, if a plant's roots cannot move through the soil, it probably cannot survive!

So what kind of soil do you have in your backyard?

Well, you would probably need a scientist to come out and test your soil to see what is inside your topsoil. But, there is a way that you can find out!

If you can grab a handful of soil from underneath the grass in your yard, you can run a simple experiment...

If you grab and squeeze your handful of dirt and it falls apart very quickly in your hand and crumbles to the ground, you probably have **sandy** soil.

If you grab and squeeze the soil and it crumbles slowly, you probably have a mixture of sand, soil **and** clay in your topsoil.

And, if you squeeze your handful of soil and it sticks together (and leaves an imprint of your fingers on it), it is probably a **clay** soil.

Remember...

The topsoil could not exist if life did not exist on our planet! We need good, healthy soil in order to survive! In the next chapter, you are going to dig even deeper into the topsoil as you explore...

...the living creatures inside the soil!

Match the words in the first column to the best available answer in the second column

___ clay	1)	different layers in the soil which are stacked on top of each other
___ humus	2)	all of the layers in the soil in a particular area
___ sandy	3)	the soil horizons on the top of a soil profile
___ silty	4)	soil horizon directly below the topsoil
___ soil horizon	5)	layer of "dead stuff" that is found inside topsoil which is always decomposing into smaller pieces
___ soil profile	6)	appearance of soil based on the size of the minerals found within it
___ soil texture	7)	type of soil which contains the largest pieces of minerals (sand)
___ subsoil	8)	type of soil which contains medium-sized pieces of minerals
___ topsoil	9)	type of soil which contains the smallest pieces of minerals

Which one is right? Circle the correct answer.

1. Which of the following is true?
   a) soil horizons are made up of soil profiles
   b) soil texture is made up of soil horizons
   c) soil profiles are made up of soil horizons

2. Where would you find the most humus in soil?
   a) topsoil
   b) the soil horizon below the topsoil
   c) subsoil

3. Which is the best soil texture to grow plants?
   a) sandy
   b) silty
   c) clay

4. The soil texture with the largest pieces of minerals is...
   a) sandy
   b) silty
   c) clay

5. Which of the following is true?
   a) subsoil is contains the most nutrients in soil
   b) topsoil contains the most nutrients in soil
   c) clay contains the most nutrients in soil

6. Which is the best mixture to grow plants?
   a) silty soil and humus
   b) sandy soil and humus
   c) sandy and silty soil

After grabbing several handfuls of soil from different areas in my yard I found that each of them acted differently when I squeezed them.

What type of soil do you think I have in each of these places:

Location #1: After squeezing this handful of soil, I left an imprint of my fingers on it. What kind of soil do you think I have in this location?

Location #2: After squeezing a handful of dirt, it fell apart in my hand and fell quickly to the ground. What kind of soil do you think I have in this location?

Location #3: After squeezing this handful of the soil, it crumbled slowly in my hand. What kind of soil do you think I have in this location?

CHAPTER 27

Our weather plays a very important role in breaking down minerals that are found in our soil. Wind, water and temperature changes are very important for the weathering and erosion of minerals!

But these are not the only things that keep our soil full of minerals!

As you learned last week, we would not have any soil if there were no living organisms! So this week we are going to explore...

...the life inside the soil!

Organisms that live inside the soil are always decomposing the "dead stuff" inside the soil. It all starts with the decomposing of dead organisms into smaller pieces which creates a layer of humus in the soil.

Inside the humus, plants find all of the minerals and nutrients they need to survive! So we should thank our tiny friends inside the soil for all their work!

How tiny are these living organisms inside the soil? Well, the most important of these organisms are so small you can't see them without using a microscope. These creatures are known as...

Bacteria

Bacteria may be tiny, but they are the most important organism for our soil! How tiny are bacteria? Well, there can be up to **five billion bacteria in one teaspoon of soil!**

Five billion bacteria need a lot of food in order to survive!

Bacteria are the main decomposers in the soil. They feed on nearly every dead organism in the ground. Bacteria break down all of these organisms into smaller pieces that can be used by plants inside the soil!

Let's take another look at that teaspoon of soil... Inside this soil you may find hundreds of different kinds of bacteria!

Each kind of bacteria can eat different things and get rid of different wastes! This is a very good thing to have inside your soil! With so many different bacteria eating everything in sight...

...your soil will have an excellent layer of humus!

Sometimes, different organisms can work together in order to survive. This is known as **symbiosis** ("sim-by-o-sis").

Bacteria and plants can work together in order to survive! It is a fact that plants need a gas called nitrogen in order to survive. However, plants cannot use the nitrogen that is found inside our air. It has to be changed into a different form. This is where bacteria go to work...

Some bacteria attach themselves to the roots of plants. While they are growing on these roots, bacteria can help the plant by **fixing nitrogen**. When bacteria "fixes nitrogen" they turn the nitrogen gas in the soil into form that the plant can use!

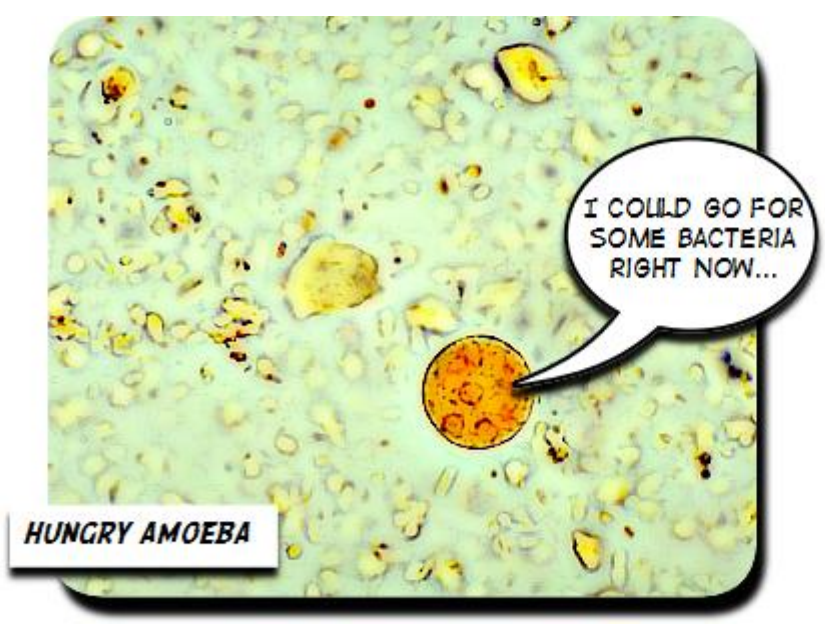
Some bacteria also produce slimy goo as a waste product. This slime helps to stick small pieces of soil to each other! In addition, this slime also helps to hold onto water inside the soil. This is very important for the next organism we are going to explore...

The Amoeba

Amoebas ("ah-me-bah") are much larger than bacteria (you may only find about 5 million of them in a teaspoon of soil), but they have a very important job.

Amoebas are a group of tiny organisms called protozoa ("pro-toe-zoh-uh"). These creatures live inside a thin covering of water around a tiny piece of soil. The slime that some bacteria make is an excellent home for the amoeba!

However, this is not good news for the bacteria! You see, amoeba's eat bacteria all day long! But this is good for the soil! We cannot have too many bacteria inside our soil or they will eat up all of the nutrients!



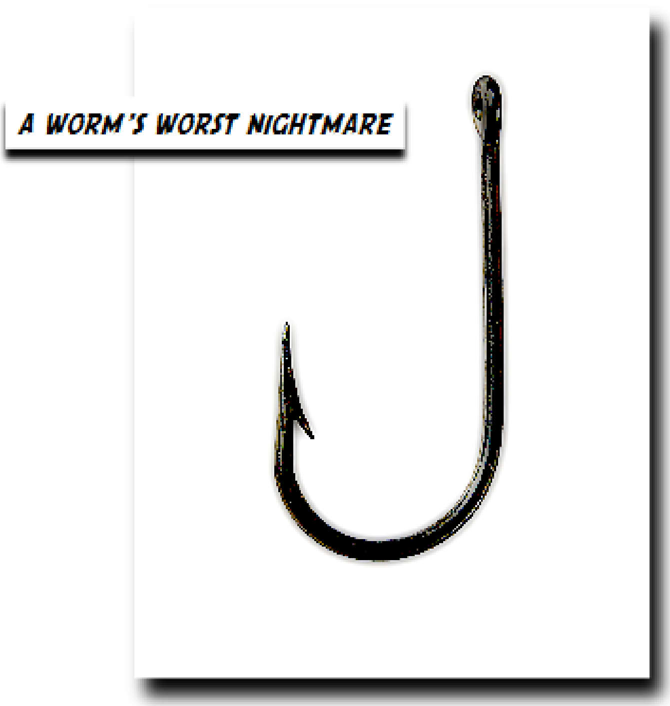
Amoeba cannot use all of the nutrients inside the bacteria they eat. Because of this, much of the wastes they place into the soil are nutrients that can be used by plants! This may be bad for the bacteria, but it is very good news for the plants!

Another organism can be found in the soil that helps to decompose dead organisms...

Fungi

Soil fungi ("fun-guy") get most of their energy from eating dead organisms in the soil. However, some fungi have a symbiotic relationship with plants, just like bacteria!

Some fungi will grow on the sides of plants and feed off of the plant. In return, the fungi bring extra water and nutrients to the plant as it absorbs these resources from the soil! Both organisms work together in order to survive!



Another symbiotic relationship can be found in our next organism...

Earthworms

Earthworms are always digging their way through our topsoil. Much of their energy comes from eating dead organisms in the ground. In fact, earthworms swallow soil as they dig their holes!

This means that earthworms swallow bacteria and amoeba too! This is not always a bad thing for bacteria because the inside of an earthworm is a great place for bacteria to grow!

An earthworm's body is so good at growing bacteria...

Its waste products contain more bacteria than what the Earthworm eats!

With more bacteria in the soil, and with earthworms always eating and mixing our topsoil, the amount of humus in the soil continues to grow!

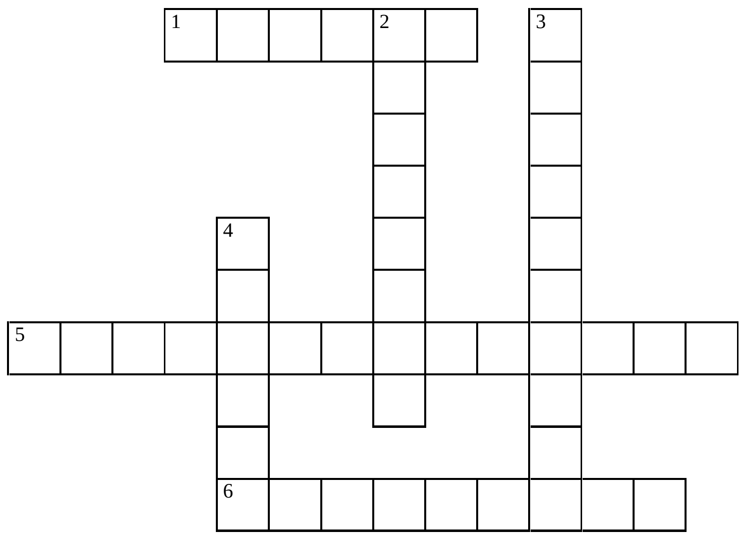
You have only explored a few of the decomposers that live inside our soil. They each may survive in different ways, but they all help to produce soil that is full of broken down minerals. Because of their work, plants and animals are provided the nutrients they need to stay alive!

While these organisms keep our soil alive, it is our job to protect our soil. In the next chapter, you are going to explore how scientists and farmers work to protect this natural resource.

Match the words in the first column to the best available answer in the second column

___ earthworms	1) tiny organisms that can be found within soil; responsible for decomposing biotic material
___ amoeba	2) the ability of different kinds of organisms to work together in order to survive
___ bacteria	3) the ability of a bacteria to turn the nitrogen gas in the soil into form that a plant can use
___ fixing nitrogen	4) organism (called a "protozoa") which lives inside a thin covering of water around a tiny piece of soil and eats bacteria
___ fungus	5) organism in the soil which decomposes biotic material; much larger than bacteria
___ symbiosis	6) organisms which move through the soil by swallowing soil, along with its bacteria and amoeba

Place the answers to the following clues in the boxes below. Each box should contain one letter.



ACROSS

1 Organism (called a "protozoa") which lives inside a thin covering of water around a tiny piece of soil and eats bacteria

5 The ability of bacteria to turn the nitrogen gas in the soil into form that a plant can use

6 The ability of different kinds of organisms to work together in order to survive

DOWN

2 Tiny organisms that can be found within soil; responsible for decomposing biotic material

3 Organisms which move through the soil by swallowing soil, along with its bacteria and amoeba

4 Organism in the soil which decomposes biotic material; much larger than bacteria

Compare and Contrast Bacteria and Fungi

Compare (things that are the **same** between these two)	Contrast (things that are **different** between these two)

CHAPTER 28

You should understand by now how important soil is to all of us! Without soil, there would be no plants. Without plants, there would be no animals (like cows) that eat the grass.

