Science

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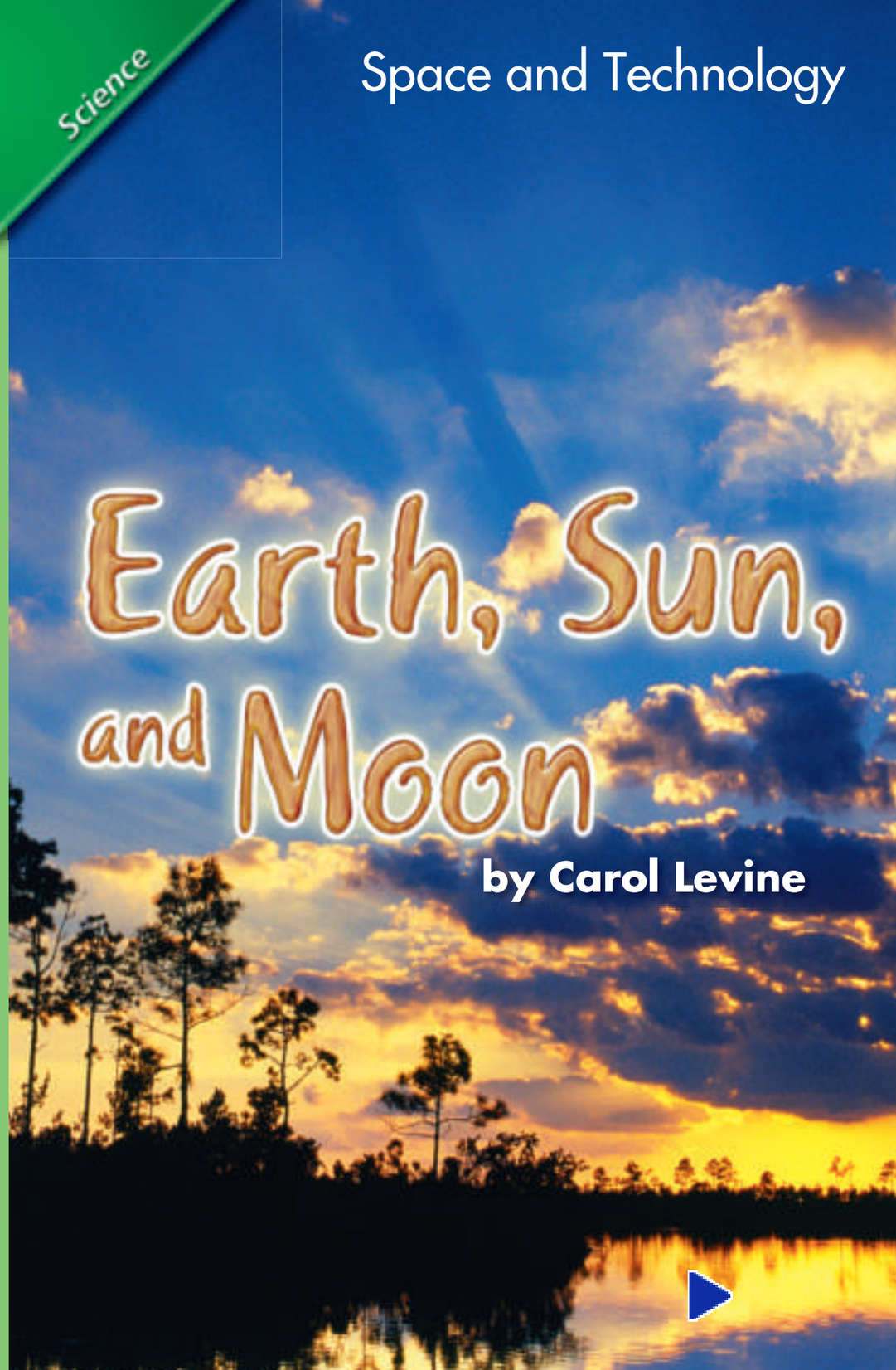
Space and Technology

