Student Name: _____

5th Grade Science
Distance Learning Packet
Week 4

Directions:

Daily Directions

1. Read each passage.
2. Complete the following comprehension questions.
3. Students should complete approximately 5-6 pages per day.

Note- The work increases difficulty throughout the week.

Contact Information:

Teacher Contact Information

School Contact Information

How Do Earth and Its Moon Move?

Earth makes one complete trip around the sun in a year. While orbiting the sun, Earth also turns on an imaginary line called an axis. With each rotation, or turn, on Earth's axis, there is one period of daylight and one period of night. Earth's axis is tilted slightly from its orbit. This tilt and Earth's orbit around the sun cause Earth's seasons.

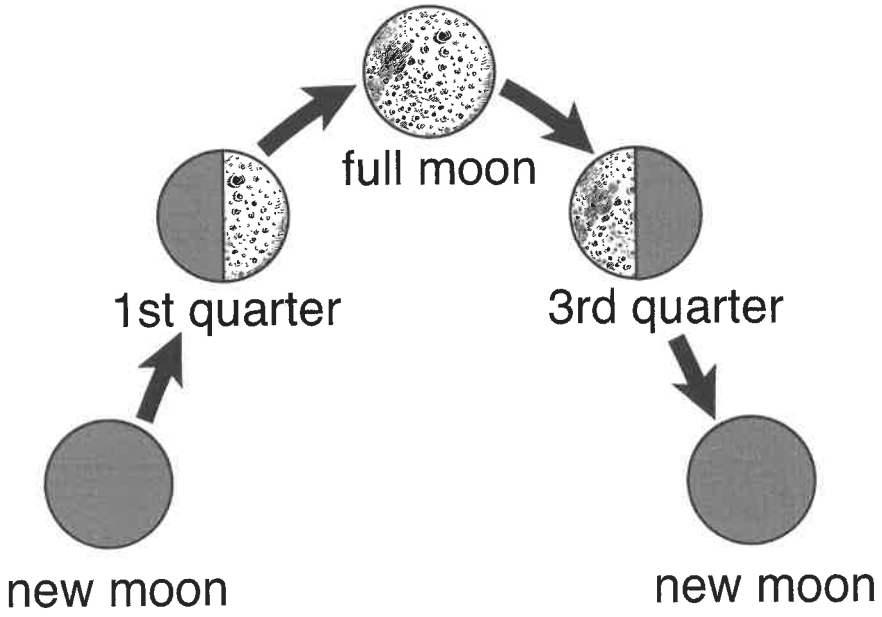
As Earth orbits the sun, different parts of it are tilted toward the sun. When the northern half of Earth tilts toward the sun, it is summer there. Sunlight hits that part of Earth more directly. The period of daylight is longer. The air is warmer.

When the northern half of Earth tilts away from the sun, it is winter there. Sunlight hits that part of Earth less directly. The period of daylight is shorter. The air is colder.

How the Moon Moves

When you look at the moon, you always see the same craters and mountains. You see the same things because the same side of the moon always faces Earth.

Why does the same side of the moon always face Earth? Like Earth, the moon rotates on its axis. The moon rotates once every 27.3 days. The moon also orbits Earth once every 27.3 days. Because these two things take the same amount of time, the same side of the moon always faces Earth.



The different ways the moon looks are called the phases of the moon.

You have probably noticed that the moon seems to change shape from one night to the next. Why? The moon does not make its own light. It reflects, or sends back, light from the sun.

Half of the moon is almost always in sunlight. As the moon orbits Earth, the amount of the lighted side facing Earth changes. These changes cause phases of the moon. Sometimes you see just a small part of the moon's sunlit side. This is when the moon looks thin. Sometimes you can't see any of the moon's sunlit side. This is called a new moon.

The moon is not lighted by sunlight during a lunar eclipse. A lunar eclipse occurs when the moon passes into Earth's shadow. This happens two to four times a year.

Comparing Planet Movements

Earth rotates on its axis once each day. The other planets also rotate, but not at the same speed. The table shows how long it takes for each to rotate. All eight planets also orbit the sun. Each revolution, or trip around the sun, is a year. But the length of a year is different for each planet.

Rotation and Revolution

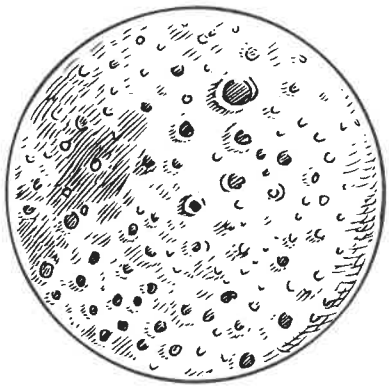
Planet	Period of Rotation (in Earth hours or time)	Period of Revolution
Mercury	59 days	87.9 days
Venus	243 days	225 days
Earth	23 hours, 56 minutes	365.25 days
Mars	25 hours	1.88 years
Jupiter	9 hours, 55 minutes	11.86 years
Saturn	10 hours, 40 minutes	29.46 years
Uranus	17 hours, 14 minutes	84 years
Neptune	16 hours, 6 minutes	164.79 years

Name _____ Date _____

How Do Earth and Its Moon Move?

Write answers to the questions on the lines below. Use the diagram below to answer the first question.

Moon

Temperature	Day: 123°C (253°F) Night: –233°C (–387°F)	
Diameter	3,476 km (2,085 mi)	
Distance from Earth	384,400 km (230,600 mi)	
Length of day	About $29\frac{1}{3}$ Earth days	

1. What can you conclude about the moon's temperature compared to Earth's temperature?

_____

2. What are phases of the moon?

_____

_____

3. When is the only time the moon is not lighted by sunlight?

_____

4. Why do other planets have days that are longer or shorter than days on Earth?

_____

_____

Name _____ Date _____

5. **Main Idea** The sun shines more directly in the northern part of Earth during which season?

_____

6. **Vocabulary** Write a sentence using the term *phases of the moon.*

_____

_____

7. **Reading Skill: Cause and Effect** Explain why a year on Neptune is much longer than a year on Earth.

_____

_____

8. **Critical Thinking: Analyze** Suppose a new planet were discovered between Jupiter and Saturn. What can you infer about the length of the new planet's year?

_____

_____

9. **Inquiry Skill: Experiment** Suppose Earth's axis became more tilted than it already is. How would this affect Earth's seasons? Make a model using a globe and a flashlight to test your ideas.

_____

_____

10. **Test Prep** The phase of the moon when none of the lighted side is visible from Earth is called a

A new moon.

B full moon.

C first quarter.

D third quarter.

What Are Stars and Galaxies?

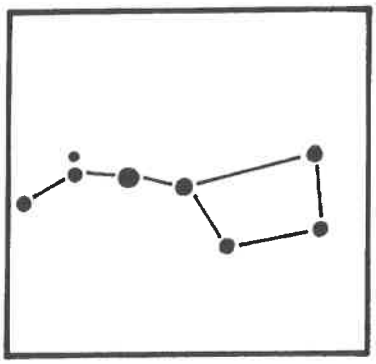
What Are Stars and Galaxies?

A star is a huge ball of very hot gases. It gives off light, heat, and other kinds of energy. Stars can be grouped by their size, color, brightness, and temperature, and they can shine for billions of years.

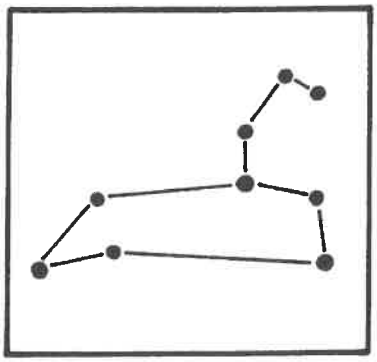
The sun is a star that is medium in size and brightness. Many other stars are larger and brighter. Why does the sun look so much brighter than any other star? The reason is that the sun is much closer to Earth than any other star. Light from the sun takes about eight minutes to reach Earth. In comparison, light from the next closest star takes over four years to reach Earth. The sun's energy has been giving Earth light and heat for 4.5 billion years.