Without plants or cows there would be no hamburgers!

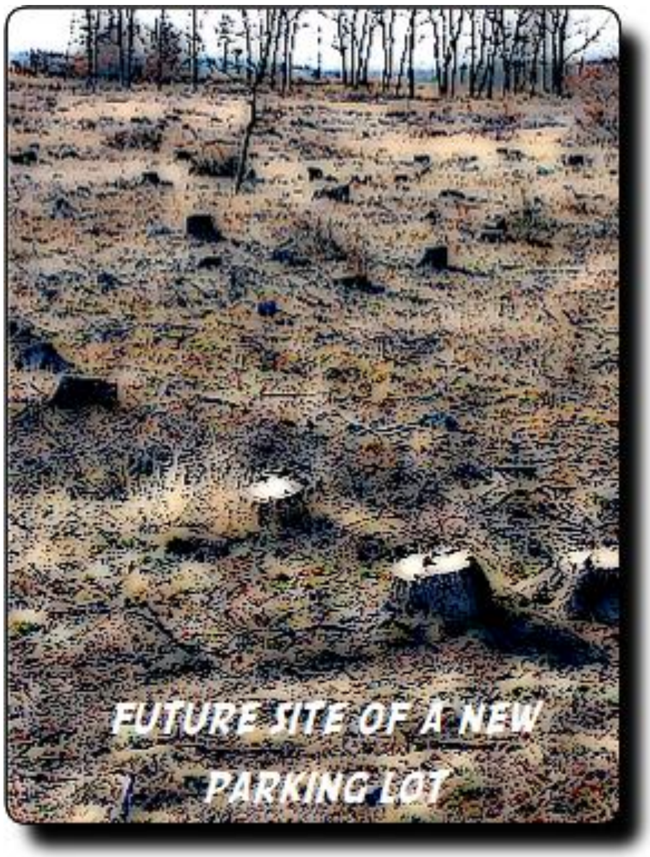
Oh no !

It is very important to protect the soil that we have on our planet! Soil controls the decomposing of dead organisms and provides nutrients to new plants!

As you have learned, there are many different kinds of soil. Some are better for growing plants while others are not! It is the soil we use for farming that we worry about the most! In this chapter, you are going to explore a few of the ways that soil can be harmed and how people can prevent this from happening!

But how can soil be harmed? It is everywhere! Good question!

There are many ways that our soil can be harmed. Some of these ways are caused by nature and others are caused by humans. The main problems for soil from humans are:



Land clearing and Pollution

Nature can hurt our soil too! Two ways that nature can harm our soil are:

Erosion and Salination

("sal-eh-na-shun")

A lot of soil has to be moved away to make room for new buildings. This is what is known as **land clearing**. Sometimes, it is not just soil that has to be moved away. Trees and forests are sometimes moved too! Trees are very important for our layers of soil. Their roots hold the soil together and help to slow down erosion.

Pollution ("pole-loo-shun") is an unwanted item or items that can be found in the air, water or soil. These unwanted items usually harm the living organisms that may be living in the area.

There are many different kinds of pollution. The pollution that may get into our soil can come from chemicals, waste products from companies, landfills and many other places. It is very important that you do not spread any kind of pollution into the ground. All chemicals have special ways to be stored and thrown away. Be very careful with chemicals. In fact, you should always have an adult take care of them for you!

Erosion is a big problem for most farmers. Wind and moving water can easily remove layers of soil from the ground. Heavy rains and strong winds can remove the top layer of soil in a farmer's field! This would wash away many of helpful nutrients for plants. If a farmer's soil does not have the right amount of nutrients, his plants may not grow! When an area of soil becomes very full of salt, it is known as **salination** of the soil.

This is a problem because plants cannot grow in soil that is too salty. Salination can happen in nature when the climate of an area becomes warmer. When an area gets warmer, more water is evaporated (liquid water turns into gas) into the air. This leaves behind all of the chemicals (this includes the salt) inside the soil.

Farmers are always checking their soil to make certain that it does not have too much salt! Sometimes, farmers can make mistakes with their soil that causes salination to take place! This can happen when they water their crops too quickly or too much. Farmers have a big responsibility to take care of their soil!

Land clearing, pollution, erosion And salination are all problems that can harm our soil...

So how do people protect the soil? That is another good question!

Scientists who study the soil have listed four things that landowners can do to protect the soil:

Windbreaks
Terracing
Cover crops
and **Contour plowing**

A person can create a **windbreak** on their land by planting one or more rows of trees. Most of the time, you will find windbreaks around the edges of fields on farms.

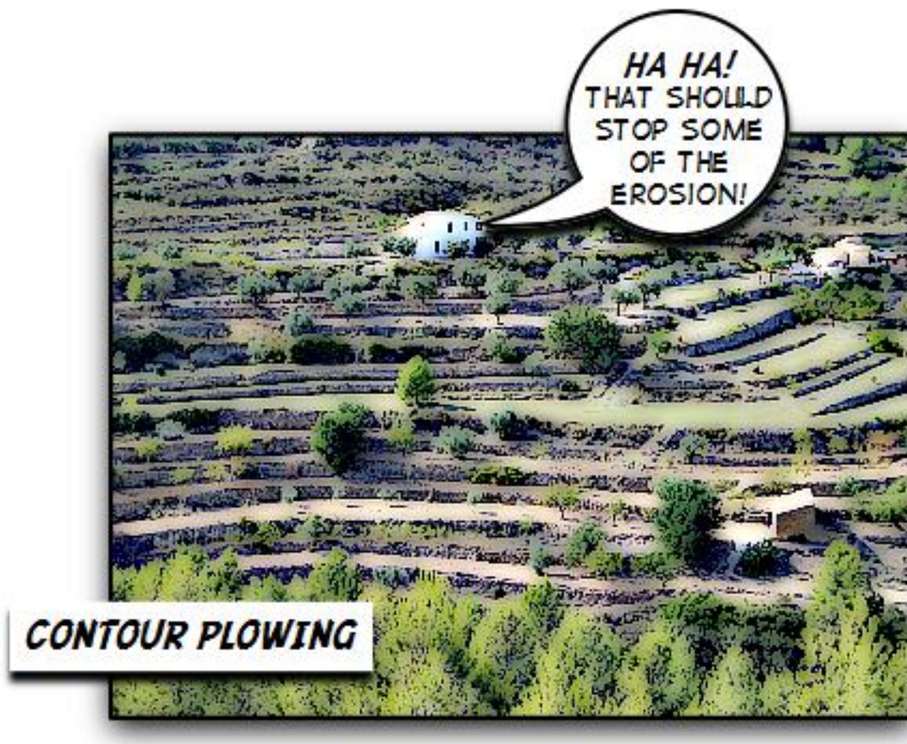
The roots of trees do a very good job in holding the topsoil together. This keeps wind and running water from causing too much erosion.

Erosion can completely remove the topsoil from the side of a hill. If you are a farmer, and your crops have to be planted on a hill... this could be a problem! This is when farmers use **terracing** ("tare-a-cing") so slow down the erosion of the soil.

The "terracing" of a hill means that many different layers are cut into the ground to form a pyramid shape. each of these layers are flat, which makes it easier for a farmer to grow crops. In addition, it is much easier to **harvest** crops (this means to pick your crops).

The flat layers, called **terraces**, slow down the erosion of the soil. This is because the moving rain water can be directed across the terraces, instead of it running straight down the hill!

If a farmer's field is full of small hills, terracing may not be the best way to protect the soil. In this case, the farmer may want to try **contour plowing** ("kon-tour"). To "plow" a field means to dig small trenches or valleys into the soil in order to plant seeds. This creates rows in a field where plants can be harvested from later in the year.



When a farmer uses contour plowing, he plows around the small hill. Imagine putting on a large bead necklace. It goes over your head and rests on your shoulders, right? Now imagine putting on another necklace, and another, and another! All of these necklaces follow the "contours" of your body. This is what happens in contour plowing.

The rows of crops can be planted around the small hill, just like the bead necklaces can be placed around your neck and shoulders! These rows slow down water from running downhill! By slowing down the moving water, a farmer can protect the soil by slowing down erosion!

The last way that people can use to protect their soil is by growing **cover crops**. Cover crops are plants that are grown on unused areas of land. The leaves and roots of these small plants protect the soil by holding it together! Most of the time, cover crops are grown for short periods of time, maybe for only one season!

These are very easy ways that landowners can help to keep our soil safe! Don't forget...

...the Earth has a changing face!

and...

Erosion will always be harming our soil!

However, it is still our responsibility to protect this resource as much as we can! All of our lives depend upon soil in order to survive!

Match the words in the first column to the best available answer in the second column.

__ contour plowing	1)	the movement of land to create new buildings
__ cover crops	2)	an unwanted item or items that can be found in the air, water or soil
__ harvest	3)	when an area of soil becomes very full of salt
__ land clearing	4)	a row of trees planted on the edge of a farm
__ pollution	5)	method of cutting many different flattened layers into the ground to form a pyramid shape
__ salination	6)	to pick crops
__ terraces	7)	the flattened layers of land created by terracing
__ terracing	8)	to dig small trenches or valleys into the soil around a hill in order to plant seeds
__ windbreak	9)	plants that are grown on unused areas of land

Unscramble the words below:

(Hint: check out the bold-faced words in your reading!!!)

1. srartece ______________________________
2. nialatsion ______________________________
3. utonilpol ______________________________
4. rovcpsrceo ______________________________

Write the definitions for each word:

1.

2.

3.

4.

Describe why a farmer would want contour plowing on his farm? Be certain to explain what contour plowing is and why it is needed.

Unit Seven Review

Fill in the blanks with the correct letters. The words in the list on the right provide a clue to the answer.

1) _m_eba	organism (called a "protozoa") which lives inside a thin covering of water around a tiny piece of soil and eats bacteria
2) _acte_ia	tiny organisms that can be found within soil; responsible for decomposing biotic material
3) _iotic res_urce_	living or dead organisms
4) cl_y	type of soil which contains the smallest pieces of minerals
5) _ontou_ _lo_ing	to dig small trenches or valleys into the soil around a hill in order to plant seeds
6) co_er _rops	plants that are grown on unused areas of land
7) dec_mpo_ers	organisms that break down dead organisms into smaller pieces
8) _arth_orms	organisms which move through the soil by swallowing soil, along with its bacteria and amoeba
9) _ixing _itro_en	the ability of a bacteria to turn the nitrogen gas in the soil into form that a plant can use
10) fun_us	organism in the soil which decomposes biotic material; much larger than bacteria
11) ha_ves_	to pick crops
12) hu_u_	layer of “dead stuff” that is found inside topsoil which is always decomposing into smaller pieces
13) _and cl_a_ing	the movement of land to create new buildings

14) _arent _at_rial	original layer of bedrock in an area; responsible for providing most of the minerals within the soil
15) _ollu_ion	an unwanted item or items that can be found in the air, water or soil
16) _ali_ation	when an area of soil becomes very full of salt
17) s_ndy	type of soil which contains the largest pieces of minerals (sand)
18) si_ty	type of soil which contains medium-sized pieces of minerals
19) s_i_	a mixture of minerals and biotic material found on the outside of our crust which is responsible for all plants to grow
20) s_il ho_izo_	different layers in the soil which are stacked on top of each other
21) _oil pr_fil_	all of the layers in the soil in a particular area
22) _oil t_x_ure	appearance of soil based on the size of the minerals found within it
23) s_bso_l	soil horizon directly below the topsoil
24) s_mb_osis	the ability of different kinds of organisms to work together in order to survive
25) t_rrac_s	the flattened layers of land created by terracing
26) _er_acing	method of cutting many different flattened layers into the ground to form a pyramid shape
27) _opo_raphy	the shape of the land
28) t_ps_il	the soil horizons on the top of a soil profile
29) w_nd_reak	a row of trees planted on the edge of a farm

Be certain to go over your definitions for the test!

CHAPTER 29

You have explored a huge amount of information about our little planet so far! You know all about the rocks and soil under your feet. You also know about the air above us, and how it moves around the Earth! You even know how the Earth changes every day!

But there is still more to learn!

Don't forget that the Earth has a changing face! In fact, let's take a look at our own changing face! Think about what it takes to put a smile on our face. It takes many different parts to work together in order for us to smile! In order to smile you need your brain, nerves, muscles, bones and skin all to work together.

The Earth is no different! Everything in the world is connected together!

In this unit, you are going to use all of the information you have explored in this book so far. The changing face of the Earth depends on all of this information working together!