Earth, Sun, and Moon

by Carol Levine



Genre	Comprehension Skill	Text Features	Science Content
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Vocabulary

lunar eclipse

orbit

revolve

rotate

solar eclipse

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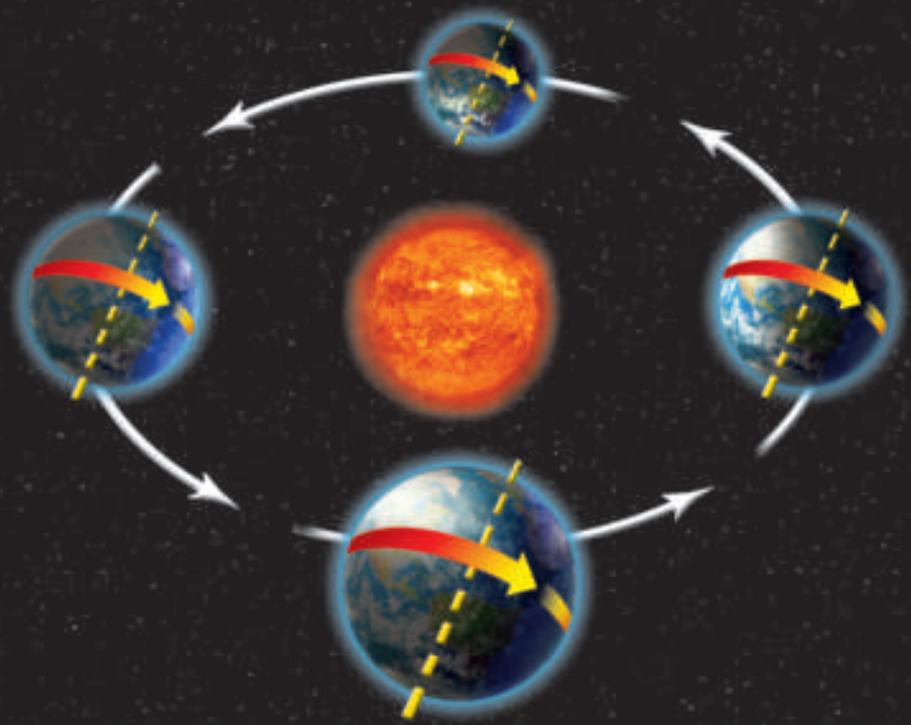

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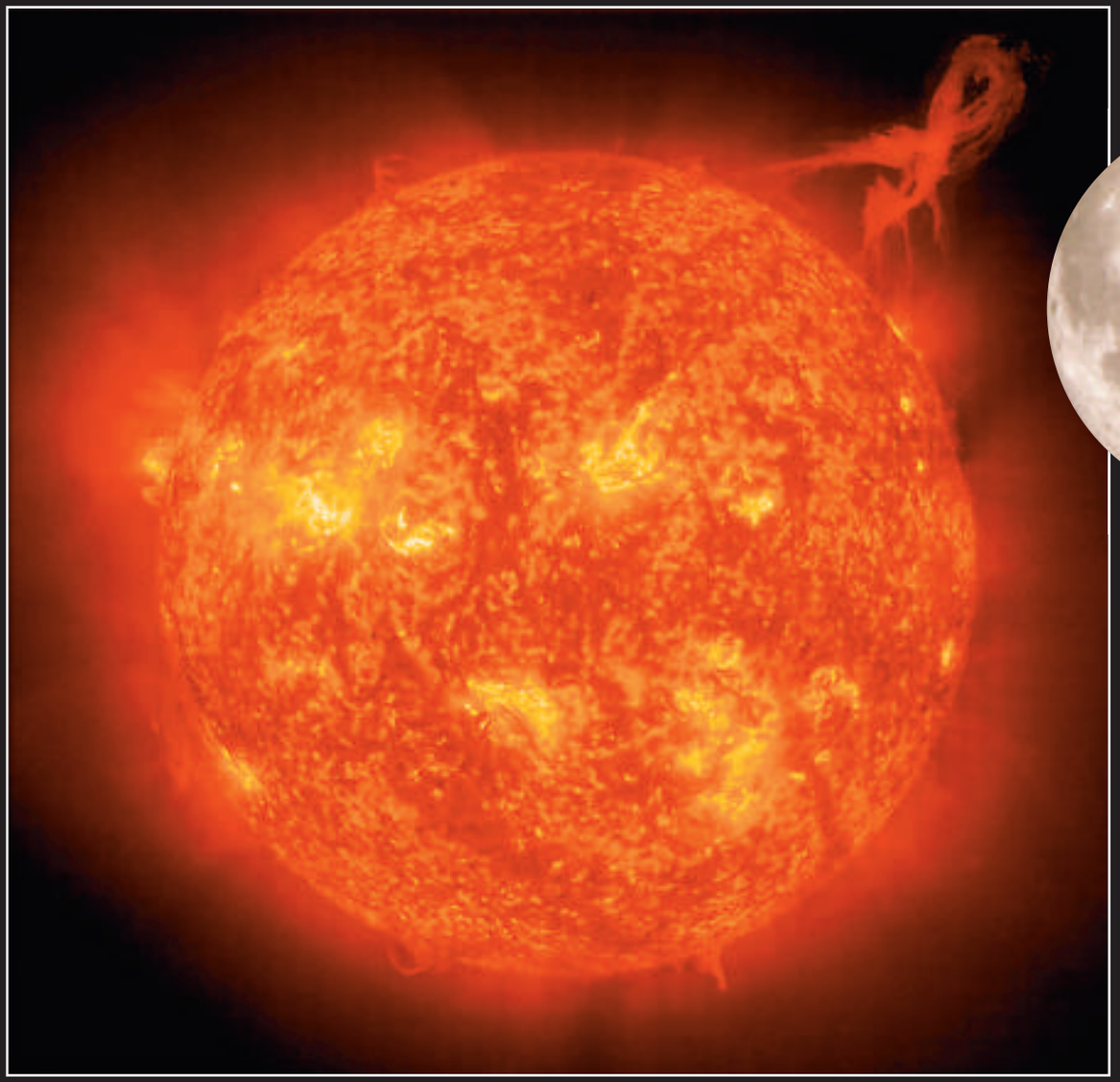
What are the characteristics of Earth's Sun and Moon?