Constellations

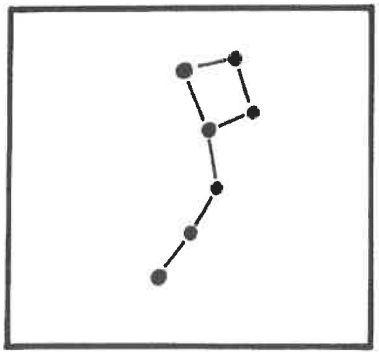
A constellation is a group of stars that forms a pattern in the night sky. One well-known constellation is called Ursa Major, which means "Great Bear." Some of the stars in Ursa Major make up another group of stars called the Big Dipper. There are many other constellations as well, including one that looks like a lion and another that looks like a hunter. The sky is full of constellations.



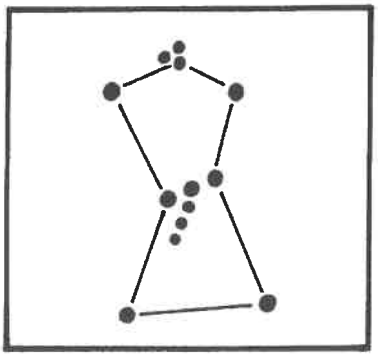
Big Dipper



Leo the Lion



Little Dipper



Orion the Hunter

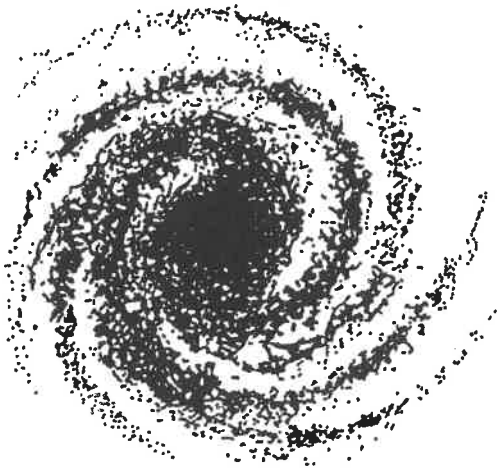
Have you ever looked at a bright star early in the evening? If you look for it again later that night, it will seem to be in a different spot. The stars do not actually move, however; it is the rotation of the Earth that causes their apparent movement. As Earth rotates on its axis, you see different parts of the sky. As a result, the stars look like they are moving across the sky at night. There are stars in the sky during the day as well, but the brightness of the sun makes it impossible for you to see them.

Galaxies

The sun, the planets, and the moons are part of the solar system. The solar system is part of a larger group, too. It is part of a galaxy, which is a huge system, or group, of stars held together by gravity.

The solar system is in a spiral-shaped galaxy called the Milky Way. The stars and planets that you see at night are in the Milky Way. Not all galaxies are spiral shaped, however. Some are oval or round, and others are irregular.

The universe is made up of all the matter and energy there is, including all the galaxies and their stars, planets, and moons. There are billions of galaxies in the universe, and no one knows how big the universe truly is. Scientists have discovered that it continues to grow larger and larger.



Name _____ Date _____

What Are Stars and Galaxies?

Fill in the blanks.

1. Four ways that stars can be classified are _____

_____.

2. The sun appears brighter and larger than other stars because it

_____.

3. The sun is a star that is medium both in its _____ and its

_____.

4. The Big Dipper is a _____.

5. Stars appear to move because _____.

6. The brightness of the sun makes it impossible to _____

_____.

7. A galaxy is _____

_____.

8. The Milky Way is _____

_____.

9. There are billions of galaxies in the _____.

Name _____ Date _____

10. Main Idea What objects can be found in a galaxy?

_____

_____

_____

11. Vocabulary Write a sentence about the universe. Be sure to use the terms *galaxy* and *stars*.

_____

_____

12. Critical Thinking: Analyze Suppose the Sun were bigger and brighter. What would happen to Earth?

_____

13. Inquiry Skill: Observe Choose a picture from this lesson. Study the picture and write a detailed description of what you see.

_____

_____

_____

_____

14. Test Prep A constellation is a

A young, growing star that is new to the universe.

B ball of extremely hot gases that gives off energy.

C group, or system, of stars held together by gravity.

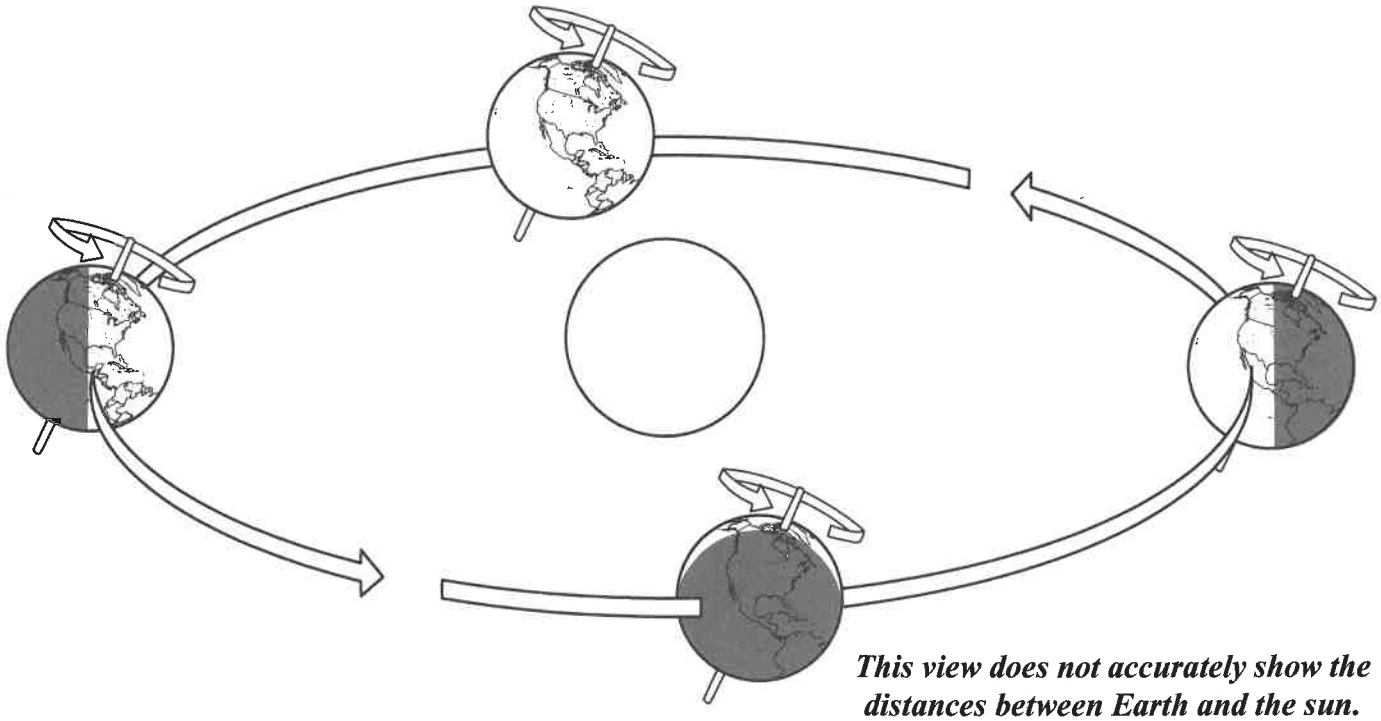
D group of stars that forms a pattern in the night sky.

What Causes Day and Night?

When students in the United States arrive home from school, it is already the next day in China. How is this possible? Planets revolve, or move in a path, around the sun. At the same time, planets rotate, or spin. Each planet spins around an axis, or an imaginary line that goes through the center of an object. Earth's axis goes through the North and South Poles.

Imagine the sunrise where you live. Although it appears that the sun is rising in the east, Earth is really just rotating on its axis. Your side of Earth is just beginning to face the sun, which signals that morning has begun. The side of Earth that faces the sun has daylight.

As the day goes on, the sun seems to move across the sky. In reality, however, Earth's rotating just makes it look that way. Earth continues to rotate throughout the day, and your side of Earth gradually turns away from the sun. As the sun appears to set in the west, your side is facing away from it. This signals the beginning of nighttime on your side of the world.



This view does not accurately show the distances between Earth and the sun.

Day and night happen because Earth rotates on its axis. As Earth spins, it revolves around the sun.