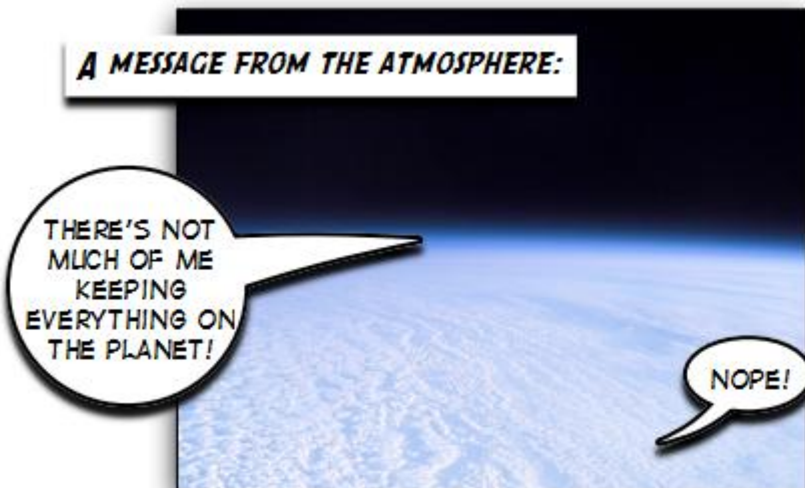
But how does it all work together?!

Good question !

First... let's make it easier for us to answer this question. We need to classify (this means "to put into groups") all of the information you have explored so far.

Scientists have placed the Earth into four different groups that are called **"spheres"**. You should be able to recognize each of these four spheres because you have studied each of them. The names of these spheres are:

Lithosphere
("lith-ohs-fear")
Atmosphere
("at-mohs-fear")
Hydrosphere
("high-drohs-fear")
and **Biosphere**
("bi-ohs-fear")



The **lithosphere** contains all of the solid land (rocks, minerals and soil) that can be found on the Earth's crust. The lithosphere also includes all of the rocks and minerals found within the Earth's mantle and core. This includes the liquid magma (melted rock) is part of the lithosphere!

So when you are studying about earthquakes and volcanoes, you are looking at the lithosphere! The movement of tectonic plates is also something that happens within the Earth's lithosphere.

Wind, gases and storms are all found within the **atmosphere!** When you are studying the weather, you are looking at changes in the atmosphere! Every time you breathe, you are using the atmosphere in order to survive!

But what about all of the water vapor that is found in the air? And what about clouds? I thought they were made up of liquid water?

You are correct! Clouds are made up of liquid (and maybe even solid) water! But all of the water in the world makes up another sphere called the **hydrosphere**!

The hydrosphere contains all of the water found in the air, on the Earth and under its surface!

When you explored the water cycle, you began to study how all of these spheres work together. For example, the water cycle contains water under the Earth's surface (lithosphere), the water covering the surface of the Earth (in oceans, lakes, rivers...) and the water in the air (atmosphere).

But, there is one more place that you can find water on the Earth - in living organisms! All of the living organisms on the planet make up our **biosphere!** It is the biosphere that scientists spend most of their time!

Think of it this way... most scientists study the Earth to understand how humans (or other organisms) can live better, longer and healthier lives.

Scientists study volcanoes to better protect people from getting hurt when they erupt. This is the same for scientists who study earthquakes, the weather, tsunamis and all other events!

It is the biosphere that links all of the other spheres together!

Living creatures can be found in the ground (lithosphere), the water (hydrosphere) or the air (atmosphere)! To be honest, you work with these spheres almost every day:

When you work in a garden, you are working with the lithosphere.

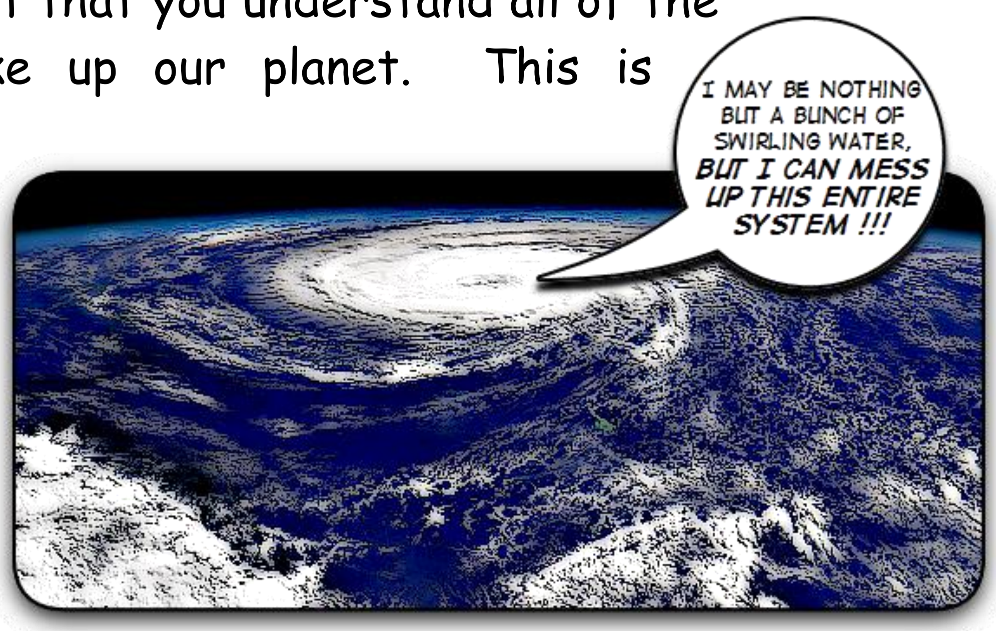
When you take a bath or go swimming, you are working with the hydrosphere.

Every time you breathe, you are working with the atmosphere.

When you play with your pets or talk to your parents and friends, you are working with the biosphere.

It is very important that you understand all of the spheres that make up our planet. This is because each of these spheres work with each other to make up something that is much larger...

a system!



Our bodies have systems too! Our heart and lungs work together to form a system in our body. Together, our heart and lungs help to keep our blood moving through our bodies that is filled with the gases we need to survive!

Many scientists study the Earth as a system. By exploring all of the spheres and how they connect with each other, scientists can understand more about ourselves! This is very important for scientists to explore new medicines and ways to treat people who are sick!

You have already started to look at the Earth as a system when you studied Earth's four spheres. Understanding how these spheres work together is important to our survival. Humans can change the face of the Earth very quickly! There are so many of us, we have to be very careful not to harm the Earth! The more you understand how each of the spheres work together, the more prepared you will be to help out when you can! Even something simple, like picking up trash, can help out all of the spheres at one time!

The lithosphere, atmosphere, hydrosphere and biosphere are connected together very closely! In the next chapter, you are going to explore how these spheres are related to each other!

Match the words in the first column to the best available answer in the second column

___ atmosphere

___ biosphere

___ classify

___ hydrosphere

___ lithosphere

___ system

___ sphere

1) to put into groups
2) sphere of the Earth which contains all of the solid land (rocks, minerals and soil) that can be found on the Earth's crust
3) sphere which contains all of the wind, gases and storms in the air
4) sphere which contains all of the water in the Earth whether in the air, on land or in the sea
5) sphere which contains all of the living organisms on the planet
6) a category made by scientists to describe four different areas of the Earth - living organisms, solid Earth, liquid water and all of the gases
7) a collection of all spheres which work together in any area of the Earth

Circle the hidden words from below:

S A E O B A M M H T E R O A N S E H P S R P S H A
S L S H A P S S O O S H I B H E S P H Y O Y E P P
Y S I T Y N R T R D T E E P A T H S R T R R F Y E
S L A T C S F E E R W O H S T W R E L H T H T E S
S P B Y H R S C A T R M E T Y I R T O S O E S T O
R Y F Y H O H E H S S I T R E W H F H H E T R C B
F E E E W S S E R R H R Y R T T A H A R I D P E S
S Y E H L P M P E R H T R C A Y T E P M H E S S F
S R H E P C H R H R I T H T S E T R P S T O R R S
H L E S M I P O L E O T M E E P S W Y M E L R T N
M T L R E S S S H E R O M T R R H S S E N R S H R
R Y H L A Y I P E A S E W T B E T E R E C S E E E
R R E T S P T S H P Y Y H S L R H Y E L L M H H S
H E R P I P L S H E E P P C E E I M A R E O L I S
P H O S T B W E O E R O H T E D R S E A L P H S R
E L E Y R A R H Y E H E R R E P S P H O S S F P P
L R B H T E H E E S A L E H H I H R Y E S E S M S
L E H E R S R O L D W H S A F H O F R S E R M E E
C C R O L E H A S T P Y L Y E S S E R S P E H R S
H P F R O E T E E S S R S E E P H Y S L M E P H A
S E H I S E H S O T F I H O S P R T A R E L S I S
T E H Y T L S R E S W A R P S P W S E P Y N R B O
S H S H H R D M E S S R A O H R N H H A L R E S P
H H O P E Y T R S O E R I E R O T A Y T H T L S A
H S E H H A P T S H E B R T L Y S I H E W T I O S

classify **lithosphere** **atmosphere** **hydrosphere**

biosphere **sphere** **system** **earth**

water

Provide three examples of how you work within each of the four spheres

Lithosphere

Atmosphere

Hydrosphere

Biosphere

CHAPTER 30

In the last chapter, you looked at the Earth as a collection of spheres that work together to form a system. By exploring the Earth as a system, you can see all kinds of patterns that take place every day!

You have studied some of these patterns in earlier chapters:

Pattern #1

Water flows through a **cycle** as it evaporates from a liquid into a gas and condenses into a liquid again!

(A cycle is a pattern that can happen over and over again!)

Pattern #2

Energy **flows** to us from the sun. As this energy reaches our planet, it is used for living organisms to survive. It is also used to keep cycles moving, like our weather or the water cycle!

(The flow or movement of energy is another pattern that scientists study.)

Pattern #3

All life on Earth has found a way to survive with the changing seasons, climates and other natural events. This is nature's way of **balancing** all living and nonliving factors in our world.

(Our environment has always found a way to stay balanced on its own! This ability to "balance" is another pattern that scientists study. This usually happens when people start to upset this balance!)

Scientists explore the cycles, the flow and the balancing that takes place in each of the spheres. This is very true when they study how each of these spheres work together.

For example...

All animals (biosphere) need water (hydrosphere) in order to survive. After drinking their water, some animals may fly through the air (atmosphere) or build a home on the ground (lithosphere).

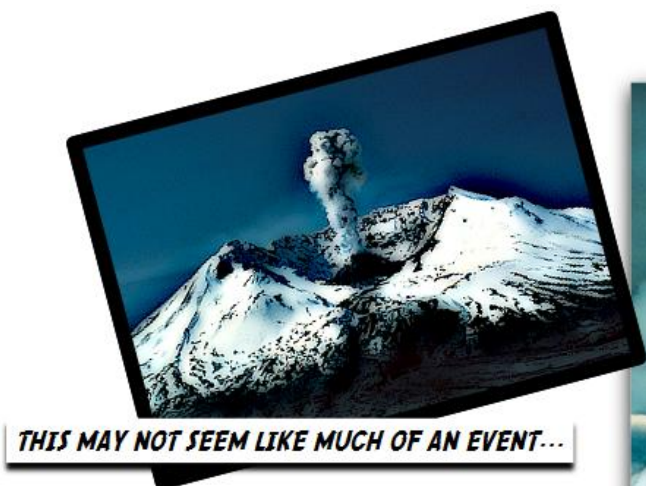
What do you think would happen if one of these spheres were changed?

That's right! The animal may not be able to find water to survive, or air to breathe, or an area to build a home. Some times, these changes do happen! And these changes affect the living organisms living in those areas!

Scientists call these changes in our spheres "**events**".

Some natural events, such as volcanoes and earthquakes, can cause huge changes in the environment! Other changes can be caused by humans. Pollution is a well-known way that humans change the environment.

Understanding these events help scientists to predict how they will affect the biosphere! Being able to make these predictions is very helpful for our survival!



As scientists study an event, they ask themselves two questions:

Question #1: How could the Earth's spheres cause an event to take place?

and

Question #2: What are the effects of the event on each of the Earth's spheres?

(Now let's use both of these questions to explore the relationship between an event and all four spheres. There are many different events to choose from, but let's see the effects of a flood for this example...)

Lithosphere

Question #1: How could the lithosphere cause a flood to take place?	The soil of an area may be too full of water. Because of this, it cannot absorb any more rain so the area fills with water and floods!
Question #2: What are the effects of a flood on the lithosphere?	Water that is moving quickly over the soil can wipe away all of the topsoil in an area very quickly!

Hydrosphere

Question #1: How could the hydrosphere cause a flood to take place?	Most floods are caused by too much rain in one area.
Question #2: What are the effects of a flood on the hydrosphere?	A flood moves many sediments into water making it "muddier" and not as clean.

Biosphere

Question #1: How could the biosphere cause a flood to take place?	Without many plants to hold onto the soil, flood water can move much faster.
Question #2: What are the effects of a flood on the biosphere?	Floods can easily destroy areas for animals to live.

Atmosphere

Question #1: How could the atmosphere cause a flood to take place?	The atmosphere can produce many fronts to move over an area. This causes more rain and flooding.
Question #2: What are the effects of a flood on the atmosphere?	Flooded areas can contain large amounts of organisms that produce mold. When mold is released into the air, it can cause problems if it gets inside our bodies.