Our Sun

Our Sun is a star. It only appears to be larger than other stars because it is much closer to Earth than the stars we see at night. It is made of hot gases called plasma. The Sun does not burn; it glows similar to a light bulb.

A heavy core makes up the inner part of the Sun. Its temperature is about 15 million degrees Celsius. Particles react in the core and release large amounts of energy. This provides light and heat that living things on Earth need to live. Without the Sun, Earth would be cold and could not support life.

The Sun has no solid surface. Swirling layers of plasma surround the core. Prominences are large loops of gases that extend thousands of kilometers from the Sun. Some stay in place for weeks. Others explode into space. Solar flares are temporary releases of energy from the Sun's surface. Energy from these flares can reach Earth. This energy causes auroras, which are light displays usually seen near Earth's poles.



Earth's Moon

The Moon has no light of its own. Sunlight reflects off the Moon's surface. This is what makes it appears lit. The Moon is like a giant rock in space. It has almost no atmosphere.

The Moon **revolves,** or moves in a path, around Earth. The Moon also spins on its axis, or **rotates,** as it revolves. The same side of the Moon always faces Earth. This is because the time it takes the Moon to revolve and the time it takes to rotate are the same.

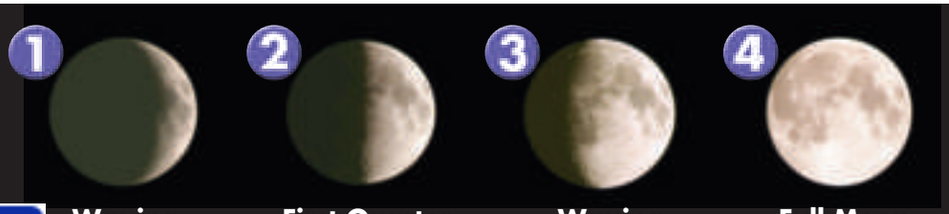
Phases of the Moon

The Moon appears to change shape each night of the month. But it does not actually change. The different shapes are called the phases of the Moon. We see these changes because of changes in the size of the lighted part of the Moon we can see. Only the half of the Moon that faces the Sun is lighted. The positions of the Moon, Earth, and the Sun determine how the Moon will look from Earth at any given time. A complete cycle of the Moon happens every 29.5 days.

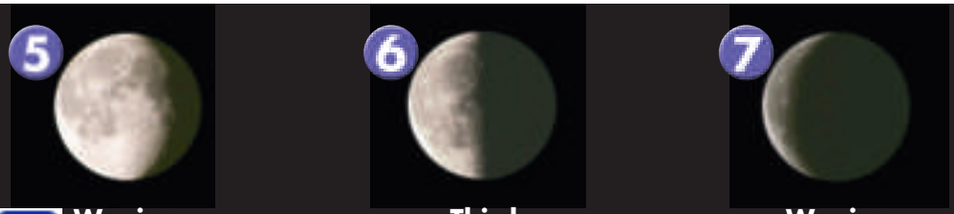
Learning About the Moon

The first visit to the Moon happened in 1959. An unmanned Soviet spacecraft called *Luna 2* landed on the Moon's surface. In 1969, *Apollo 11* carried astronauts Edwin "Buzz" Aldrin and Neil Armstrong, the first humans to land on the Moon. There were five more Moon landings. The last one was in 1972.