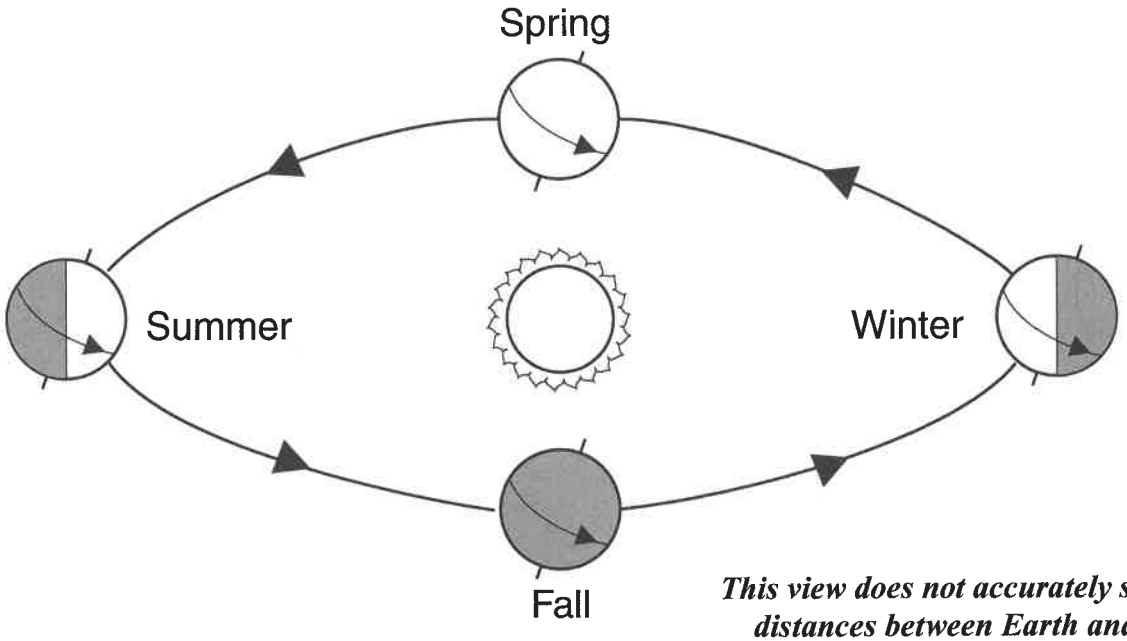
Days and nights do not always last the same amount of time. Their length is different on different parts of Earth, and it also changes during the year. The reason why this occurs is that some parts of Earth face the sun longer than other parts do.

Because Earth's axis tilts, the part of Earth tilted toward the sun gets more hours of light. Therefore, its day is longer. The part of Earth tilted away from the sun gets fewer hours of light, causing its night to be longer.

Earth continuously revolves around the sun. As Earth revolves, different parts are tilted toward the sun.

In June, the North Pole is tilted toward the sun. Places north of the equator face the sun for many hours each day. Because they do not face away from the sun for as long, they have more hours of daylight. This means that they also have fewer hours of darkness.

In December, the North Pole faces away from the sun. Places north of the equator face away from the sun for more hours than they face toward it, which results in more hours of darkness than daylight.



This view does not accurately show the distances between Earth and sun.

In summer, the North Pole faces toward the sun. In winter, the North Pole faces away from the sun.

Name _____ Date _____

What Causes Day and Night?

Write answers to the questions on the lines below.

1. Describe how Earth moves.

_____

2. Describe planets' movements when they rotate.

_____

3. What effect does Earth's rotation have on the planet's time of day?

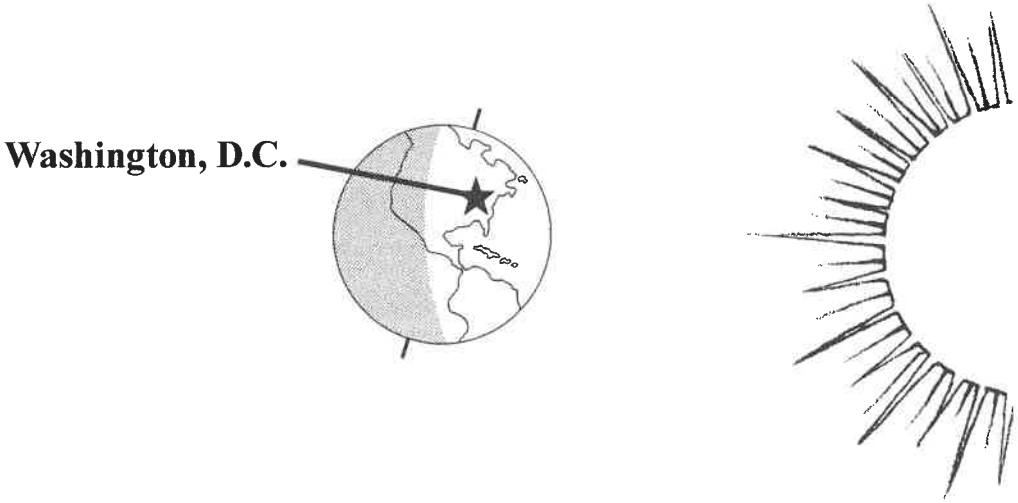
_____

_____

4. Why does the length of day and night change throughout the year?

_____

Use the diagram to answer the question below.



5. What are two things you can infer about Washington, D.C., based on Earth's position? Explain.

_____

Name _____ Date _____

6. **Main Idea** Why does the sun appear to move across the sky?

_____

_____

7. **Vocabulary** If you spin a top that stays in one place, are you causing the top to rotate or revolve? Explain.

_____

_____

8. **Reading Skill: Cause and Effect** What is one effect of Earth's axis being tilted?

_____

9. **Critical Thinking: Apply** Sydney, Australia, is south of the equator. In January, the South Pole is tilted toward the sun. In Sydney, are there more hours of daylight or darkness in January? Explain.

_____

_____

10. **Inquiry Skills: Use Models** Describe how you could make a model of Earth revolving around the sun.

_____

_____

11. **Test Prep** How does Earth move?

A It only revolves.

B It only rotates.

C It rotates and revolves.

D It rotates in the morning and revolves at night.

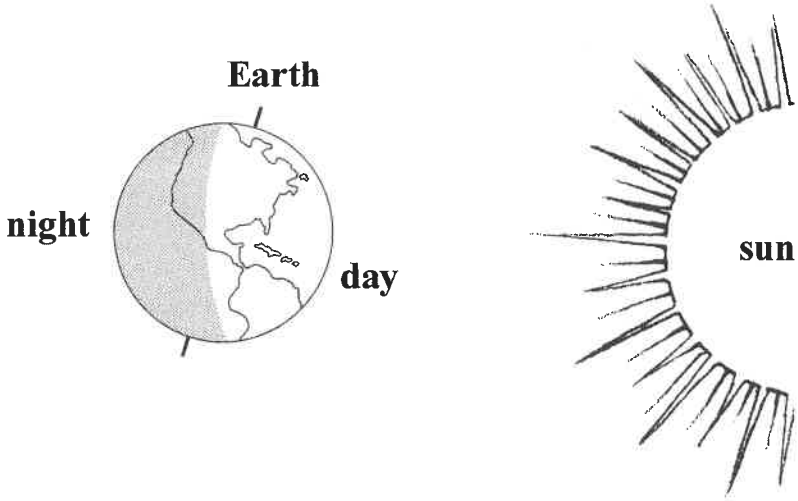
What Causes Earth's Seasons?

You know that Earth rotates on its axis, causing day and night. Earth also revolves around the sun, causing the seasons.

Earth's Tilted Axis

Remember, Earth always rotates, or spins around, on its axis. The axis is like a line that goes from the North Pole through the center of Earth to the South Pole. This line is not straight up and down. It is tilted.

It takes 23 hours and 56 minutes for Earth to rotate once around. This time period is called a day. As Earth rotates, different parts face the sun. Remember, the side of Earth facing the sun has daytime. The side facing away from the sun has nighttime.



Earth also moves around the sun. One full trip around the sun is called a revolution, which takes a year, or $365\frac{1}{4}$ days.

Because Earth's axis is tilted, some parts of Earth are tilted toward the sun while other parts are tilted away. It is summer in the parts of Earth tilting toward the sun. It is winter in the parts of Earth tilting away from the sun.