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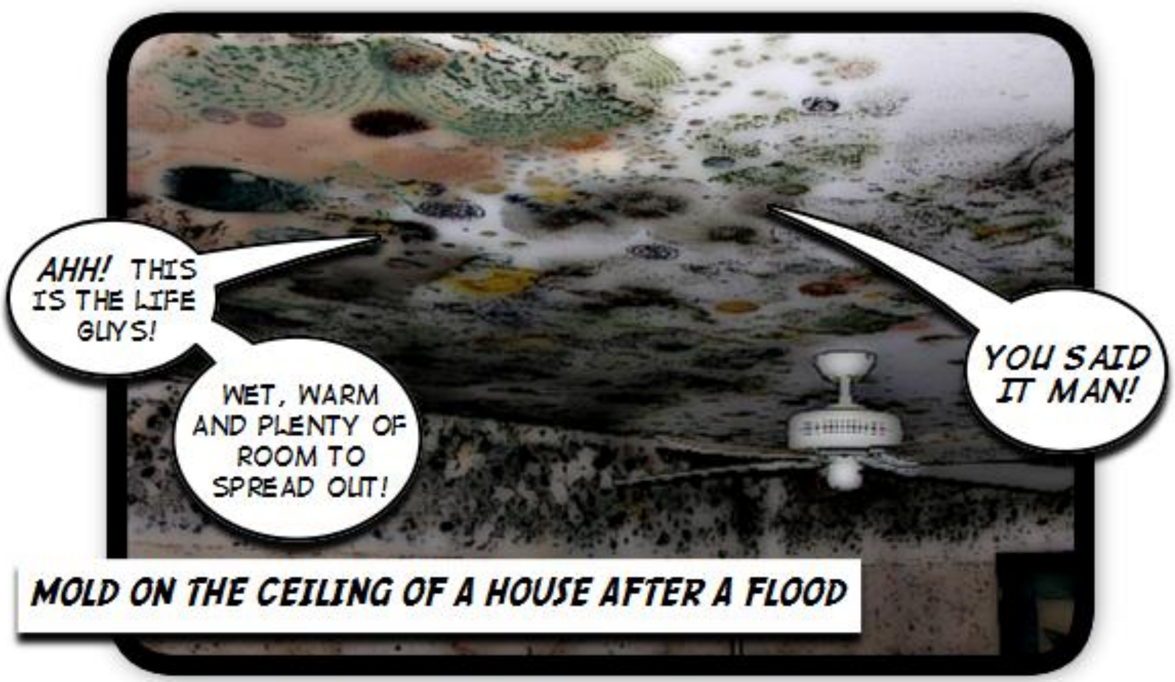


MOLD ON THE CEILING OF A HOUSE AFTER A FLOOD

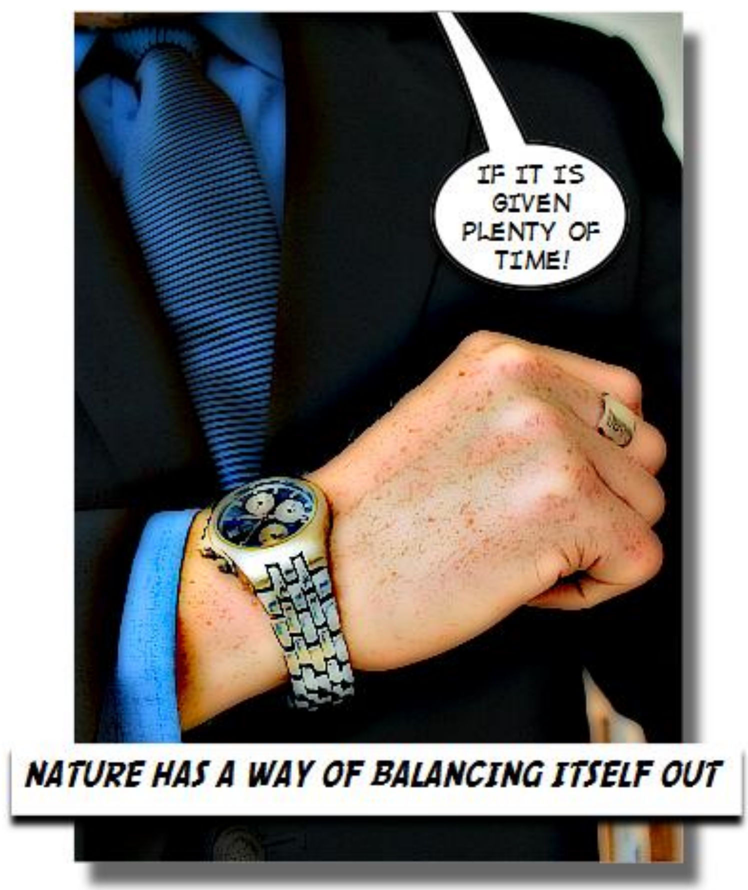
Please understand that these are not the only effects a flood has on our four spheres! If we were to list all of the good and bad things a flood can do...

...you would be reading for many, many years!

Whenever an event like a flood takes place, each of the Earth's spheres are affected. In fact, most events change the natural cycles and flows inside the spheres. This changes the balance that exists inside these areas!

But do not worry!

Earth's spheres are always changing! The balances inside our environment are always changing too!



Cycles, flows and balancing are always being studied when an event takes place. However, an event like a flood causes a series of changes in each of the Earth's spheres. Sometimes, as a sphere changes, it starts to affect other spheres too! Next week, you will be looking at how these events affect everything on our planet!

Match the words in the first column to the best available answer in the second column

____ balance	1) changes in any of Earth's spheres
____ events	2) a pattern that can happen over and over again
____ flow	3) an equal amount of two opposite items
____ cycle	4) the movement of an object

Next week you are going to look at how each of our spheres affect each other. Let's see how well you can predict will happen during a flood between the...

Lithosphere and the Hydrosphere

What are the effects of the changes in the lithosphere on the hydrosphere during a flood?

My prediction is:

Lithosphere and the Biosphere

What are the effects of the changes in the lithosphere on the biosphere during a flood?

My prediction is:

Lithosphere and the Atmosphere

What are the effects of the changes in the lithosphere on the atmosphere during a flood?

My prediction is:

Hydrosphere and the Biosphere

What are the effects of the changes in the hydrosphere on the biosphere during a flood?

My prediction is:

Hydrosphere and the Atmosphere

What are the effects of the changes in the hydrosphere on the atmosphere during a flood?

My prediction is:

Atmosphere and the Biosphere

What are the effects of the changes in the biosphere on the atmosphere during a flood?

My prediction is:

CHAPTER 31

In the last chapter, you learned how events, like a flood, can change each of our spheres. You also used two questions to help you understand more about the changes in our spheres:

Question #1: How could the Earth's spheres cause an event to take place?

and

Question #2: What are the effects of the event on each of the Earth's spheres?

This week, you are going to use a third question to understand how each of our four spheres can cause changes in each other:

Question #3: What are the effects between two of the Earth's spheres during an event?

That's right! One single event, like a flood, can affect not just one sphere, but all of them!

When one sphere causes changes in another sphere, it is called an **interaction** (“in-tur-ack-shun”).

And, if many interactions start to take place, scientists call this activity a **chain reaction** (“ree-ack-shun”).

Scientists try very hard to understand how a single event can cause chain reactions in all of our spheres! Remember! Each of our four spheres work together to make up something that is much larger - a system!

In order to make it easier for you to explore one of these chain reactions, let’s look at the interactions first.

There are six different ways we can put all of the Earth’s spheres into pairs:

Lithosphere and the Hydrosphere
Lithosphere and the Biosphere
Lithosphere and the Atmosphere
Hydrosphere and the Biosphere
Hydrosphere and the Atmosphere
Biosphere and the Atmosphere

We could spend many days exploring each of these pairs and all of the interactions that could happen! But we do not have that much time! So let's look at one example...

The lithosphere and the hydrosphere

During a flood, a huge amount of rain can cause a lot of erosion of soil in the lithosphere. As the soil is moved into a river or lake, the water becomes muddier and affects the water cycle of the area (hydrosphere).

Remember, this is just one example of how two spheres affect each other! There are so many interactions between the lithosphere and hydrosphere we do not have enough time to study them all!

Let's use a flood as the natural event that can cause these interactions:

Lithosphere and the Hydrosphere

What are the effects of the changes in the lithosphere on the hydrosphere during a flood?

During a flood, a lot of soil (lithosphere) can be carried away to a river (hydrosphere) where it makes the water very muddy.

Lithosphere and the Biosphere

What are the effects of the changes in the lithosphere on the biosphere during a flood?

During a flood, the erosion of the soil (lithosphere) can destroy much of the plants (biosphere) in an area.

Lithosphere and the Atmosphere

What are the effects of the changes in the lithosphere on the atmosphere during a flood?

The atmosphere can produce many fronts to move over an area. This causes more rain and flooding which damages the soil (lithosphere).

Hydrosphere and the **Biosphere**

What are the effects of the changes in the hydrosphere on the biosphere during a flood?

Large amounts of water (hydrosphere) can hurt or kill many plants and animals (biosphere).

Hydrosphere and the **Atmosphere**

What are the effects of the changes in the hydrosphere on the atmosphere during a flood?

Large amounts of water vapor (hydrosphere) can condense and turn into many rain clouds as they move through the air (atmosphere).

Atmosphere and the **Biosphere**

What are the effects of the changes in the biosphere on the atmosphere during a flood?

Strong winds (atmosphere) that take place during storms can destroy many plants in an area (biosphere).

As you can see, one single event can cause all of these interactions. And remember... these are not the only interactions that could happen! There are many different ways that spheres can interact!

Here is the most important lesson about learning why the Earth is a system:

You must always explore why the interactions are taking place!

For example...

The interaction between the atmosphere and the biosphere said, "Strong winds that take place during storms can destroy many plants in an area." This may be true...

But why ?

Why did the plants get killed? Was it only "strong winds" that destroyed the plants? Or did all the water from the flood move away the soil and swept away all of the plants?

We don't know! There may be more interactions that can be explored! If you always ask questions about why these interactions are happening, you may come up with many different answers! This is very good! This is how science really works!

Of course, a flood is not the only event that can cause a chain reaction in our spheres! In the next chapter, you are going to explore other events that you have studied from past chapters and how they can cause huge chain reaction!

Fill in the blanks with the correct letters. The words in the list on the right provide a clue to the answer.

1) _nte_action

when one sphere causes changes in another sphere

2) _h_i_ reac_ion

a time in which many interactions are taking place

Last week you predicted how our Earth's spheres affect each other during a flood. Take out your review from last week and look it over. Do you want to make any changes? You probably do! Make those changes here...

Lithosphere and the Hydrosphere

What are the effects of the changes in the lithosphere on the hydrosphere during a flood?

My prediction is:

Lithosphere and the Biosphere

What are the effects of the changes in the lithosphere on the biosphere during a flood?

My prediction is:

Lithosphere and the Atmosphere

What are the effects of the changes in the lithosphere on the atmosphere during a flood?

My prediction is:

Hydrosphere and the Biosphere

What are the effects of the changes in the hydrosphere on the biosphere during a flood?

My prediction is:

Hydrosphere and the Atmosphere

What are the effects of the changes in the hydrosphere on the atmosphere during a flood?

My prediction is:

Atmosphere and the Biosphere

What are the effects of the changes in the biosphere on the atmosphere during a flood?

My prediction is:

CHAPTER 32

So far, you have explored our four spheres:

Lithosphere
Atmosphere
Hydrosphere
And the **Biosphere**

You have also learned how a natural event can cause changes in each of these spheres. You have even learned how one single event, like a flood, can cause a chain reaction of interactions with all of these spheres! This week, we are going to look at other natural events and how they affect our biosphere!

If you remember from chapter 30, some events, like volcanoes and Earthquakes, are caused by nature... while other events can be caused by humans. Pollution is a well-known way that humans change the environment.

Understanding these events help scientists to predict how they will affect the biosphere! Being able to make these predictions is very helpful for our survival!

The following natural events can affect our biosphere in many different ways:

Volcanoes

Volcanoes can be very dangerous! When a volcano erupts, it can cover the lithosphere with magma and burn almost everything it touches! All of the ash that erupts out of a volcano can hurt the biosphere too!

Ash from a volcano can turn a lake or river very muddy. This harms all of the plants and animals that live in this area. This ash is also carried by the atmosphere very far away from the erupting volcano!

This is not good! It is not healthy for most animals to breathe ash!

Earthquakes

The movement of the Earth caused by an Earthquake is not dangerous to most humans... unless it happens near a city!


IT'S NOT JUST BUILDINGS THAT GET SHAKEN APART.

When the Earth shakes during an earthquake, it shakes everything that is on the surface of the Earth. If a building shakes too hard, it can fall to pieces. This is not good if you are inside the building! Most people get harmed by earthquakes when buildings fall to the ground.

Change in climate

The climate of an area changes very slowly. It takes many years for these changes in temperature and rainfall to affect the biosphere. However, even small changes like these can harm or kill some kinds of plants or animals.

Fire

As fire destroys the plants in an area, it also destroys the habitats for many animals. Winds can keep fires burning through grasses and trees very quickly.