Information collected during the Moon landings has helped us learn about the Moon, Earth, and the rest of the solar system. The craters and other features of the Moon's surface have been examined. This helps scientists find out the ages of the Moon and of Earth.



1 Waxing Crescent **2 First Quarter** **3 Waxing Gibbous** **4 Full Moon**



5 Waning Gibbous **6 Third Quarter** **7 Waning Crescent**

1. As the Moon begins to wax, or grow larger, a crescent of light begins to show on the side. Each night you can see the lighted part grow larger.
2. As the Moon begins to wax, you can see half of its lighted side.
3. The Moon continues to wax. The shape of the Moon we now see is called gibbous.
4. About two weeks after a new moon, the Moon appears fully lighted. It has revolved halfway around Earth.

Astronauts on the *Apollo 16* mission to the Moon in 1972 collected samples, performed experiments, and took photographs.

5. The Moon begins to wane. The gibbous shape is now on the left side of the Moon.
6. The Moon has now revolved about three-quarters of its way around Earth. The lighted half you see is now on the other side of the Moon.
7. The Moon is now waning. Each night, the lighted portion grows smaller until only a thin crescent of light is visible.
8. At the New Moon phase, the Moon has completed one revolution around Earth. Once again, the Moon is between Earth and the Sun.

What are the effects of the movements of Earth and the Moon?

Earth on Its Axis

In the past, many people thought that the Sun moved around Earth. They thought this because they watched the Sun appear to rise in the east and set in the west every day.

Now we know that the Sun is the center of the solar system. We also know that Earth and the other planets revolve around it. Earth rotates on its axis, the imaginary line between the poles. One complete rotation takes a day. The rotation of Earth makes it seem as though the Sun is moving around our planet.

The Sun appears to rise in the east because Earth spins from west to east, and we spin with it. Daytime lasts as long as the Sun is visible. As Earth turns, the Sun seems to set in the west. Then it is nighttime.

The number of daylight hours changes throughout the year. That is because Earth is tilted on its axis. One half of Earth is always tilted a little bit toward the Sun. That side has more hours of daylight and fewer hours of nighttime. The opposite is true on the side tilted away from the Sun. The effect of Earth's tilt is greatest at the poles. When the northern part of Earth is tilted toward the Sun, the Sun never completely sets at the North Pole. When the southern part of Earth is tilted toward the Sun, the Sun never completely sets at the South Pole. Day and night at the poles each last for six months.

The Moon is usually visible at night, but sometimes it can be seen during the day. The Moon can be visible whenever it is on your side of Earth.

Heat from the Sun is most intense around noon, when the Sun is at its highest point.

