They are caught by planet's gravitation pull. 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. 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.

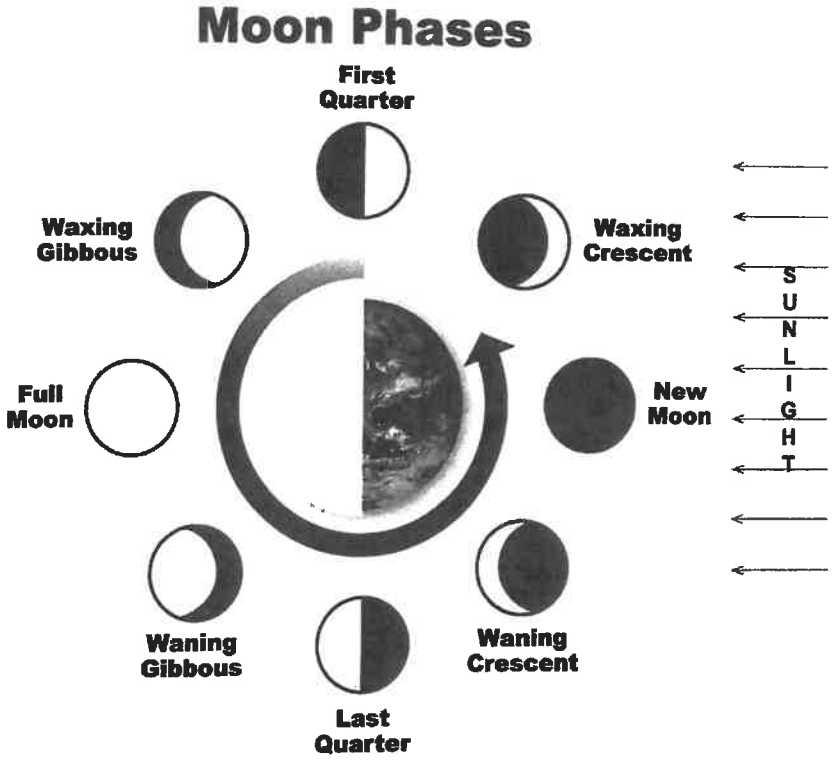

Figure 1.6 Moon Phases

On its journey from new moon to full moon, the moon is **waxing**. Waxing 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 very small and less light is reflected. Look at Table 1.1 to better understand the phases of the moon.

The positions of the Sun and Luna determines the phase of the moon. Follow Table 1.1 and Figure 1.6 as we describe the positions of the moon and Sun for the four major phases.

Position	1	2	3	4
Phase	new	first quarter	full	third quarter
Visibility	tiny crescent	half moon	full	half moon

Table 1.1 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 1.6.

During the 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 1.6 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 bright part decreases from right to left until the new moon. There is about a week between each major phase of the lunar cycle. So, there are 7 to 8 days between the new moon and first quarter, between first quarter and full moon, and so on.

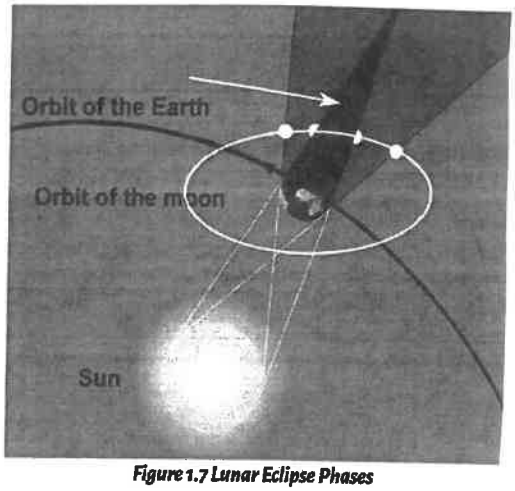

Figure 1.7 Lunar Eclipse Phases

How the Earth moves in space may seem unimportant. You might think it doesn't affect you very much, but it affects you every day and every night. You see, how the Earth moves in space determines days, nights, and seasons. This is because of the Earth's relationship with the Sun. An **eclipse** occurs when one object in space casts a shadow on another object. A **lunar eclipse** happens when the Earth comes between the Sun and the moon. The shadow of the Earth falls on the moon, because the Earth is in a position where it blocks the light from the Sun. When the moon passes between Sun and Earth, the lunar shadow is seen as a **solar eclipse** on Earth.