Pollution

People can spread pollution into the lithosphere, atmosphere or the hydrosphere. However, most pollution does not stay in one sphere. It tends to move and affect all of the spheres too! Most of the time, we see how harmful pollution can be when it comes back to the biosphere and affects other organisms.

Until now, we have only looked at the bad things that some of these interactions can do. But...

...not all events are always bad!

Sometimes, an event can cause good interactions as well! Let's take a look at these events again and see how they can help out our biosphere!

Volcanoes – the good stuff...

An erupting volcano may cover up all of the topsoil of an area. This makes the soil no longer any good for growing plants. However, the minerals inside the ash are great nutrients for new soil to be formed!

Earthquakes – the good stuff...

It may be hard to think that good things come from earthquakes, but they do! Many scientists work very hard on creating buildings that cannot be shaken to the ground very easily. This is very helpful to areas where earthquakes take place.

Change in climate – the good stuff...

Changes in the climate may hurt some organisms, but it can help others to survive! Any change in an area allows for new organisms to find a habitat to live and grow. Remember, what is bad for one organism, may not be bad for all organisms!

Fire – the good stuff...

Fire is not always such a bad thing. In fact, some pine cones cannot grow into new trees without fire! The heat from the fire bakes the pine cones and opens them up. When the pine cones are opened up and fall to the ground, they can grow into a new tree!

Pollution – the good stuff...

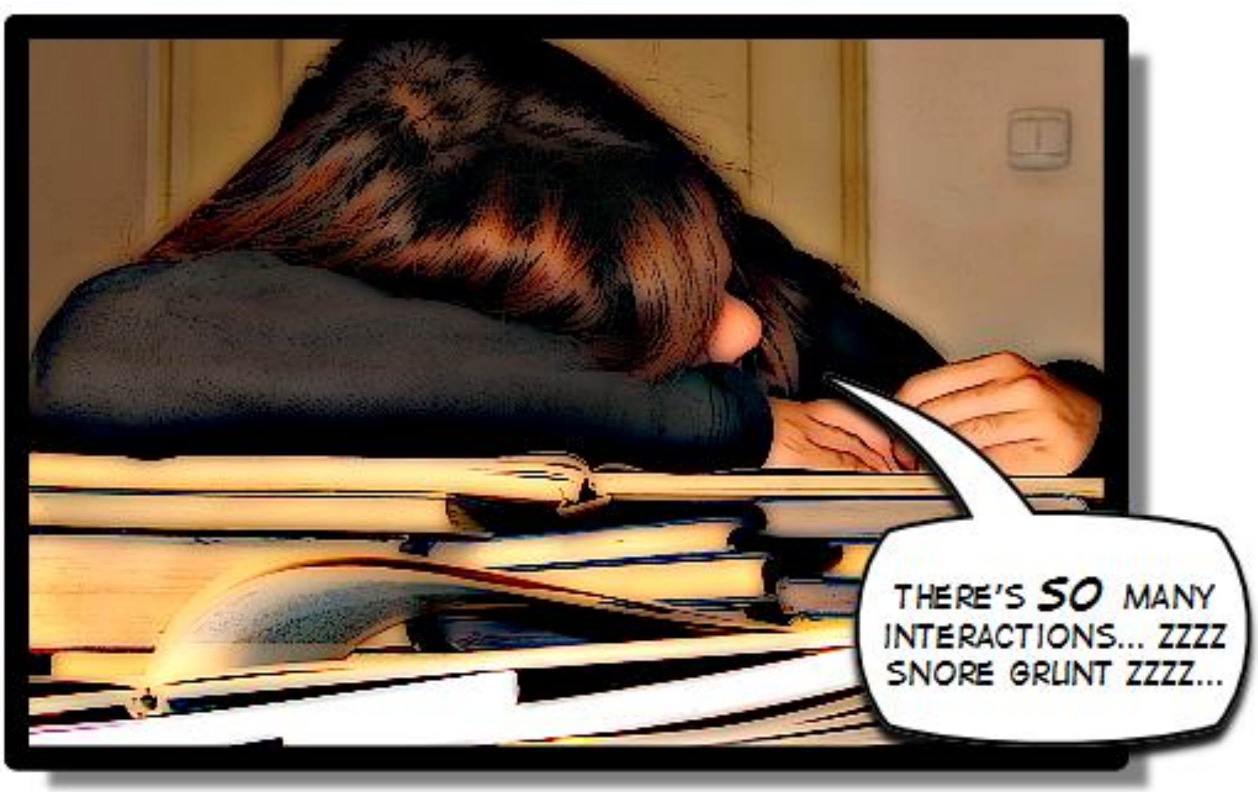
It is impossible to keep all people from polluting. However, scientists are trying to find new and better ways to use our natural resources. These changes keep the material from hurting the environment if it is spread throughout the air, land or water as pollution!

Don't forget !

It is very important for everyone to know that each of our spheres work together to make up a much larger system!

By exploring all of the spheres and how they connect with each other, scientists can understand more about ourselves and our biosphere!

Humans can change the face of the Earth very quickly! Remember, the more you understand how each of the spheres work together, the more prepared you will be to help out when you can! Even something simple, like picking up trash, can help out all of the spheres at once!



True or false? Write "true" next to all of the following statements that are true. Write "false" next to all those which are false. If false, change the statement to make it true.

____ one single interaction, like a flood, can cause a chain reaction of events with all of these spheres

____

____

____ not all events are always bad. Sometimes an event can cause good interactions as well.

____

____

____ some events, like pollution, are caused by nature. while other events can be caused by humans.

____ By exploring all of the spheres and how they connect with each other, scientists can understand more about ourselves and our biosphere.

Which one is right? Circle the correct answer.

1. Humans can spread pollution into which spheres?
   a) biosphere and lithosphere
   b) atmosphere, lithosphere and biosphere
   c) atmosphere, lithosphere and hydrosphere

2. Which of the following is true?
   a) fire can only destroy the biosphere
   b) volcanoes can only destroy the environment
   c) a change in climate can help and hurt organisms

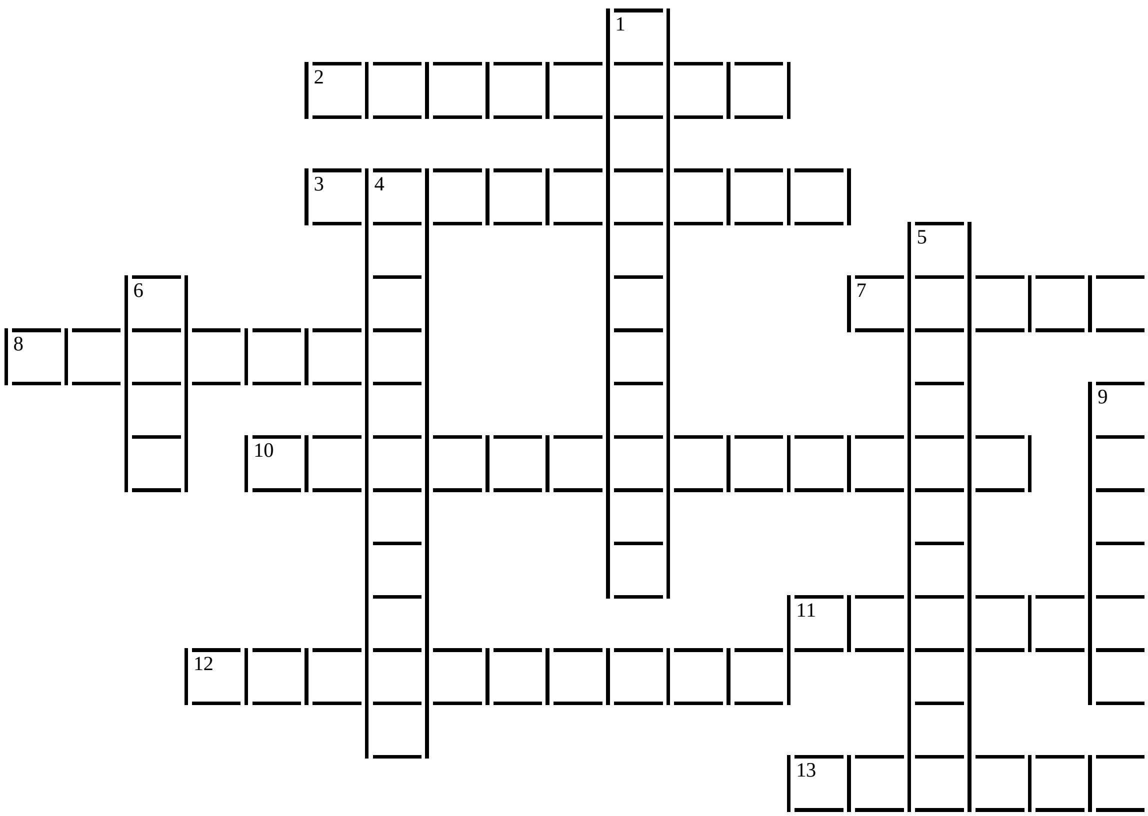
3. Ash from volcanoes affects the atmosphere by...
   a) putting dangerous items into the air
   b) turning the water very muddy
   c) burning everything it touches

4. Why do scientists study the Earth's spheres?
   a) to make new interactions within the spheres
   b) to predict how events will affect the biosphere
   c) to predict how the biosphere will affect different events

5. One positive effect of earthquakes is...
   a) scientists who attempt to create better buildings
   b) movement of the tectonic plates
   c) shaking of buildings

Unit Eight Review

Place the answers to the following clues in the boxes below. Each box should contain one letter.



ACROSS

2 To put into groups

3 Sphere which contains all of the living organisms on the planet

7 A pattern that can happen over and over again

8 An equal amount of two opposite items

10 A time in which many interactions are taking place

11 A category made by scientists to describe four different areas of the Earth - living organisms, solid Earth, liquid water and all of the gases

12 Sphere which contains all of the wind, gases and storms in the air

13 Changes in any of Earth's spheres

DOWN

1 Sphere of the Earth which contains all of the solid land (rocks, minerals and soil) that can be found on the Earth's crust

4 When one sphere causes changes in another sphere

5 Sphere which contains all of the water in the Earth whether in the air, on land or in the sea

6 The movement of an object

9 A collection of all spheres which work together in any area of the Earth

CHAPTER 33

You have worked so hard with this book!

I'm very proud of you!

Let's take it easy for the rest of the book! This unit is a little different than what you have explored so far…

By now, you should understand how our planet works. That's great! However, not everyone may be as smart as you are about the Earth! In this unit, you are going to explore many of the **myths** that several people believe to be true.

A myth is a story that people may believe to be true, but it is not!

It is very important for all of us to know the difference between a myth and the truth! For example, if I told you that apples fly through the air with their wings... you should know that this is a myth!
(I hope!)

Let's take a look at some of the most popular myths and see if you thought they were true…

Myth #1

Stars are not out in the daytime

The stars do not disappear during the day! They are still out there! The reason why you can't see the stars is because of our sun.

The light from the sun fills our sky and keeps us from seeing the stars. The only time that you can see stars in the middle of the day is during a solar eclipse.

If you remember, a solar eclipse is when the moon gets in between the Earth and the sun and blocks its light for a short period of time. This makes everything very dark here on Earth! During this time, it is possible to see some of the brightest stars in the sky! Cool, huh?!

So, whenever you look up into the sky, the stars are still up there. You just might not be able to see them all the time!

Myth #2

Stars appear in the same place in the sky every night

This is an easy one to test. If you go outside on a clear night, look straight above your head and find a single star. You will want to be able to find this star again, so try to remember exactly which one you are looking at!

Now, try finding this same star later in the evening. If you have a very good memory, try to find this star at a different time of the year!

If you are very careful, and you try to find the same star, I bet you would find out that...

...the star is not in the same place!

Don't worry! Nobody has moved your star! In fact, that star has not moved at all!

Remember, it is the Earth that is rotating (spinning like a top) and revolving (moving around the sun). All of this movement makes the stars look like they are moving. But they don't!

Think of it this way - when you are riding in a car, it looks like everything around you is moving really fast!

But you know that those buildings and trees and light poles are standing still... it is you that is moving!

This is the same thing with the stars in the sky! When we move, we are looking at the stars from a different location.

Myth #3

The reason why it is hot in the summer is because we are closer to the sun.

You can throw this idea into the trash! The reason why it is hot in the summer and cold in the winter has nothing to do with how close we are to the sun!

Our planet has different seasons because of many different things. But the distance between our planet and the sun is not one of them!

The main reason is because of the way our planet it tilted towards the sun during the summer months and away from the sun during the winter months!

Myths #4 and 5

Half of the moon is always in the dark

There are a lot of people out there who think this myth is true. But they are totally wrong! It is true that there is always one side of the moon that is not facing the sun. And, since this side is not facing the sun, it is in the dark!

But...

The moon is always rotating (Yes! It spins like a top just like the Earth!) So, there is no side of the moon that is always in the dark!

People who think this myth is true sometimes also say that...

The moon only shows one face to Earth because it is not rotating!