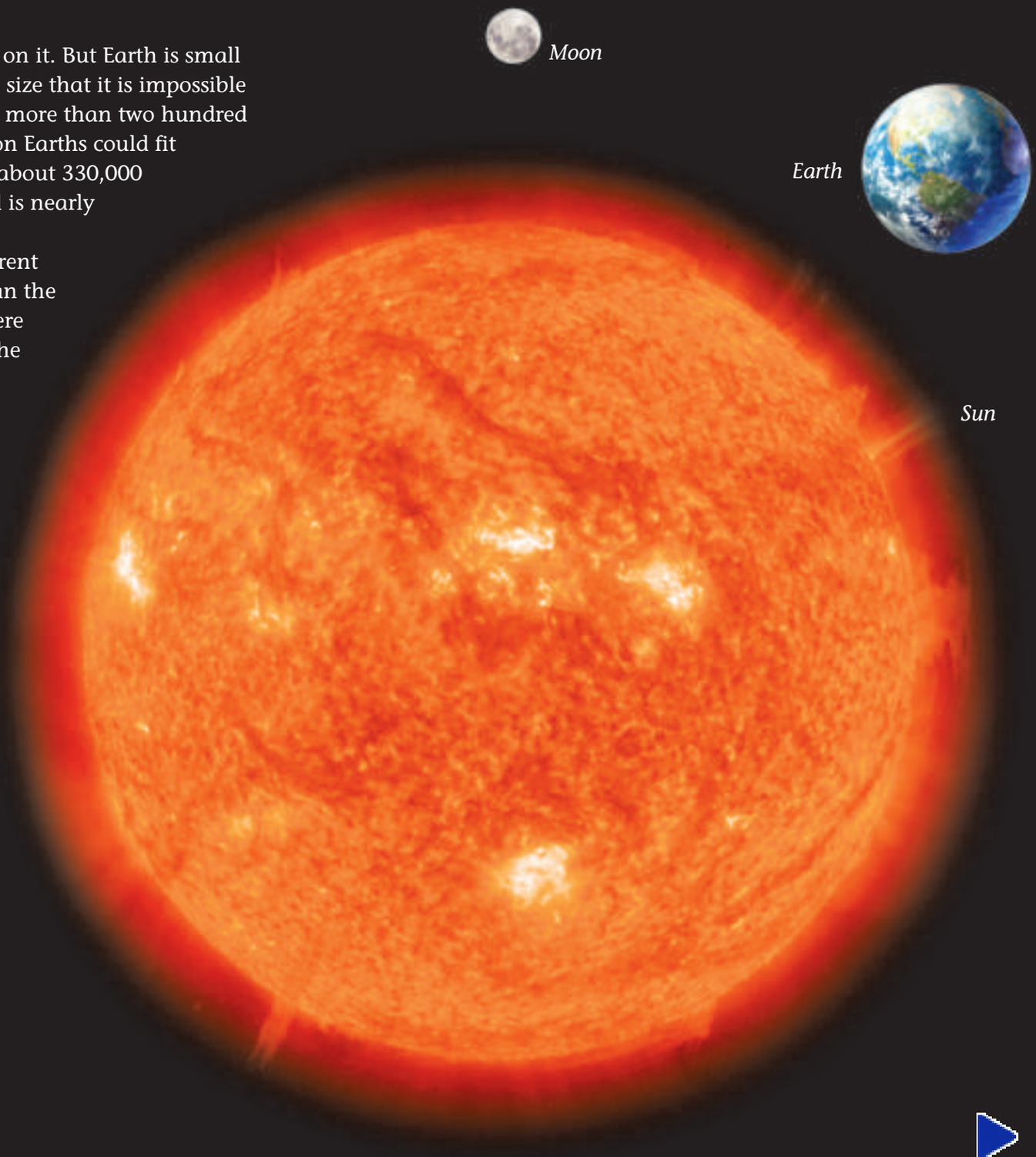
As the Sun rises in the eastern sky, sunlight begins to warm Earth.

In the evening, the Sun appears to sink below the western horizon.

Comparing Sizes

Earth feels very large to the humans living on it. But Earth is small compared to the Sun. They are so different in size that it is impossible to picture them to scale in a book. The Sun is more than two hundred times wider than Earth. More than one million Earths could fit inside the Sun if it were hollow. The Sun has about 330,000 times the mass of Earth. Its gravitational pull is nearly 30 times stronger.

Earth and the Moon are not nearly so different from each other. Earth is four times wider than the Moon. 50 moons could fit inside Earth if it were hollow. Earth has 80 times more mass than the Moon. It has six times the gravitational pull. Things weigh less on the Moon than they do on Earth. For instance, an object that weighs 60 newtons on Earth weighs only 10 newtons on the Moon.



Earth's Orbit and Seasons

Earth tends to move in a straight line. But the force of the Sun's gravity pulls Earth out of its path. This causes Earth to revolve around the Sun. An **orbit** is the path of an object as it revolves around another object. Earth's orbit around the Sun is a slightly flattened and circular ellipse. One orbit takes one year, or 365 days.

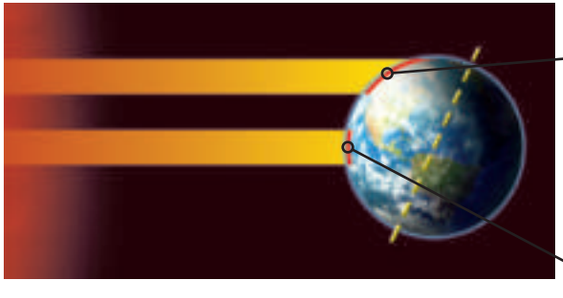
Earth's elliptical orbit causes it to be closer to the Sun at some times than it is at other times. The difference in distance does not cause the seasons. In fact, Earth is closest to the Sun when the Northern Hemisphere has winter.

The tilt of Earth on its axis causes the seasons. The Northern Hemisphere of Earth has summer when the North Pole is tilted toward the Sun. During this time the Southern Hemisphere has winter.