The gravity of the moon impacts the ocean tides. The ocean waves bulge out towards the direction of the moon's pool. As the Earth rotates, the tides are pushed and pulled. When the moon waxes and wanes, it affects the high and low tides. A high and low tide happens once each day.

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. It 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 rotates, it wobbles. It 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.

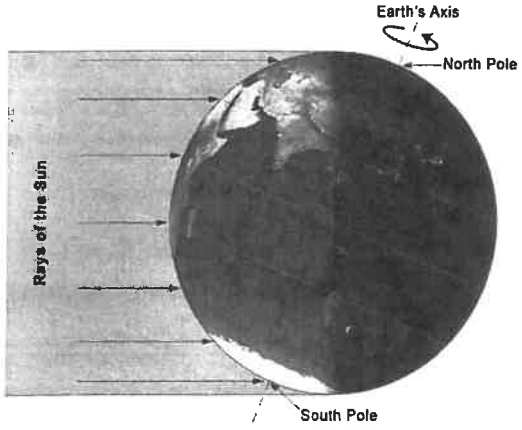

Figure 1.8 Day and Night

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 go outside at 12:00 pm, you will see that your shadow is tiny. 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 experiment, go outside at noon and sunset and look at the size of your shadow. Figure 1.9 diagrams the position of the Sun and the length of the shadows.

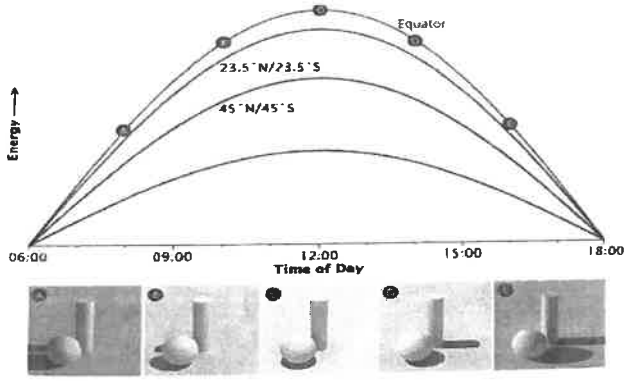

Figure 1.9 *Sun and Shadows, nasa.gov*

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 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. A shadow band is a light which moves in wave pattern during an eclipse.

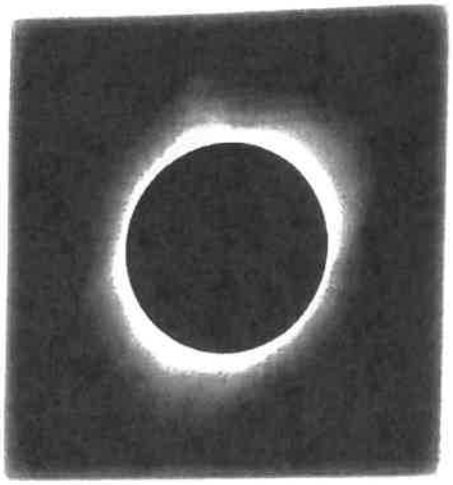

Figure 1.10 Solar Eclipse

Revolution Causes Seasonal Changes

The Earth **revolves** in a fixed orbit around the Sun. It takes Earth 365 days to make one trip around the Sun. Therefore, one year is equal to 365 days.

Earth's axis is not straight up and down. It is inclined or tilted. The axis always points toward the North Star. The tilt of the axis causes the Sun's rays to strike the surface of the Earth at different angles. This is the reason we experience different seasons in a year. If Earth's axis were not inclined, there would be no change of seasons.