Ouch! This myth really hurts! It is true that you only can see one side of the moon. But this is because the moon only shows one face because it rotates once every time it revolves around the Earth!

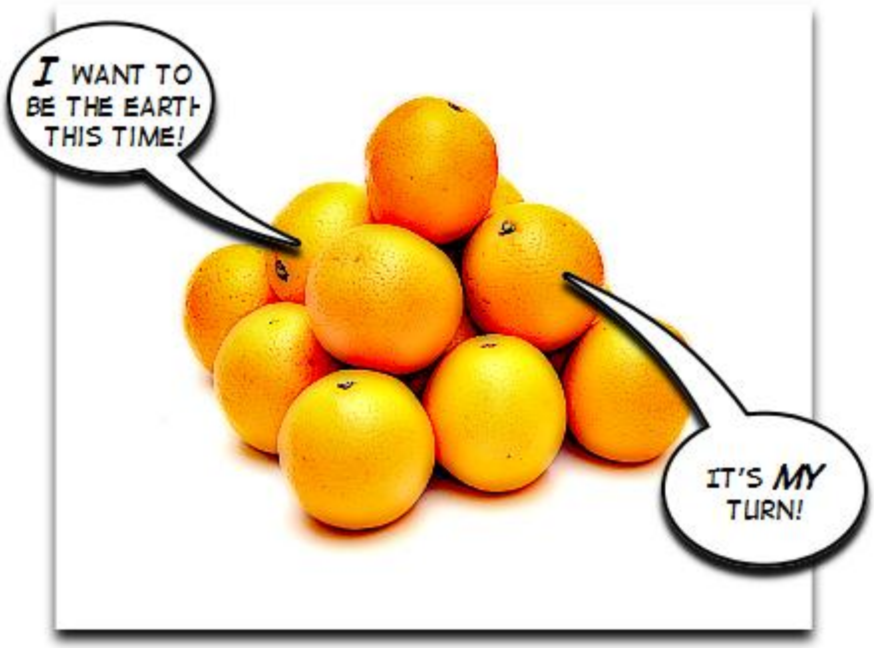
Okay… here is something you can do at home to test this out!

Go get a couple of oranges (or grapes or apples or candy...) mark one of them with a big "x". This orange will be your moon and the "x" is the "moon face" that you are used to seeing. Now, take the other orange and set it down in the middle of the table. This orange will be your Earth!

Place the "moon" about a foot away from the "Earth" with the "x" facing the Earth. Now, move the moon as if it were revolving around the Earth... be certain that the "x" faces the Earth at all times! This is very important!

As your moon revolves around the Earth, the "x" makes one complete rotation as it moves around the Earth each time!

This is how the moon rotates as it revolves around the Earth.   And it explains why we only see one side of the moon.



You see, if the "x" was not always facing the Earth, the moon would show all of its sides to the Earth... **and this does not happen!**

Good job! You just learned about five myths that most people believe to be true. Now you can help them to understand the truth about our moon, the stars and our seasons. Next week, you are going to explore a few more myths. This time, it will be about our weather!

All of these statements are completely false! Explain why they are so wrong!

Stars are not out in the daytime

Stars appear in the same place in the sky every night

The reason why it is hot in the summer is because we are closer to the sun.

Half of the moon is always in the dark

The moon only shows one face to Earth because it is not rotating

True or false? Now let's see how well you do on myths about the weather. Make your best guess!

____ **Two snowflakes can look the same**

____ **Raindrops do not look like teardrops**

____ **The same water goes through the water cycle forever...**

____ **Rain falls out of the sky when clouds evaporate**

CHAPTER 34

Okay... you have explored a few myths about space last week. This week, you are going to look at myths about our weather!

Remember, a myth is only a story! It does not tell the truth about what is going on! Don't feel bad if you have believed some of these myths are true. That is okay! Nobody on Earth knows everything!

But what is important is that you learn from your mistakes. And, the most important, and scientific, thing to do is:

Keep asking questions!

You are never going to learn about how things work if you don't ask lots of questions! Keep looking for the truth!

Now... let's take a look at a few myths about the weather:

Myth #1

No two snowflakes are the same

That's right! Almost everyone has heard that no two snowflakes are the same, but this is not really true!

Think about a single snowball. Inside that snowball you would find more than 10,000 snowflakes! Now, try to imagine how many snowballs you could make after a really big snow storm!

Even with billions of shapes that a snowflake can have, there is a small chance that two snowflakes can be the same. In fact, some scientists have even discovered twin snowflakes! Before you go outside and start collecting snowflakes, remember - this does not happen very often! It may take you a very very long time to find twin snowflakes!

Just because something seems to be impossible, does not mean that it cannot happen!

Myth #2
Raindrops look like teardrops

All of us have drawn pictures of rain before, and I would guess most of us have a picture in our head of what a raindrop looks like… **a teardrop!** But this is not true!

The shape of a raindrop is based on its size. Small raindrops look just like a round ball. Now, if you were to squish that ball just a little bit, you'd be looking at the shape of a medium-sized raindrop. Large raindrops do not last very long at all. Most of the time they break up into smaller round drops!

Now you know the truth! So the next time you watch the weatherman on TV, look for pictures of teardrops and remember what you have learned!

Myth #3

The same water goes through the water cycle forever...

If you remember, water evaporates from the Earth into a gas called water vapor. This gas cools and condenses back into tiny liquid water drops and forms a cloud. When these drops of water get too large, they fall back to Earth as rain. At this time, the cycle can begin again!

You may think that the water you drink is the same water that has always been around... but this is not true!

In order to understand why this is a myth, you need to see what makes up a water molecule. Water is made up of two atoms called hydrogen and one atom of oxygen. Think of these three atoms as building blocks! Together, they make up one molecule of water.

Now imagine making hundreds of these water molecules and connecting them together. You have now made water!

But can you break your new building block structure? Of course you can! In fact, you can take every piece apart and put it back together again!

However, the chance of you putting each piece back into the same place is not very good, is it? **NO!**

This is what happens with water molecules. They get split up too! Sometimes this happens when water vapor is passed through a plant as it makes its own food. It may sound strange, but it is very true!

Water is always being pulled apart and used for other things! Luckily, new molecules of water can be created too! When we burn most of our fuel, one of the waste products is new water molecules...

So do water molecules stick around forever? No way!

Myth #4

Rain falls out of the sky when clouds evaporate

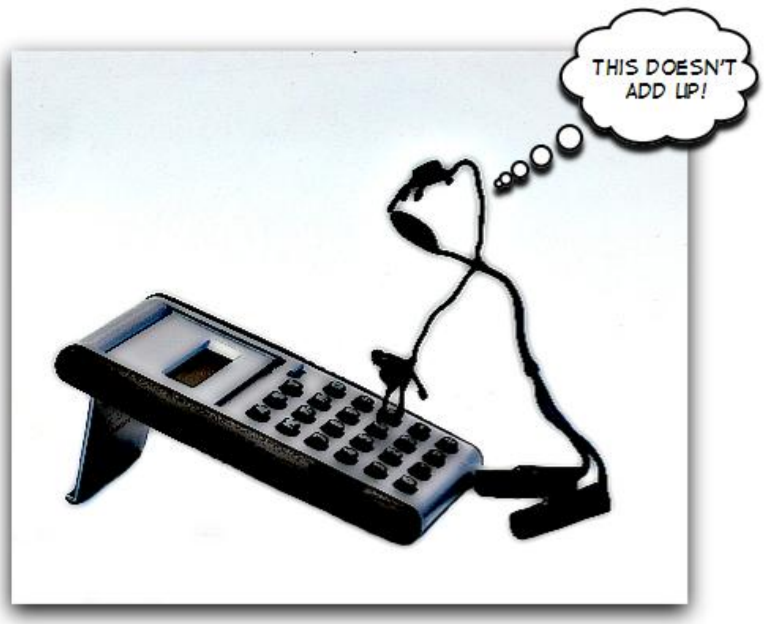
I've heard this one all of my life! Somehow, people have the wrong idea about what makes up a cloud!

A cloud is a large group of tiny water drops that are either liquid or solid (ice). When liquid water evaporates, it turns into a colorless gas that will be moved through the atmosphere by our wind.

So, if a cloud evaporates, what would you have left over? That's right - **water vapor!**

There is no way you can create liquid water through evaporation! It simply does not work that way!

The reason it rains is because tiny water drops get larger and larger until they are too heavy to be carried through the air by wind. When this happens, they fall to the ground as water drops... **ROUND WATER DROPS!!!** (Remember... no teardrops!!!)



So did you learn anything new today? I hope so! Many of these myths are believed to be true by many people! I'm very happy that you know the truth behind these myths.

Next week, you are going to look at some myths about another part of our weather... lightning!

Last week you made some predictions about the weather. I hope you did well! Pull out last week's chapter review and let's see how well you did!

True or false? Write "true" next to all of the following statements that are true. Write "false" next to all those which are false. If false, change the statement to make it true.

____ **two snowflakes can look the same**

____ **Raindrops do not look like teardrops**

____ **The same water goes through the water cycle forever...**

____ **Rain falls out of the sky when clouds evaporate**

True or false? Now let's see how well you do on myths about lightning. Make your best guess!

____ Lightning sometimes strikes twice in the same place

____ Rubber shoes or rubber tires on a car protect you from being hurt by lightning

____ Any objects in a storm can get struck by lightning

____ You can tell the distance you are from a thunderstorm by counting 1 second per mile after the thunder

____ Ben Franklin's kite was not struck by lightning

CHAPTER 35

Here we go again! In the past two chapters, you have explored myths about space, our moon and the weather...

This week, you are going to look at only one part of our weather...

Lightning!

There are a lot of myths out there about lightning. Don't fool yourself...

Lightning can be very dangerous! You always want to keep yourself safe if there is a chance of lightning outside. But there is no need to be worried about lightning, as long as you understand some of the myths about this part of our weather.

Myth #1

Lightning never strikes twice in the same place

No way! This is completely wrong! In fact, some tall buildings can be struck by lightning several times during the same storm!

Myth #2

Rubber shoes or rubber tires on a car protect you from being hurt by lightning

Most of you have probably seen an electric spark before, right?! Well, it takes a lot of energy to make a spark that is just one inch long! (That is about as long as a quarter!)

Now try to imagine how much energy it takes to create a lightning bolt that is several miles long! (That would be about 63,000 quarters lined up next to each other!)

That is a huge amount of energy! In fact, there is so much energy in a bolt of lightning that it is hotter than the sun!

Electricity cannot easily pass through some items, like rubber! But, do you really think that a small amount of rubber in your shoes or in your tires is going to help you?!

No way!

Myth #3

The tallest objects in a storm always get struck by lightning

It is true that taller objects are closer to the clouds. However, this does not mean that lightning only strikes tall objects! Lightning can strike anywhere, but I would still stay away from taller objects anyway. Just in case!

Myth #4

You can tell the distance you are from a thunderstorm by counting one second per mile after the thunder

This is a simple mistake that some people make. Luckily, there is a simple way to fix this problem.

First of all, you always see the bright light from a bolt of lightning before you hear the thunder! If you did not know this, pay attention the next time a thunderstorm comes by.

This may sound little weird, but light moves much faster than sound! That is why you always see the lightning before you hear the thunder!

Now, on to the math! It takes thunder about five seconds to travel one mile! So, the next time you see a bolt of lightning, count to five by saying,

> *"one one-thousand, two one-thousand, three one-thousand, four one-thousand, five one-thousand"*

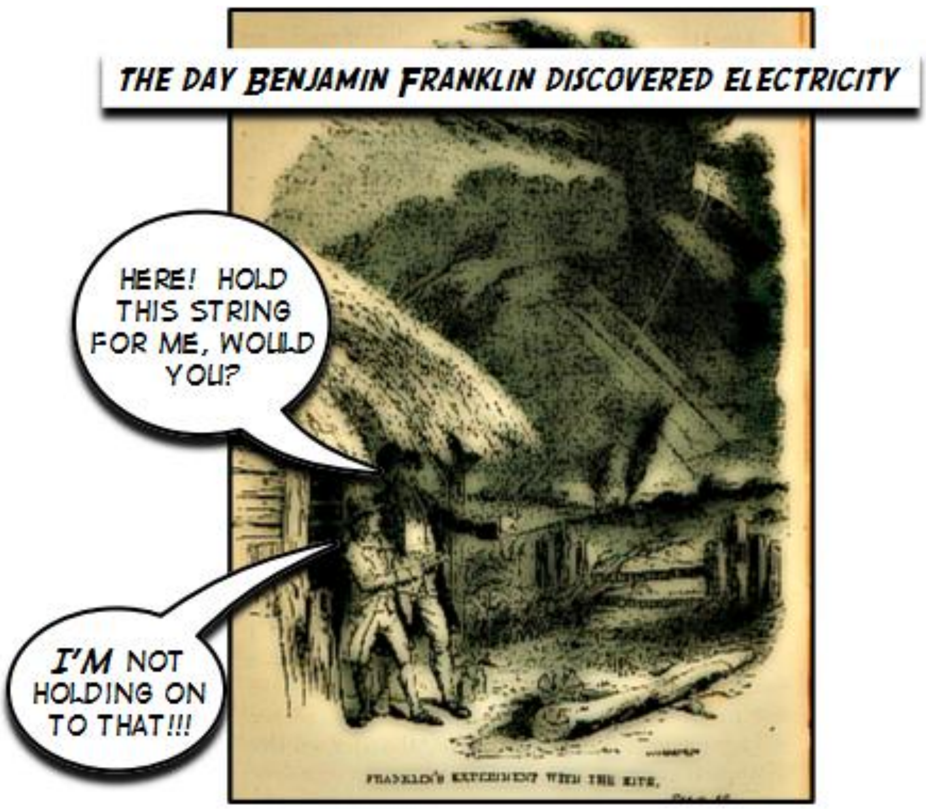
If you have not yet heard the thunder yet, start over and count to five again! Every time you can count to five after you see flash of lightning, you will know it is one mile away! So, if you can count to ten, the lightning is two miles away!