This changes when the South Pole is tilted toward the Sun. Then the Northern Hemisphere has winter and the Southern Hemisphere has summer. Neither pole is tilted toward the Sun in spring and fall. This causes milder temperatures for both hemispheres.

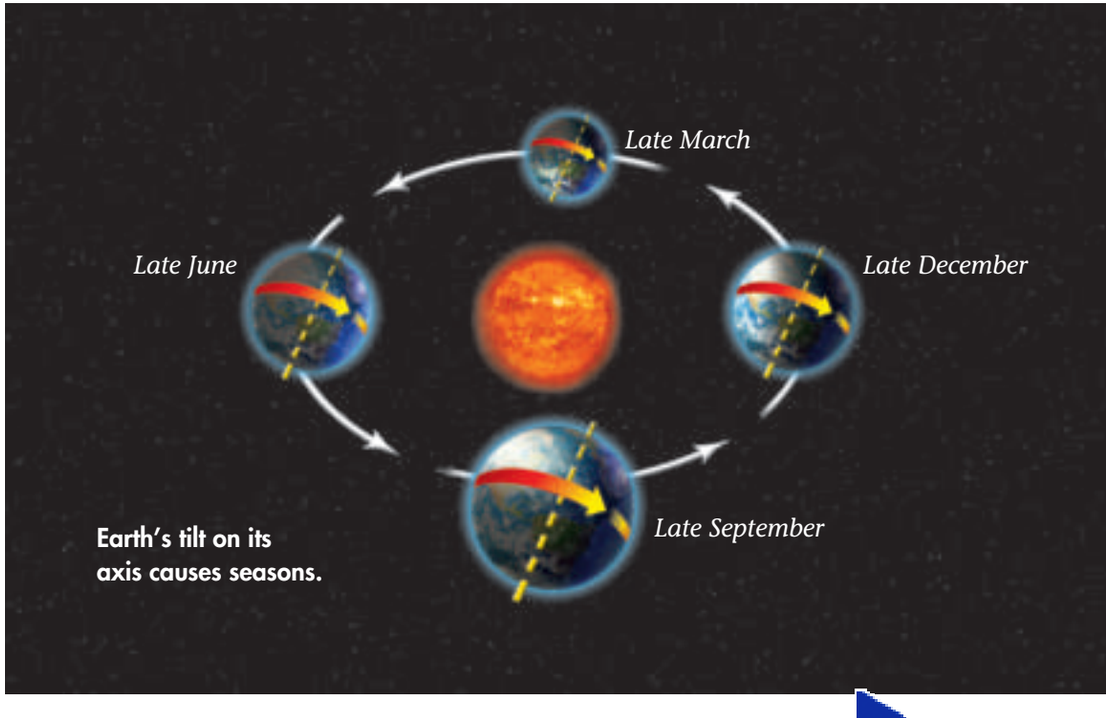
During the summer, the Sun's direct light causes warm days. Your shadow at noon is very small. As the days go by, the Sun's rays reach you at a greater and greater angle. Your shadow at noon gets longer and longer. The days are not as warm. It is fall. More days pass by, and the angle of the Sun's rays is now very large. Your shadow is long because the Sun is lower in the sky. Now it is winter. Eventually, the Sun's rays strike you at a smaller angle. The days are warmer. Your shadow at noontime starts to shorten again. It is spring!

Earth's axis is tilted. This affects how the Sun shines on Earth.



The North Pole tilts away from the Sun. The Sun's rays are spread over a wide area. Temperatures are cooler.

At the Equator, the Sun's rays strike Earth more directly. The concentrated energy makes this area warmer.



Earth's tilt on its axis causes seasons.