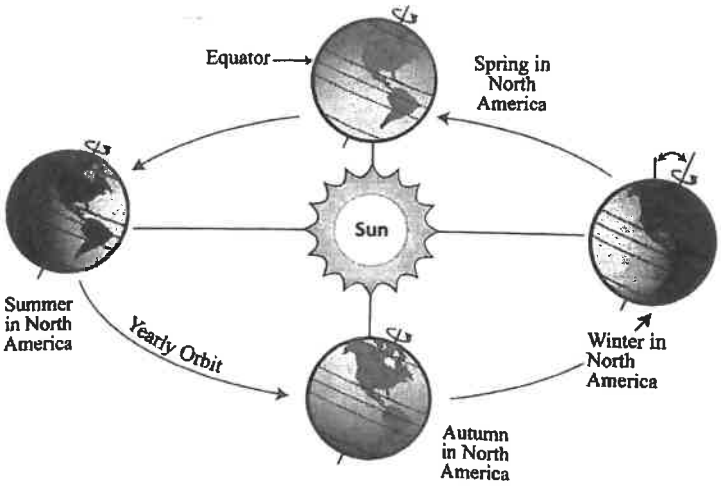

Figure 1.11 Sun/Earth Relationship

Figure 1.11 shows the relationship between the Earth and the Sun throughout the year. Notice how Earth's axis always points in the same direction in its orbit. In this figure, the size of the Earth is enlarged to help you learn about the tilt of the Earth's axis.

Sometimes the Earth's axis is tilted toward the Sun. This is when it is summer in the Northern Hemisphere. During summer, the hours of daylight are longer than the hours of nighttime. The increased sunlight makes temperatures warmer. It is hotter during the summer than in the winter.

During the same time, the Southern Hemisphere is pointing away from the Sun. The decreased sunlight means that part of the Earth experiences cooler temperatures. It is experiencing winter.

When the axis is tilted away from the Sun, it is winter in the Northern Hemisphere. During winter, the hours of nighttime are longer than the hours of daytime.

When the Earth is halfway between summer and winter in its revolution, it is fall or autumn in the Northern Hemisphere. When it is halfway between winter and summer, it is spring in the Northern Hemisphere. During fall and spring, the length of day and night is nearly equal.

Journal Activity

Objective: Describe the seasons on Earth where you live.
Notes: Summarize what you know about Earth's revolution and its axis to explain the seasons.
Summary: Write a short paragraph or draw a picture describing each season in your hometown.

Practice 2: The Moon's and Earth's Rotation

1. If the lit part of the moon is getting larger, it is
   - **A** waxing.
   - **B** waning.
   - **C** a full phase.
   - **D** in the third quarter.

2. The Earth _____ on its axis one time every 24 hours, producing day and night.
   - **A** revolves
   - **B** rejuvenates
   - **C** rotates
   - **D** changes orbit

3. The Earth _____ around the Sun one time every 365 days.
   - **A** revolves
   - **B** rotates
   - **C** rejuvenates
   - **D** changes orbit

4. Explain what happens to the Sun and Earth during a solar eclipse.

_____

_____

_____

_____

5. When the Earth's axis is tilted away from the Sun in Louisiana, the season there is
   - **A** summer.
   - **B** winter.
   - **C** spring.
   - **D** fall.

6. At what time of day is a person's shadow the largest?
   - **A** 12:00 p.m.
   - **B** 6:00 p.m.
   - **C** 9:00 a.m.
   - **D** 3:00 a.m.

Chapter 1 Key Term Activity

Fill in the blank with the correct word.

Word Bank	
luna	waning
waxing	gravitational force
Sun	Milky Way
solar system	solar eclipse

Understanding the 1. _____ is knowing how the gravitational force works. The closest star to our planet is the 2. _____. Because of 3. _____, planets orbit the Sun. The galaxy we live on, called the 4. _____, is where our Earth resides.

Another important part solar system is moons. Our moon is called 5. _____. Our moon goes through phases. When the moon is 6. _____, it is going from the new moon to the full moon. On the journey from the full moon to the new moon, the moon is 7. _____. One last fact to know is when there is a 8. _____, the moon passes through the Earth's shadow.

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