Remember! For every five seconds, the lightning is one mile away! With this information, you can tell if a storm is getting closer to you or farther away! Cool, huh?

Myth #5

Ben Franklin's kite was struck by lightning

Benjamin Franklin is known for a very important (and dangerous) experiment. He was trying to find out if lightning was a form of electricity by flying a kite during a storm. Mr. Franklin was very lucky that his kite was not struck by lightning!



In fact, if his kite was struck by lightning, we would be telling a much different story about Benjamin Franklin today...

...because he may not have survived !

(His experiment should never be repeated by anyone, ever, I mean it!)

In fact, you should know a couple of easy tips about lightning:

#1 - If you can see it, flee it!

(This means if you can see lightning, go inside!)

#2 – If you can hear it, clear it!

(This means if you can hear thunder, the lightning is close by! Start to get ready to leave and "clear" out of the area.)

You can be extra safe while you are inside during a lightning storm by not using the phone or computer. You may not want to take a shower or a bath either. It's not wise to be around water during a lightning storm!

Don't panic! It is very likely that you will never in your life be very close to a bolt of lightning. And if you remember to "flee it when you see it" and "clear it when you hear it" you should be fine!

Next week, you are going to explore the biggest myth of them all! Stay tuned!

Last week you made some predictions about lightning. I hope you did well! Pull out last week's chapter review and let's see how well you did!

True or false? Write "true" next to all of the following statements that are true. Write "false" next to all those which are false. If false, change the statement to make it true.

____ **Lightning sometimes strikes twice in the same place**

____ **Rubber shoes or rubber tires on a car protect you from being hurt by lightning**

____ **Any objects in a storm can get struck by lightning**

____ **You can tell the distance you are from a thunderstorm by counting one second per mile after the thunder**

____ **Ben Franklin's kite was not struck by lightning**

Which one is right? Circle the correct answer.

1. Which of the following is correct?

a) lightning travels faster than thunder
b) thunder travels faster than lightning
c) sound travels faster than light

2. Where could lightning possible strike?

a) tallest buildings
b) objects near water
c) anywhere

3. Rubber shoes cannot protect you from lightning because...

a) electricity cannot pass through rubber
b) there is a huge amount of energy within lightning
c) electricity only strikes the tallest buildings

4. How fast does thunder travel?

a) five miles per second
b) one mile per second
c) one mile per five seconds

5. What should you do if you hear thunder?

a) keep playing outside
b) get ready to go inside
c) look for the lightning

6. If a building is struck by lightning...

a) it can never be struck by lightning again
b) it could get struck by lightning again very soon
c) it was probably struck by lightning before

CHAPTER 36

You made it! The last week of your reading is finally here! I'm very proud of you!

In this final chapter, you are going to look at the biggest myth of them all… Can you guess what it is?

Well here it is...

The biggest myth of them all is...

....one person cannot change the world!

This is a huge myth because...

YOU CAN MAKE A DIFFERENCE IN THE WORLD !

You may not have a lot of money or a really important job, but you can help the world out a lot!

You have spent a lot of time this year exploring our planet within this textbook.

But your journey does not end here! Now you have to **use** this information every chance you get!

You may be saying to yourself, "But I am only one person... and there are over six billion people on this planet. What could I do to help the earth?"

That is a great question!

Here are some ways you can stop this myth from spreading!

First of all, you have to **believe** that you can make a difference in the world! Even small things that you do around your home helps out the planet! For example...

Do you leave the water running while you brush your teeth?

If you do, you are pouring several gallons of water down the drain every month! Remember, someone in your home is paying to use that water! Use a cup filled with water to rinse your mouth. You can clean off your toothbrush quickly with running water. That doesn't sound too hard, does it?

This simple act could save dozens of gallons of water every year! Good job! Here are some more ways to save water around your home:

- Take shorter showers. A short shower uses less water than taking a bath.
- Don't let the water run while you're washing or rinsing dishes.
- Fill a pitcher with tap water and keep it in the refrigerator instead of running the water until it gets cool enough to drink!
- Clean sidewalks and driveways with a broom--not the water hose!

Here's another one...

By a good bag, or a set of them!

Why? Stop and think about all of the bags that you use all week long that end up being thrown away. You get bags from the grocery store, the library and nearly every other story you go to! That is a lot of bags! And a lot of trash!

Now, if you can't live without that huge amount of bags inside your home, okay! But if you are given the choice between paper or plastic bags, choose the paper bags! You can always recycle them (unlike the plastic bags.)

That brings up our next hint...

Recycle Recycle Recycle !

Glass, paper, metal cans, and some plastics can be recycled! This is good news! By recycling our resources, you are lowering the amount of trash and helping to create new materials. All of those things you recycle are ground up and changed back into items that you use every day.

That's right! The car you drive in may have come from that box full of soda cans you recycled in the past!

And our last hint is...

Get in touch with our green friends !

You guessed it - plants! Go out and plant a tree. Why stop there? Plant a whole forest! They are perfect for our environment!

Not only are trees useful for our survival, they are also pretty to look at!

Now if you do not have enough space to plant a whole forest of trees in your yard, that is okay. Maybe you could try growing a small garden. Gardening is an excellent hobby! What other hobbies do you know of that lets you eat what you collect?!

Now if I could only find a way to grow a chocolate ice cream tree. Yes... that would be perfect!

Don't ever forget...

YOU CAN MAKE A DIFFERENCE IN THE WORLD !

Go out and explore the world around you. With the information you have now, you are ready for much larger adventures into our tiny little planet!

Enjoy yourselves and remember...

...never stop asking questions!

List the eight hints that were given in this chapter on how you can change the Earth!

1)

2)

3)

4)

5)

6)

7)

8)

Now come up with five new ways you can make a difference in the world!

1)

2)

3)

4)

5)

Unit Nine Review

Which one is right? Circle the correct answer.

1. **Which of the following is not correct?**
   a) Our seasons are caused by the tilt of the Earth
   b) It is hot in the summer because we are closer to the sun
   c) We are closer to the sun during the wintertime

2. **Why do we only see one side of the moon?**
   a) Because there is only one side to the moon
   b) The moon rotates once every time it revolves around the Earth
   c) The other side of the moon is always dark

3. **Which of the following is true?**
   a) Large raindrops look like squished balls
   b) Small raindrops look like round balls
   c) Large raindrops look like large round balls

4. **We do not see stars during the day because…**
   a) The stars are not out during the day
   b) The stars are always moving
   c) The light from the sun is too bright

5. **The reason stars appear to move in the sky is because…**
   a) They revolve around our solar system
   b) Earth's rotation makes the stars appear to move
   c) Earth's revolution makes the stars appear to move

Glossary

active volcano	a volcano that erupts all the time
air masses	large areas of air with similar temperatures
air pressure	weight of the air pressing down on the Earth
aluminum	("a-loom-eh-num"); mineral that can be used to make foil
amoeba	("ah-me-bah"); organism (called a "protozoa") which lives inside a thin covering of water around a tiny piece of soil and eats bacteria
asteroids	("ast-ur-oids"); large chunks of rock that are floating in space
astronauts	people who travel in outer space
astronomers	("a-straw-no-murs"); scientists who study the universe
atmosphere	("at-mos-fear"); all the gases that make up our air
atmosphere	sphere which contains all of the wind, gases and storms in the air
atom	smallest part of everything in the world
axis	an imaginary line that connects the north and south poles through a planet

bacteria	tiny organisms that can be found within soil; responsible for decomposing biotic material
balance	an equal amount of two opposite items
bedrock	top layer of solid rock beneath the soil
beryllium	("bur-ill-e-um"); mineral that can be used within a lightbulb to help make it glow
biosphere	sphere which contains all of the living organisms on the planet
biotic resources	living or dead organisms
blue moon	the occurrence of two full moons in one month
burn off	when the heat from the sun causes the top of a batch of fog to evaporate
calcium	("kal-see-um") ; a mineral that helps to build strong bones in your body
carbon dioxide	a gas that our bodies breathe out; most of the air around venus and mars contain this gas
cardinal directions	("card-in-all"); north, south, east and west; a set of directions created to help everyone face the same way
ceiling	("see-ling"); the distance between the Earth and the bottom of a cloud
chain reaction	("ree-ack-shun"); a time in which many interactions are taking place
chemical weathering	takes place when acids cause small parts of rock to dissolve
chromium	("kro-me-um"); a mineral you can find in most shiny metal objects

cirrus	clouds that are very high, thin and see-through
classify	to put into groups
clay	type of soil which contains the smallest pieces of minerals
cleavage	("klee-vuh-j"); flat and smooth sides of a mineral
climate	the normal weather for an area over a long period of time (like 30 years!)
clouds	a visible collection of tiny water droplets or frozen ice pieces floating in the air
cold front	type of front that take place when cold air mass runs into a warmer air mass
comet	("cah-met"); a chunk of ice, gases and dust that spins around a sun; a "dirty snowball"
condensation	("con-den-sa-shun"); the ability to turn a gas into a liquid by removing heat
condensation nuclei	("kon-den-sa-shun nuke-lee-eye"); tiny particles of dust, dirt, smoke, etc. that allow water vapor to hold onto before it can condense to form a cloud
conduction	("con-duck-shun"); the transfer of heat between two objects that are touching
constructive forces	("kon-struck-tiv"); forces like deposition that act to build new land forms
contour plowing	("kon-tour"); to dig small trenches or valleys into the soil around a hill in order to plant seeds
convection	("con-duck-shun"); the transfer of heat through a gas or liquid that is in motion

convection currents	areas of warm air rising from the surface of the Earth
convergent boundaries	(“kon-vur-gent”) ; areas where two tectonic plates are crashing together
copper	mineral that can be used in wires
core	the very hot center of the Earth that is made up of different kinds of metals
coriolis effect	("core-ee-o-liss"); the curving motion of our wind around the Earth as it rotates on its axis
corona	a bright ring of light that encircles the moon when it is completely blocking the sun's light within the path of totality
cover crops	plants that are grown on unused areas of land
craters	bowl-shaped holes found on the moons and other terrestrial planets when meteoroids, comets and asteroids smashes into its surface
crescent	"curved shape"
crust	the outside area of our planet
crystal	a solid material that has all of its molecules lined up, in a pattern
cumulus	clouds that have flat bottoms and large, puffy shapes (almost like cotton balls)
cycle	a pattern that can happen over and over again
cyclone	(“sigh-clone”); low pressure area at the center of all storms; the air inside these low pressure areas are spiraling upwards into its center
day	the time it takes for a planet to make one rotation on its axis

decomposers	organisms that break down dead organisms into smaller pieces
deposition	the change of state of a gas directly into a solid; frost is a product of deposition which occurs when the dewpoint falls below the freezing point of water
deposition	deposits of soil, sand and rocks that have been dropped off by moving water
destructive forces	("dee-struck-tiv"); forces like weathering and erosion which break things down
dew	condensed water on objects on the surface of the Earth whose temperature has reached the dewpoint temperature
dewpoint	the temperature in which a gas is able to condense
disk	a round-shaped object
dissolve	melt away
divergent boundaries	("die-vur-gent"); areas where two tectonic plates begin to move away from each other
dormant volcano	a volcano that has erupted a long time ago
Earth	our home planet, the third planet from the sun
earthquake	a vibration (think of a vibration as a "shaking") that moves through the Earth's crust
earthworms	organisms which move through the soil by swallowing soil, along with its bacteria and amoeba
energy	the ability to do work
equator	("ee-quay-tor"); an imaginary line that divides a planet into two equal sides, each of these sides is called a hemisphere