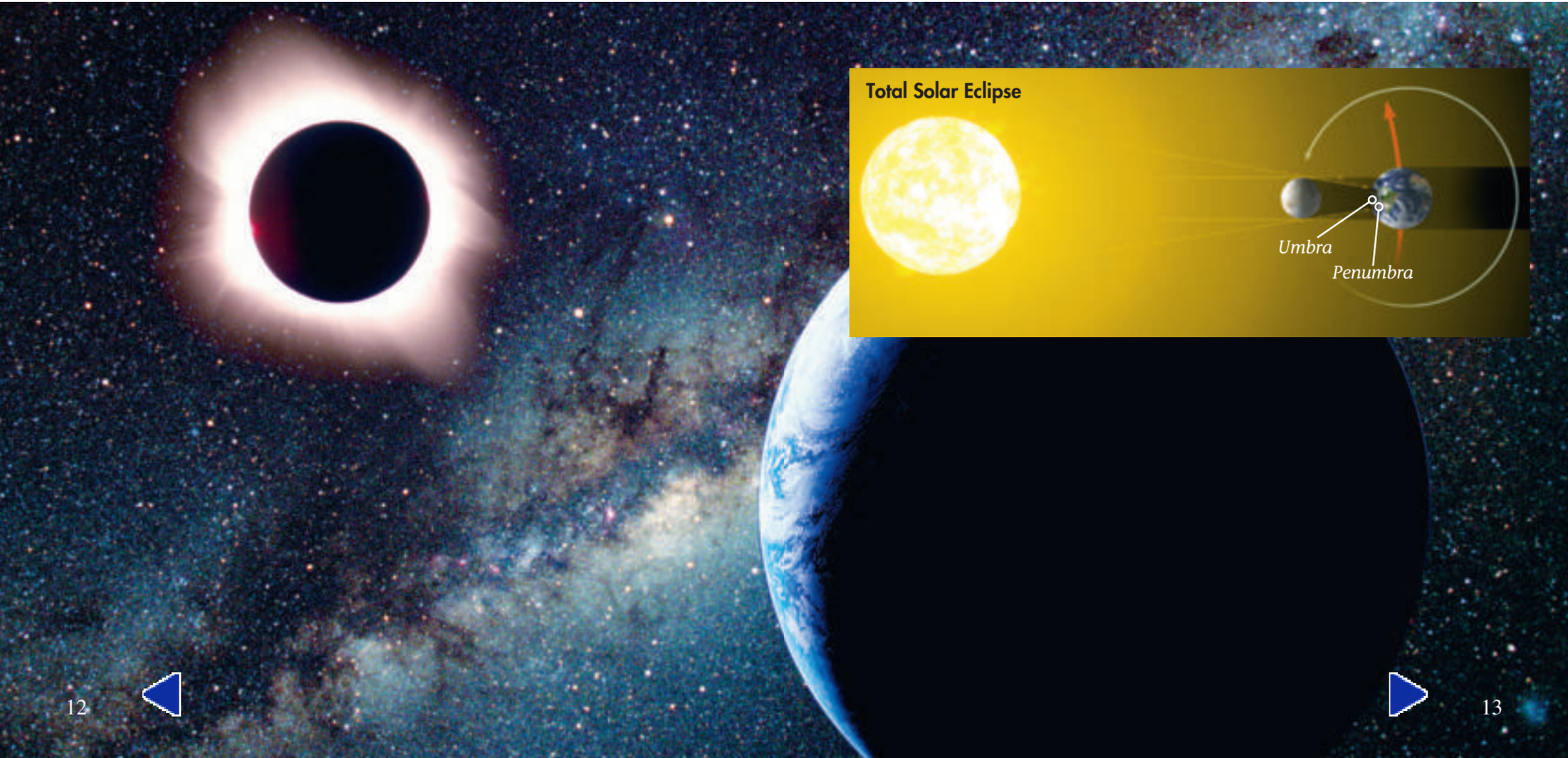
Solar Eclipses

Most of the time, the Moon's orbit is tilted at a slight angle from Earth's orbit around the Sun. This slight tilt causes the Moon to be a little above or below the Sun. There are times, however, when the tilt of the Moon's orbit around Earth causes the Moon to cross exactly between the Sun and Earth. This causes a **solar eclipse.** When this happens, the Moon blocks the light of the Sun.

During an eclipse, the Moon makes two kinds of shadows on Earth. The umbra is the darker, inner part of an eclipse shadow. The penumbra is the lighter, outer part of an eclipse shadow. Solar eclipses happen several times a year. But each place on Earth can only see one every few hundred years.