Solstices and Equinoxes

On June 21 or 22 in the Northern Hemisphere, the North Pole points *toward* the sun. This is the summer solstice. It is the longest day of the year and marks the start of summer. At the same time, in the Southern Hemisphere it is winter because the South Pole is pointing away from the sun.

The shortest day of the year is the winter solstice on December 21 or 22. This marks the start of winter. The North Pole points directly *away* from the sun.

There are two equinoxes each year. On these days there is the same amount of sunlight and darkness everywhere on Earth. The vernal equinox is in March and marks the start of spring. The autumnal equinox is in September and marks the start of fall.

Seasons

All places on Earth have four seasons: spring, summer, fall, and winter. Not all places on Earth feel the seasons in the same way.

Near the poles, the sun's rays hit at sharp angles. These places, such as McMurdo, a research station in Antarctica, have cold weather all year long. Near the equator the sun's rays hit more directly. These places, such as Panama City, have mostly warm weather.

Some places feel the seasons more strongly. Chicago, Illinois, and Santiago, Chile, are about halfway between the equator and a pole. Their temperatures go up and down a lot. This shows that a place's position on Earth has a big effect on the place's weather and seasons.

Ideas About the Sun

Hundreds of years ago, people had ideas about the sun that were wrong. For example, people used to think that Earth was the center of the universe. They thought the sun revolved around Earth.

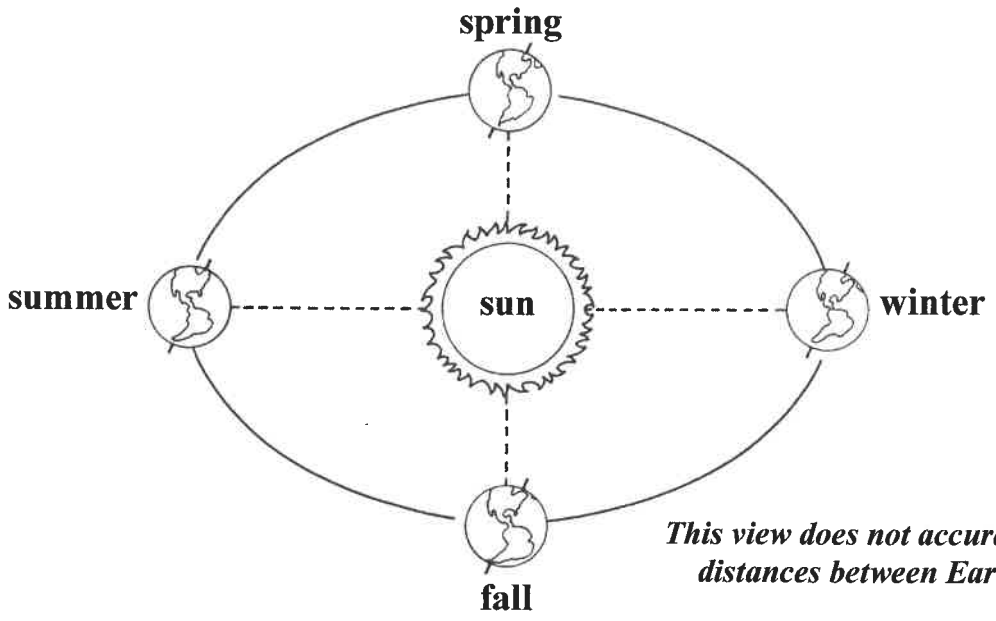
Galileo was an astronomer. An astronomer is a person who studies the skies. In the 1600s, he wrote a book that said that Earth revolved around the sun. He also explained why this happened. He was arrested for telling others about his idea.

Today, we know that Galileo was correct. Based on his work, scientists can tell where Earth, the sun, and other objects will appear in the sky.

People had other false ideas, too. They thought that the seasons came because of Earth's distance from the sun. We now know that Earth is actually closer to the sun in December than in June, so the Earth's closeness to the sun doesn't cause the seasons. We also know that the seasons are caused by Earth's tilted axis and revolutions around the sun. Because of the tilt, the sun rises higher in the sky. This makes summer days last longer.

Name _____ Date _____

What Causes Earth's Seasons?



This view does not accurately show the distances between Earth and sun.

Fill in the blanks.

1. Seasons change as Earth _____ around the sun on its tilted axis.

2. When it is summer in the Northern Hemisphere, it is

   _____ in the Southern Hemisphere.

3. One full trip of the Earth around the sun is a(n) _____.

4. The longest day and the most light occur on the

   _____.

5. On the summer solstice, the North Pole tilts _____ the sun.

6. The shortest day and the least light occur on the

   _____.

7. Days equal in length occur on the vernal equinox and the

   _____.

Name _____ Date _____

8. **Main Idea** What causes day and night? What causes seasons?

_____

_____

9. **Vocabulary** Compare a solstice with an equinox. What seasons do these events mark?

_____

_____

10. **Reading Skill: Cause and Effect** Chicago, Illinois, lies midway between the North Pole and the equator. Why does Chicago have a wide range of yearly temperatures?

_____

_____

11. **Critical Thinking: Apply** Explain why summer in the Northern Hemisphere occurs when winter occurs in the Southern Hemisphere.

_____

_____

12. **Inquiry Skill: Infer** Why did people who lived hundreds of years ago think that the sun revolved around Earth?

_____

_____

13. **Test Prep** During an equinox, the number of hours of daylight is

A greater than the number of hours of darkness.

B less than the number of hours of darkness.

C the same as the number of hours of darkness.

D sometimes less than and sometimes greater than the number of hours of darkness.

How Does the Sun Affect Earth?

The Sun

The sun is a huge ball of hot, glowing gas. More than 1 million Earths could fit inside the sun! The sun is about 150,000,000 km (93,000,000 mi) away from Earth. It is the star closest to Earth. Life on Earth depends on the sun, which is the main source of Earth's energy.

The sun's gravity keeps Earth and the other planets in orbit around the sun. The sun is very hot. A hot day on Earth may be 38°C (100°F). Inside the sun, the temperature is about 15,000,000°C.

Inside the sun, hydrogen is changed into helium. This change occurs through a process called nuclear fusion. Nuclear fusion gives off huge amounts of energy.

Day and Night

Life on Earth depends on the sun, which is the main source of energy for Earth. Plants need sunlight to grow. Plants use the energy in sunlight to make their own food through photosynthesis. In turn, plants are food for other living things.

From Earth, the sun seems to move across the sky. It rises each morning in the east and sets in the west each evening. The sun seems to move because Earth rotates, just like a top spins. Earth spins on its axis, which is an imaginary line that runs through the center of Earth.

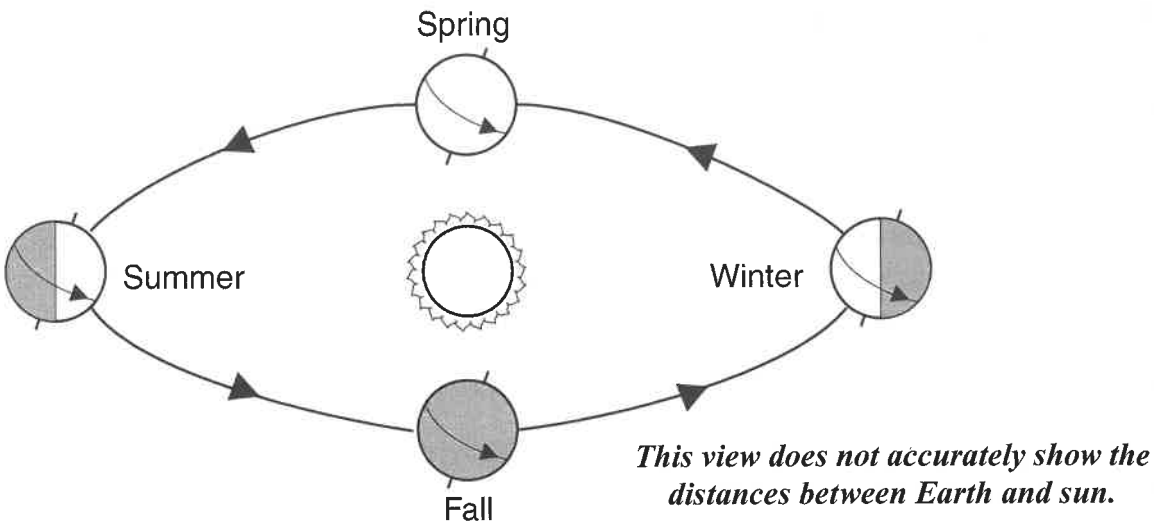
Earth's axis passes through the North Pole and the South Pole. Each complete turn of Earth on its axis is called a full rotation. A full rotation takes one day, or 24 hours. As Earth rotates, one half of the planet faces the sun, so that side has daytime. One half of the planet faces away from the sun, where it is nighttime.