erosion	the moving of rocks and soil to another place
evaporation	("ee-vap-or-a-shun"); the complete separation of molecules from each other from a liquid into a gas
events	changes in any of Earth's spheres
extinct volcano	a volcano that has not erupted in recorded history
faults	huge cracks in the Earth's crust
fixing nitrogen	the ability of a bacteria to turn the nitrogen gas in the soil into form that a plant can use
flow	the movement of an object
fog	a cloud that forms near the ground as the air temperature at the surface cools to the dewpoint temperature
fracture	("frak-chur"); rough and jagged sides of a mineral
freezing	ability of molecules to stick to each other to turn a liquid into a solid by removing heat
front	the area where a cooler air mass and a warmer air mass join
fungus	("fun-guy"); organism in the soil which decomposes biotic material; much larger than bacteria
galaxies	("gal-axe-eez"); a large group of gas, dust and many stars; there are billions of galaxies in the universe
gas giants	planets which do not have much (if any) solid ground at all; the gas giants in our solar system are Jupiter, Saturn, Uranus and Neptune
geologists	("gee-all-o-jists"); scientists who study the Earth
geology	("gee-aul-o-gee"); the study of the Earth and its rocks and minerals
gibbous	"gib-us"; to swell

glaciers	large sheets of ice that slowly slide down a mountain, causing large amounts of erosion
gneiss	("neese"); a type of metamorphic rock that is formed from schist
granite	("gran-it"); a type of igneous rock that is made up of the minerals quartz, feldspar and mica
gravity	("gra-vi-tee"); a force that pulls objects towards each other in space
greenhouse effect	the ability of greenhouse gases like water vapor to absorb and reflect heat from Earth
greenhouse gas	a gas that is able to absorb and reflect some of the heat that is given off from the Earth
h20	the chemical formula for water
halite	("hal-ite"); the mineral name for salt
harvest	to pick crops
hemisphere	("hem-es-fear"); equal sides of a planet, divided by an equator
high air pressure	areas where there is much more air crammed into a small part of the atmosphere
high clouds	clouds with ceilings that are at least 20,000 feet
humidity	("hue-mid-a-tee"); amount of water vapor in the air
humus	layer of "dead stuff" that is found inside topsoil which is always decomposing into smaller pieces
hydrogen	("hi-dro-jen"); the most common chemical found in the known universe
hydrosphere	sphere which contains all of the water in the Earth whether in the air, on land or in the sea

igneous rock	("ig-nee-us"); a type of rock that is formed when molten rock (magma) is cooled and hardened
infrared light	a form of light given off by the sun which we cannot see but can feel as being warm
interaction	("in-tur-ack-shun"); when one sphere causes changes in another sphere
iron	a mineral used by your blood to carry oxygen all over your body
Jupiter	("joo-pit-er"); one of the gas giants in our solar system; the largest planet in our solar system; may have more than 39 moons; the temperature on this planet is about -211°F; most of the gas on this planet is hydrogen
land clearing	the movement of land to create new buildings
lava	magma that has reached the Earth's surface
limestone	a type of sedimentary rock used for making concrete, toothpaste, soap, paper and thousands of other items
lithosphere	sphere of the Earth which contains all of the solid land (rocks, minerals and soil) that can be found on the Earth's crust
low air pressure	areas where there is very little air crammed into a small part of the atmosphere
low clouds	clouds with ceilings under 6,500 feet
lunar day	the time it takes for the moon to rotate once on its axis; 27 days

lunar eclipse an event in which the Earth gets in between the sun and the moon, causing a shadow that can be seen on the moon

lunar orbit one complete revolution of the moon around the Earth; approximately 29.5 days; contains all of the lunar phases

luster the ability of a mineral to shine

magma molten rock

mantle large area of the Earth under the crust; this area contains large amount of solid and melted rock

marble a type of metamorphic rock formed from limestone

Mars the fourth planet from our sun; the coldest of all the terrestrial planets (about -80°F); known as the "red planet" because of its color; two moons orbit this planet; the air around this planet is filled with carbon dioxide gas

melting the ability to make molecules slide around each other to make a fluid from a solid by adding heat

Mercury ("mur-cur-ee"); the closest planet to our sun; does not have a moon; it is less than half the size of Earth; it has no air; and, the temperature of the ground reaches 800°F

metamorphic rock ("met-a-morf-ick"); type of rock that is formed from heat and pressure within the Earth

metamorphosis ("met-a-morf-o-sis"); a change

meteor ("meet-ee-or"); "shooting stars" or "falling stars"; falling meteoroids that move so quickly through the air that they get very hot and burn up, leaving a glowing trail behind them in the air

meteorite	("meet-ee-or-ite"); the name given to a meteor that does not burn up in the air and smashes into the ground
meteoroids	("meet-ee-or-oids"); smaller chunks of rock (less than 20 feet long) that float around in space
meteorologists	("me-t-or-ol-o-gist"); scientists who study how the sun warms the Earth which causes our weather
middle clouds	clouds with ceilings between 6,500 and 20,000 feet
Milky Way galaxy	the name of the galaxy that we live in
mined	process by which natural resources are removed from the Earth
mineral	a solid that is made up of a group of the same atoms or molecules
molecule	("maul-ee-koo-el"); two or more atoms joined together
months	measurement of time on Earth that is closely related to the lunar day
moons	large bodies of rock that orbit a planet
Neptune	the last gas giant in our solar system; the eighth planet from the sun; contains at least eleven moons and four rings of ice; most of the gas on this planet is made up of hydrogen and it is very cold...-346°F
north pole	the most northern spot in the northern hemisphere
occluded front	("oh-klu-dead"); type of front in which the cooler air mass from a cold front runs into the cooler air mass inside a warm front
orbit	the movement of an object around a sun

parent material	original layer of bedrock in an area; responsible for providing most of the minerals within the soil
partial eclipse	an incomplete eclipse for all people within the penumbra during a solar eclipse; in this area, part of the sun can still be seen as the moon passes over only part of the sun
path of totality	the path of the moon's shadow during a solar eclipse
penumbra	an incomplete shadow that passes over the Earth during a solar eclipse
phosphate	("foz-fate") ; an important mineral that plants use to grow
phylite	("fi-light"); a type of metamorphic rock that can be turned into schist (a metamorphic rock) under a lot of heat and pressure
physical weathering	takes place when the weather causes rocks to be worn down, cracked or broken
pipe	the path that magma takes from the mantle through the crust
planets	very large round bodies of rock or gas that orbit around stars
Pluto	("plew-tow"); the ninth planet in our solar system; this planet is very small and it is made up of ice and rock
pollution	("pole-loo-shun"); an unwanted item or items that can be found in the air, water or soil
potassium	("po-tass-e-um"); a mineral that helps keep your muscles strong
precipitation	("pre-sip-eh-tay-shun"); falling droplets of liquid water or frozen ice

processed	method of taking minerals out of a rock
pumice	("pum-iss"); an igneous rock that can float on top of a container of water
radiant energy	also known as "light energy"; most of the energy we receive from the sun is a form of radiant energy
radiation	("raid-e-a-shun"); the main transfer of heat from the sun to the Earth
reflects	bounces
revolving	when an object moves around another object (for example… when a planet orbits a sun, it is revolving around the sun)
rock	a mixture of two or more minerals
rock cycle	the recycling of rocks (and the minerals inside them)
rotating	when an object spins around, like a top
salination	When an area of soil becomes very full of salt
sandy	type of soil which contains the largest pieces of minerals (sand)
satellite	any object that orbits a larger object
Saturn	a gas giant within our solar system; the sixth planet from the sun; much larger than Earth; most of the gas found on this planet is hydrogen; contains at least 47 moons and a thick band of seven rings (containing small pieces of ice) that surround the planet; the temperature of this planet is -285°F
schist	a type of metamorphc rock that can be turned into gneiss (a metamorphic rock) under a lot of heat and pressure

season	one of four parts of the year that have (roughly) the same temperature and amount of daylight and nighttime
sedimentary rock	("said-eh-men-tary"); a type of rock that is formed from the weathering, erosion and deposition of the Earth's crust
sediments	tiny rocks, mud and sand that is eroded from the Earth's crust; used to form sedimentary rocks
seismic waves	the energy that spreads through the Earth's crust during an earthquake
seismologists	("size-maul-o-jists"); scientists who study earthquakes
shale	a type of sedimentary rock that can be turned into slate (a metamorphic rock) under a lot of heat and pressure
silica	("cil-ih-kah") ; mineral that can be used in soap and toothpaste
silty	type of soil which contains medium-sized pieces of minerals
silver	mineral that can be used in expensive forks, knives and spoons
slate	a type of metamorphic rock formed from shale that can be turned into phylite (a metamorphic rock) under a lot of heat and pressure
soil	a mixture of minerals and biotic material found on the outside of our crust which is responsible for all plants to grow
soil horizon	different layers in the soil which are stacked on top of each other
soil profile	all of the layers in the soil in a particular area
soil texture	("tecks-ture"); appearance of soil based on the size of the minerals found within it

solar eclipse	an event in which the moon gets in between the sun and the Earth causing a shadow that can be seen on the Earth
solar system	("so-lar sis-tem"); all of the planets, asteroids, meteoroids and comets that orbit a star
south pole	the most southern spot in the southern hemisphere
speed of light	the speed in which light travels from the sun; 186,000 miles per second
sphere	a ball-shaped object (3D)
sphere	a category made by scientists to describe four different areas of the Earth - living organisms, solid Earth, liquid water and all of the gases
stars	huge balls of hot gas that give off a large amount of energy (like heat and light)
states of matter	different forms of matter; a solid, liquid or gas
stationary front	a front that is not moving
stratus	clouds that are long, flat and seem to fill up the sky like a large sheet
streak	("streek"); colored line that remains after a mineral is rubbed against a white object
subsoil	soil horizon directly below the topsoil
summer solstice	the day of the year in the Northern Hemisphere where we receive the most light in one day; this occurs when our orbit around the sun points the northern hemisphere most towards the sun on June 21st
sun	our nearest star

sunrise	the time when the sun can be seen for the first time in the morning
sunset	the time when the sun can no longer be seen at the end of the day
sunspots	small, cooler areas on the sun that appear darker in color
symbiosis	("sim-by-o-sis"); the ability of different kinds of organisms to work together in order to survive
system	a collection of all spheres which work together in any area of the Earth
tectonic plates	large pieces of the Earth's crust that fit together like a jigsaw puzzle and float on top of our mantle
telescope	("tell-eh-scope"); a tool that is used to make faraway objects look closer than they are
terraces	the flattened layers of land created by terracing
terracing	("tare-a-cing"); method of cutting many different flattened layers into the ground to form a pyramid shape
terrestrial planets	("tur-rest-tree-ul"); planets that are "Earth-like" or "made of rock"; in our solar system they would be Mercury, Venus, Earth and Mars
the "great red spot"	A huge storm on Jupiter that has lasted for hundreds of years; this storm looks like a swirling group of red clouds that is larger than the Earth
titanium	("tie-tane-e-um") ; mineral that can be used in soap and toothpaste
topography	("toe-pog-gra-fee"); the shape of the land
topsoil	the soil horizons on the top of a soil profile

transform boundaries	places on the Earth where tectonic plates slide past each other
triton	("try-ton"); a moon which orbits neptune; one of the largest moons in our solar system
tsunami	("soo-nam-ee"); very large and fast waves in the ocean caused by underwater earthquakes
tungsten	(“tung-stin”) ;mineral that can be used within a lightbulb to help make it glow
umbra	the shadow caused by the moon during a solar eclipse
universe	("yoon-ih-vurse"); a word we use to describe everything that exists...everywhere
Uranus	("yur-ah-nus"); a gas giant within our solar system; the seventh planet in our solar system; contains at least 21 moons and three small rings of ice; the temperature of this planet is -328°F; most of the gas that makes up this planet is hydrogen
vent	an opening at the end of a pipe that allows magma to reach the surface of the Earth
Venus	("vee-nus"); the second planet in our solar system; it is almost the same size as Earth; does not have a moon; surrounded by air that is filled with a gas called carbon dioxide; the temperature of this planet can reach 870°F
vibration	(“vi-bray-shun"); a shaking motion
visible light	all of the light that can be seen (i.e. all of the colors of the rainbow)

volcanic islands layers of hardened lava from underwater volcanoes that are sticking out of the ocean

volcano any place on a planet where something from the inside of the planet is moving through its crust

waning occurs when the amount of light reflecting off of the moon is getting smaller

warm front type of front where a warm air mass is moving into a cold air mass

water cycle pattern in which water travels throughout the environment

water vapor (steam) the gaseous state of matter for water

waxing occurs when the amount of light reflecting off of the moon is growing

weather our day-to-day patterns of temperature, wind, precipitation, etc.

weathering a natural method that breaks apart large rocks into smaller rocks

weightlessness also known as microgravity; a smaller amount of gravity; when astronauts are "floating" in space, gravity is not pulling on them very much, making them "weightless"

wind air in motion; affected by differences in air pressure as air moves from high pressure areas to low pressure areas

windbreak a row of trees planted on the edge of a farm; roots of trees do a very good job in holding the topsoil together and the trees themselves block wind from eroding the field

winter solstice the day of the year in the Northern Hemisphere where we receive the least amount of light in one day; this occurs when our orbit around the sun points the northern hemisphere farthest away from the sun on December 21st

work pushing or pulling something to make it move

year the time it takes for a planet to make one revolution around its sun

zinc ("zing-k"); a mineral used by your immune system to help you stay healthy

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