The Year and the Seasons

Earth moves around the sun. This movement is called its orbit. A complete orbit around the sun is called a revolution. Earth orbits the sun in about 365 days, or one year.

Earth's axis is tilted, so sometimes the North Pole points toward the sun. At other times, the North Pole points away from the sun. This causes seasons.

In most places, the weather changes with the seasons. We live in the Northern Hemisphere, which is tilted toward the sun in the summer. The sun's rays hit the ground more directly, so the weather is warm.



Earth's Seasons

In winter, the Northern Hemisphere is tilted away from the sun. The sun is low in the sky, and days are shorter. The sun's rays hit the ground at an angle. This makes the winter days cool. When the Northern Hemisphere is tilted toward the sun, the Southern Hemisphere is tilted away. So its seasons are opposite.

The beginnings of seasons are marked by dates called equinoxes and solstices. These dates are based on Earth's orbit around the sun. Equinoxes are the dates when spring and fall begin. Solstices are dates when summer and winter begin.

During an equinox, the length of day and night is almost equal everywhere on Earth. The days get longer until the summer solstice, the longest day of the year. Then the days get shorter until the fall equinox, when the day and night are equal again. The days continue to get shorter until the winter solstice, the shortest day of the year.

Near the equator, days last about 12 hours all year long. The farther from the equator a place is, the longer summer days are. At the North Pole, the sun may shine all day and all night in summer.

Constellations

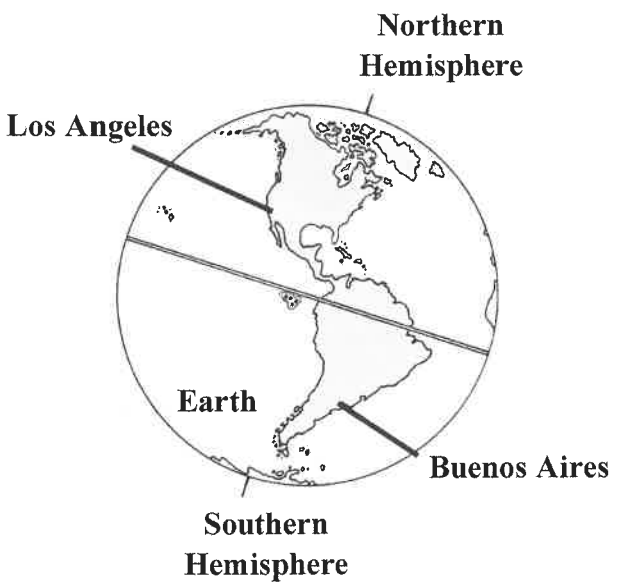
Long ago, people saw shapes or pictures in groups of stars. These groups are called constellations. Asterisms are groups of stars that are parts of constellations. The Big Dipper and Little Dipper are asterisms. They are part of the constellations Ursa Major and Ursa Minor. There are some constellations that can be seen only from the Northern Hemisphere and some that can be seen only from the Southern Hemisphere.

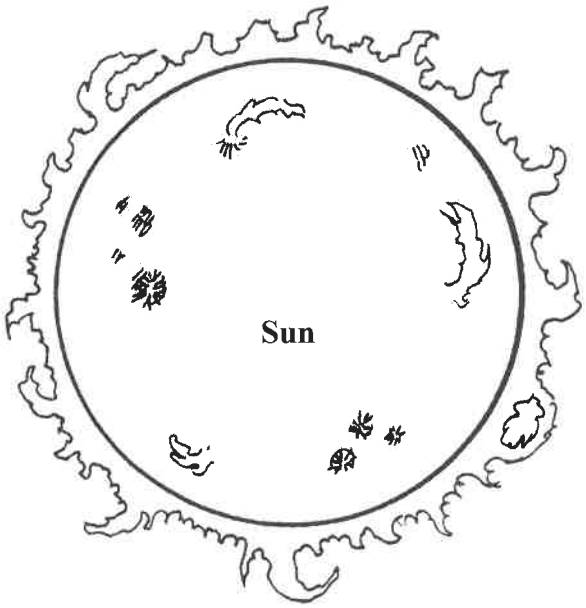
Name _____ Date _____

How Does the Sun Affect Earth?

Fill in the blanks.

1. The sun is the closest _____ to Earth.
2. The sun is essential to life on Earth and is the ultimate source of _____ for Earth.
3. As Earth _____, the half facing the sun has day, while the other half has night.
4. Earth takes one year to complete one _____, or orbit, around the sun.





5. In the diagram above, it is summer in the city of _____.
6. It is winter in Buenos Aires when the _____ Hemisphere is tilted toward the sun.
7. Asterisms are star groupings that form parts of patterns or groupings of stars called

   _____.

Name _____ Date _____

8. **Main Idea** Explain why Earth has seasons.

_____

_____

9. **Vocabulary** What is the difference between Earth's rotation and Earth's revolution?

_____

_____

10. **Reading Skill: Text Structure** List four ways the sun affects Earth.

_____

_____

11. **Critical Thinking: Synthesis** Use what you know about Earth's revolution to explain why a constellation might be seen in the summer sky, but not in winter.

_____

_____

_____

_____

12. **Inquiry Skill: Analyze Data** Light from the sun shines most directly on the equator. Three months earlier, it shone most directly on Earth's Southern Hemisphere. What time of year is it in the Northern Hemisphere?

_____

13. **Test Prep** When would most locations on Earth experience 12 hours of daytime and 12 hours of nighttime?

A summer solstice

B fall equinox

C December

D May

Chapter 7

The Universe

Standards Covered: 5-ESS1-1, 5-ESS1-2

Key Term Activity at the end of the chapter

The Sun

The **sun** is at the center of our solar system. Despite its massive size, the sun is a star. It looks different than the stars you see in the night sky. The tiny lights twinkling in the sky are a contrast to the bright, yellow sun. The reason is not that the sun is genuinely different, but because of the sun's distance to Earth.

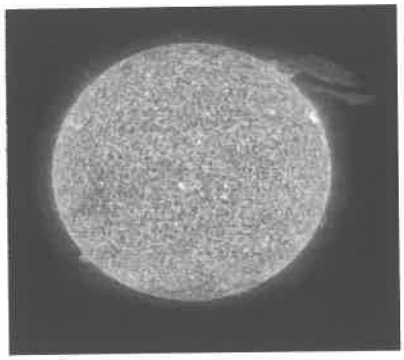


Figure 5.1 The Sun

Sun's Characteristics

The Sun is mostly hydrogen (71% of its mass) and helium (27% of its mass). Smaller amounts of other elements like iron, nickel, oxygen, silicon, sulfur, magnesium, carbon, neon, calcium, and chromium are also in the Sun. **Stars** are huge balls of hot gas. Stars give off energy in the form of light and heat. We see their energy as bright white points in the night sky. You may notice that all of the points of light are not the same. Some are bigger than others. Some are bright and some are dim. In fact, stars are not all white. They can appear in a range of colors.

Class	Apparent Color
O	blue
B	blue
A	blue-white
F	white
G	yellow-white
K	orange
M	red

HOTTEST

COLDEST

The Sun is Earth's primary energy source. All the energy on Earth originates in the Sun. Energy for photosynthesis, weather, climate, the water cycle, and convection currents all come from the Sun. The Sun's remarkable energy comes from nuclear reactions. The Sun is slowly converting hydrogen to helium. This releases vast amounts of energy. This reaction is also very hot. The temperature at the Sun's surface is 5,510 °C. That's 9,950 °F! The Sun is so hot that gas inside the Sun exists as a plasma. **Plasma** is the fourth state of matter. Plasma happens when gas particles become superheated and electrically charged.

The distance from the earth to the sun is 92.96 million miles. That's a long way for something that seems so close. If you flew to the sun in a regular airplane, it would take 19 years to reach it. The sun feels closer because of the warmth we can feel on Earth. The stars are even farther away. The light of many stars, including the sun, takes a long time to reach the Earth. The time is based on their distance from the Earth. The farthest star you can see in the night sky is V762 in the constellation Cassiopeia at 16,308 light-years away (or 9.58686×10^{16} miles). The sun you see now is about eight minutes old because that is how long it takes for the sun's light to reach the Earth. The closest star to Earth is the binary star system Alpha Centauri A and B, which are 4.22 light-years away (2.4808×10^{13} miles).

The Solar System

Our **solar system** is the part of our galaxy that moves around the Sun. The Sun is at the center of the solar system. Objects in our solar system **revolve** (move) around the Sun. The Sun's gravitational force keeps the planets revolving regularly. This **gravitational force** is the attraction that any object of mass has for other objects. The Sun's colossal mass gives it a huge gravitational force. The force of gravity has a big impact on many aspects of the solar system.

Each object in the solar system revolves around the Sun in a unique way. Their paths are called **orbits**. The shape of an orbit depends on the size of the object. The orbit of a planet is slightly oval (almost circular). Other objects in the solar system have very oval orbits.

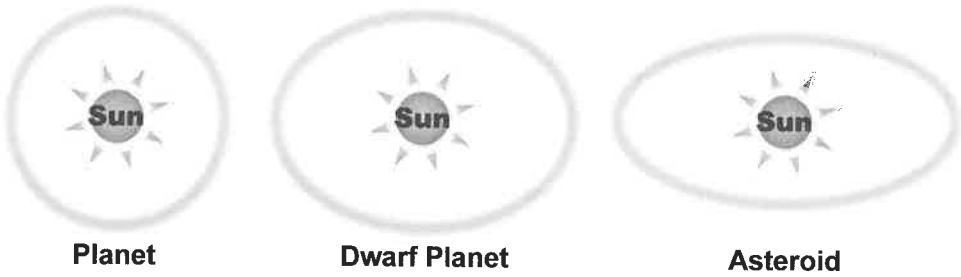


Figure 5.2 The Orbit of Objects around the Sun

Planets and Other Objects

Large objects in the solar system are called **planets**. Objects are called planets when they have enough mass to have sufficient gravity to make them a rounded shape. The force of gravity makes a planet rounder over many millions of years. **Dwarf planets** are much smaller than other planets in the solar system. Their gravitational force is also smaller. This means they are less round than familiar planets like Earth and Mars. In 2008, scientists developed a new category for objects in the solar system, **plutoids**. This is based on planetary shape and orbit. Plutoids must be round. They must also revolve around the Sun in an orbit beyond Neptune. Pluto and Eris are now considered plutoids.

The Planets in our solar system are shown in Figure 5.3.

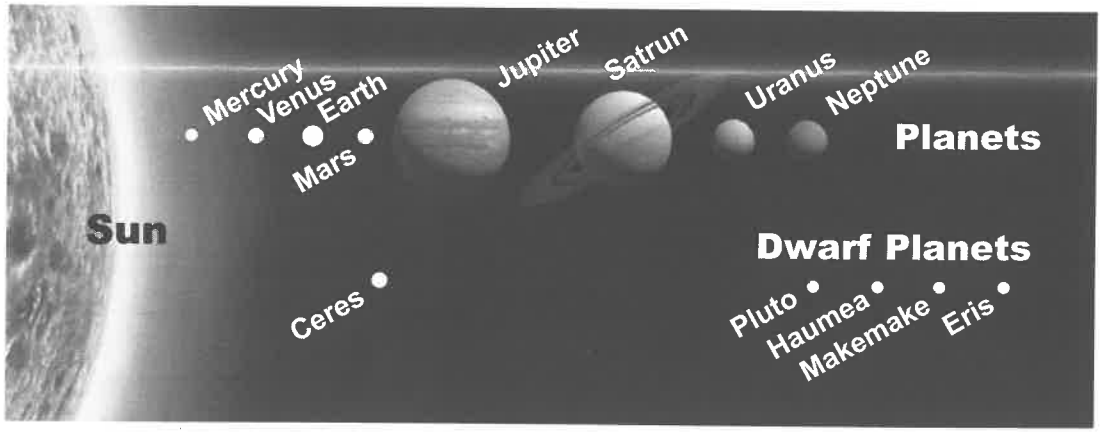


Figure 5.3 The Solar System

Looking at this figure, you should notice three important things:

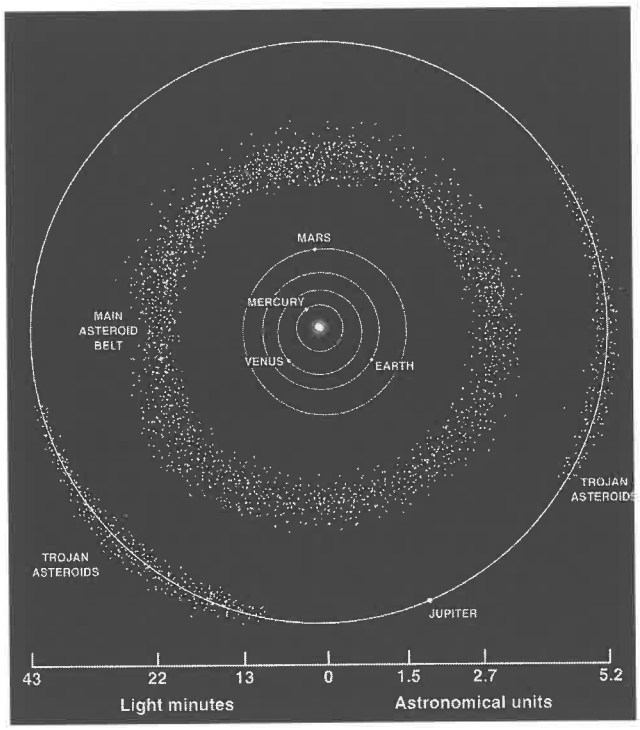
1. **The Sun is much larger than anything else in our solar system**. It has the most mass. This mass means it has the largest amount of gravitational pull in the solar system. The result is everything in our solar system revolves around the Sun.

2. **Our solar system has eight planets**. Pluto and Eris are plutoids. Ceres is a unique object and may be the only one of its kind.

3. **The first four planets are much smaller than the last four planets**. The inner planets, the first four, are called **terrestrial planets** (Mercury, Venus, Earth and Mars). The outer planets, the last four, are called **Jovian planets** or **Gas Giants** (Jupiter, Saturn, Uranus and Neptune).

The Asteroid Belt

Between the orbits of the planets Mars and Jupiter is the **asteroid belt**. Because most of the asteroids in our Solar System are located there, it is called the main asteroid belt. **Asteroids** are large solid bodies made of rock, stone or even ice. Some asteroids contain metals like iron or nickel. Some asteroids are small being only a mile wide. Others are much larger. Ceres, a dwarf planet located in the asteroid belt, is about 950 km (590 miles) in diameter. Other asteroids are just debris made of rock or stone fragments held in orbit by gravity.



Phases of the Moon

Most of the planets in our solar system have moons. **Moons** are smaller objects that revolve around a planet. Moons revolve around the planet they are closest to. They are smaller than their planet. The gravitational pull of that planet has caught them. Some planets have no moons. Some planets have many. For example, Jupiter has 63 moons! Earth's moon, **Luna**, is our only moon.

As the moon revolves around the Earth, its shape appears to change. These changes are called **phases of the moon**. The phases of the moon are produced by the alignment of the moon and the Sun in the sky. Earth's shadow does not cause them. This is a common misunderstanding. Earth's shadow causes lunar eclipses. We see an eclipse when our view of the moon or Sun is blocked. The Earth's shadow has nothing to do with the moon's phases. The side of the moon facing the Sun reflects sunlight. Therefore, the moon is illuminated. The part of the moon visible to us depends on the moon's position relative to Earth.

On its journey from new moon to full moon, the moon is **waxing**. This is just a word that means it looks bigger. It is moving farther away from the Sun. We can see more of its surface because it is farther from the Sun, and more light is being reflected. As it moves from the full moon back to the new moon, it is **waning**. This means it looks smaller. It is moving closer to the Sun. We see less of its surface because the angle between the Sun and moon is tiny and less light is reflected. Look at Figure 5.5 to better understand the phases of the moon.

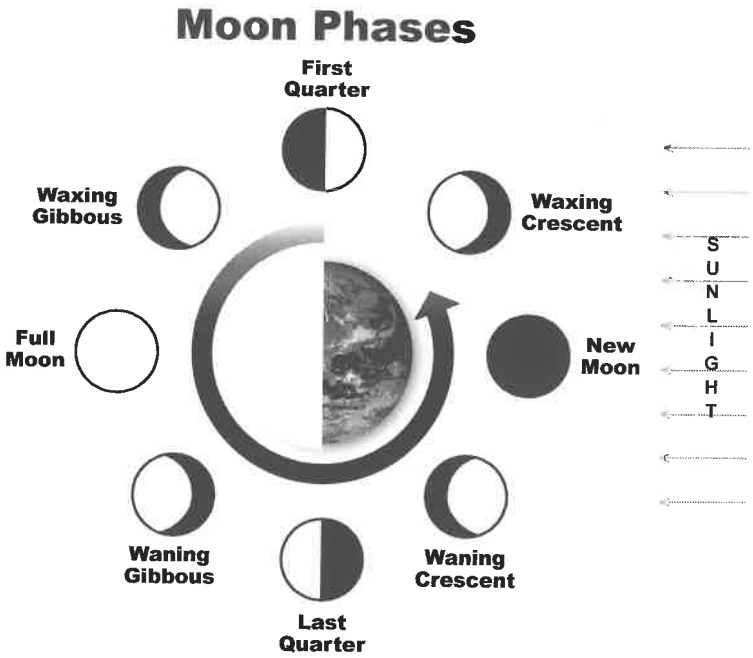


Figure 5.4 Moon Phases

The position of the sun and moon determines the phase of the moon. Follow Table 5.1 and Figure 5.4 as we describe the positions of the moon and Sun for the four major phases.

Position	1	2		4
Phase	New	First Quarter	Full	Third Quarter
Visibility	Tiny Crescent	Half Moon	Full	Half Moon

Table 5.5 Phases of the Moon

The angle between the sun and moon changes with each phase. It is smallest at the new moon. This is position 1 in Figure 5.4. As you can see a new moon, the moon is almost directly between the Sun and the Earth so no light can be reflected for us to see. At first quarter (position 2), the moon is half full. It has moved 1/4 of the way around its orbit.

At full moon (position 3), the moon shines the brightest and is completely lit. It is the farthest from the Sun and is 1/2 of the way around its orbit. You can see from Figure 5.6; the entire surface of the moon is exposed to sunlight. So, lots of light is reflected. Finally, at last quarter position 4), the moon is 3/4 of the way around its orbit. Again, it appears half full in the sky. The moon increases its brightness from right to left. It increases until the moon reaches full. Then, the lighted part decreases from right to left

until new moon. There is about a week between each major phase of the lunar cycle. So, there are 7 to 8 days between new moon and first quarter, between first quarter and full moon, and so on.

How the Earth moves in space may seem unimportant. You might think it doesn't affect you very much. But really it affects you every day and every night. You see, how the Earth moves in space determines days, nights and our seasons. This is because of the Earth's relationship with the Sun.

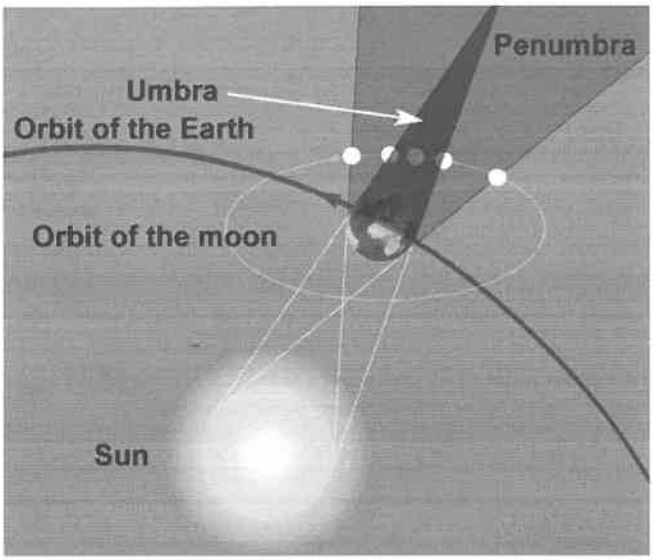


Figure 5.6 Lunar Eclipse Phases

A lunar eclipse occurs when the moon passes through the earth's shadow. A lunar eclipse can only happen when the earth, sun, and moon are aligned. Secondly, the moon must be full to have an eclipse. If all the conditions are met, the earth's shadow is reflected on the moon. There are phases during a lunar eclipse as well that are similar to the moon's regular phases, such as quarter and full.

Rotation Causes Day and Night

The Earth rotates (spins) around an imaginary line called an axis. The axis goes from the North Pole through the Earth to the South Pole. This is like a spinning top. If you have ever spun a toy top around, you probably noticed that it spins around on a fixed point, or on its axis. As it spins, it wobbles. This is a lot like the Earth's rotation on its axis.

The shape of the Earth is a sphere. As the Earth rotates, different parts of the Earth face the Sun at different times. The part of the Earth that is facing the Sun is experiencing daytime. The part that is facing opposite the Sun is in darkness. This part is experiencing nighttime. The locations experiencing day and night change as the Earth rotates. It takes the Earth 24 hours to make one complete rotation. Therefore, one day is equal to 24 hours.

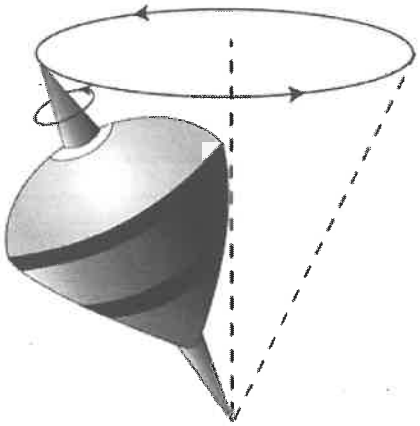


Figure 5.7 Spinning Top

On sunny days, you can see your shadow clearly on the ground. Do you notice that at different times of day your shadow gets larger or smaller? The position of the sun increases or decreases the size of shadows. If you got outside at 12:00 p.m., you will see that your shadow is very small. This is because the sun is at its peak height in the sky. Your shadow will get larger as the sun makes it way towards the horizon. If you go outside before or at sunset, you will see that your shadow is large. As a fun investigation, go outside at noon and sunset and look at the size of your shadow. Figure 5.8 diagrams the position of the sun and the length of the shadows.

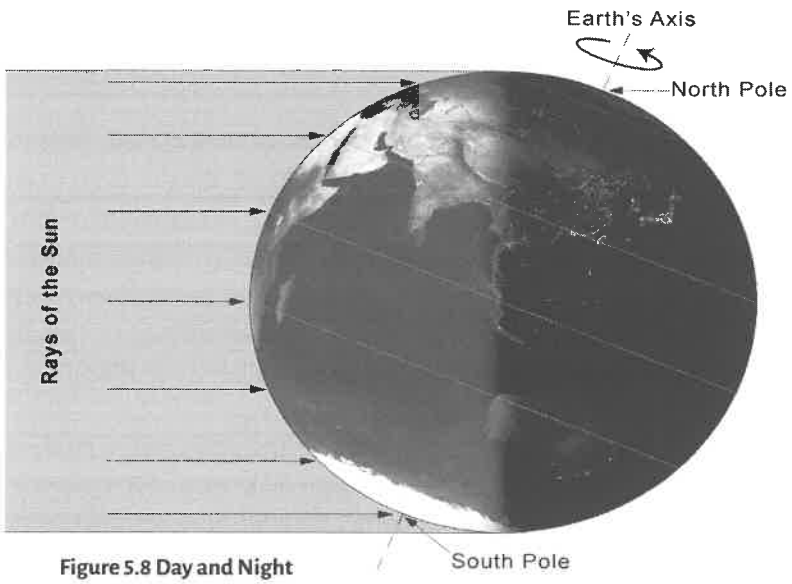


Figure 5.8 Day and Night

Most recently, on August 21, 2017, a full solar eclipse happened. During a solar eclipse, the moon passes in front of the sun. The shadow during a solar eclipse is in shape cast by the sun, like a crescent moon shape. If you look at the ground during a solar eclipse, you can see a crescent and half-moon shaped shadows on the ground. The light during an eclipse passes through any openings in the environment. Shadow bands also happened during a full solar eclipse. A shadow band is a light that moves in wave pattern during an eclipse.

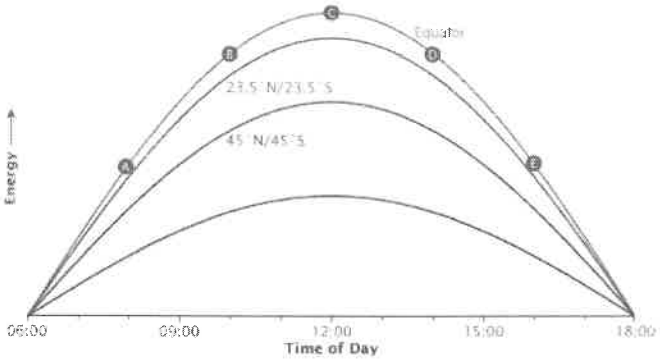


Figure 5.9 Sun and Shadows, nasa.gov

Practice 7-1: The Solar System

1. When is the best time to see Alpha Centauri A and B?

_____

_____

_____

2. Explain why the binary star system looks brighter than V762.

_____

_____

_____

3. What are the Sun's characteristics?

4. Explain why you can see the Sun only during daylight hours in your region.

5. It is 3:00 pm. You are outside on a sunny day. How does your shadow look? Explain.

Constellations

The stars are very far away. They appear to stay in the same positions. However, each night, the entire sky can be seen rotating around the North Star. The **North Star**, also called **Polaris**, is almost directly overhead if you are standing anywhere in the Northern Hemisphere. It marks true north. People in the Southern Hemisphere cannot see the North Star.

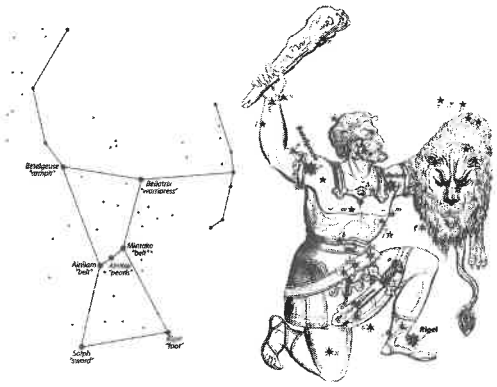


Figure 5.10 The Constellation Orion

We built our first map of the stars using just our eyes. These were the constellations. A **constellation** is a grouping of stars in a region of the sky. One you might know is Orion. Orion is sometimes called the Hunter. Orion is not really a hunter in the sky. It is a group of stars making a picture. The pictures contained in constellations are made up by humans. These pictures or maps link stars together. They help people remember an area of the sky.

The position of stars relative to each other stays the same. The shapes of the constellations do not change. Early sailors, like Christopher Columbus, used the constellations to find their way around the globe.

As the entire sky moves each night, constellations move with it. That means the night sky looks very different from day to day and month to month.

Try looking up at a constellation in the sky in the early evening. Then look for it again a few hours later. You will see it appears to have moved. Really, the stars do not move that we can easily see; it is the Earth moving. Stars move slowly as the galaxy rotates. They are so far from Earth their movement is not visible. You can see constellations for a few months at a time. They move in a predictable pattern across the sky. Planets are not part of the constellations, and their movements are not as predictable. The movement of a planet looks different from the movement of constellations. Keep in mind; the stars are not really moving, the Earth is!

You can pick up a star chart at the bookstore, which will show you the constellations seen in the sky at different times of the year. There are also magazines and websites that do the same. The figure below indicates the approximate months each constellation of the **zodiac** is most visible. The 12 constellations of the zodiac are some of the most well known in popular culture. As an example, you can see Taurus most clearly in December.

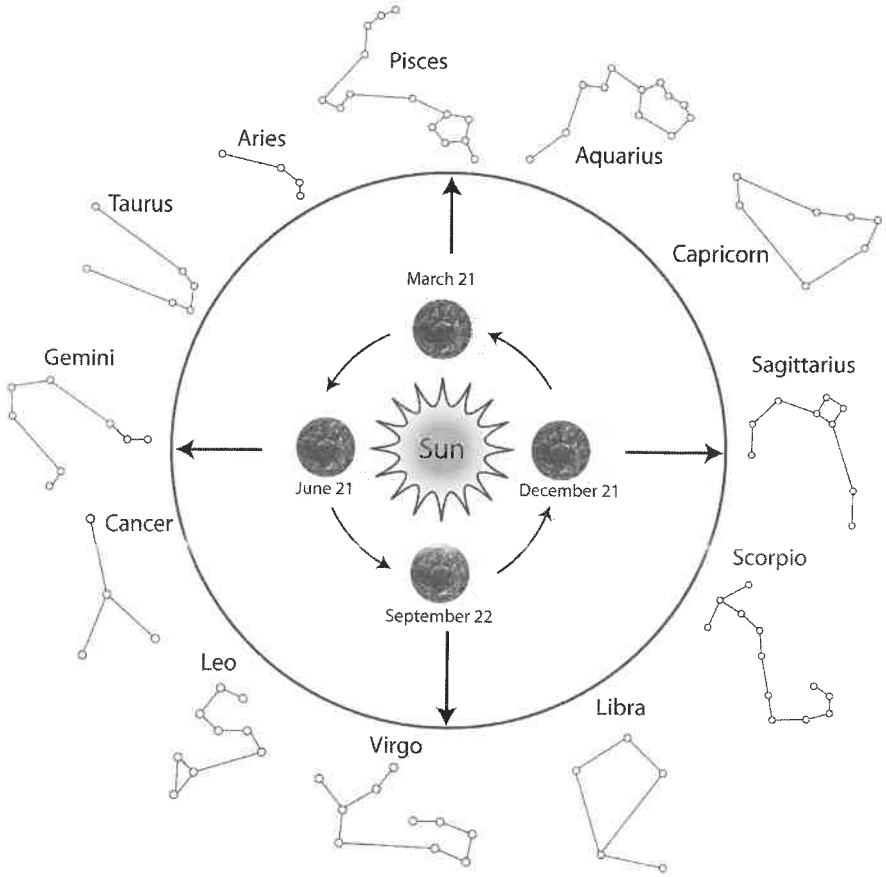


Figure 5.11 Seasonal Constellations

Artificial lights such as street lights prevent observation of the night sky. To clearly see the seasonal constellations, you need to be in an area where artificial lights are not used or limited.

Investigation: Observe the night sky (with adult supervision)

Record the constellations you observe.

Record the time you observe the constellation.

Draw a picture of the constellation and include observable stars near the constellation.

Will you be able to observe this constellation during a different season? If so, where will it be located in the night sky?
You may need to research information about the constellation to answer this question.
If you are unable to view the night sky, search the internet for an appropriate site to research the constellation.
Discuss your report and picture with the class.

Practice 7-2 Constellations

1. Select all that apply. Constellations are
   - **A.** imaginary pictures made of groups of stars
   - **B.** groupings of stars seen together
   - **C.** 88 different groups of stars
   - **D.** none of the above

2. Research the word **ecliptic**. Astronomers describe the imaginary path of the Sun as the ecliptic. Explain this concept. Does the Sun actually move?

_____

_____

_____

_____

_____

Chapter 7 Key Term Activity

Work Bank

Constellation	Mars	Solar system
Earth	Mercury	Venus
Gas Giants	North Star	planet
Luna	Plutoid	

The 1 _____ revolves around the Sun. It is made up of the Jovian planets or 2 _____ and terrestrial planets 3 _____, 4 _____, 5 _____ and 6 _____. Pluto is no longer considered a 7 _____. It is now considered a(n) 8 _____ like Eris. 9 _____, Earth's moon has phases produced by its alignment with the Sun. If you stand anywhere in the Northern Hemisphere, you can see Polaris, the 10 _____ almost directly overhead. On a clear night, you can see many star groups called 11 _____.

Key terms are defined in the book's glossary.
Answers to Key Term Activities and chapter reviews are found in the Teacher's Guide.