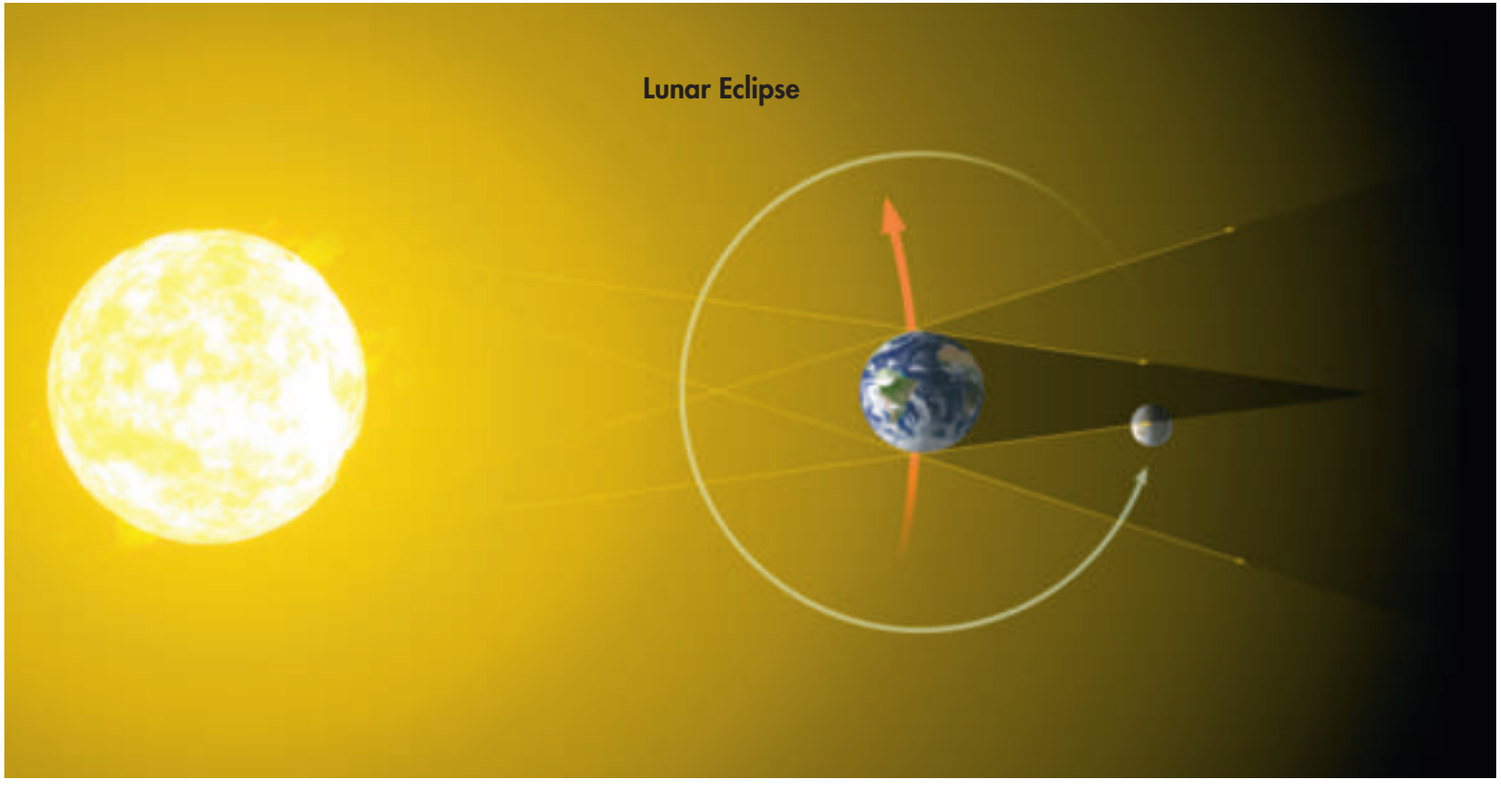
A solar eclipse can be total or partial. When the umbra passes over an area, the eclipse is total. The Sun is completely blocked, the sky is dark, and the stars are visible. This can last several minutes. Only a small area of Earth sees the total eclipse because the Moon's shadow is small. Areas that are close enough will experience a partial eclipse because the penumbra is passing over. A partial eclipse can also happen when the umbra misses Earth and only the penumbra passes over.

Never look directly at the Sun. To view an eclipse, use two pieces of white cardboard. Place one piece of the cardboard on the ground. Poke a small pinhole through the other piece and hold it so the Sun shines through the hole onto the cardboard on the ground. The round spot you see is an image of the Sun.



Lunar Eclipses

A solar eclipse is not the only kind of eclipse that Earth can experience. Sometimes Earth is between the Sun and the Moon during a full moon. This causes Earth's shadow to fall on the Moon. A **lunar eclipse** takes place when the Moon passes through Earth's shadow. During a total eclipse, it may take almost two hours for the Moon to completely pass through Earth's shadow. Partial eclipses, last for a shorter period of time. Lunar eclipses can be seen from all parts of Earth where it is nighttime. Lunar and solar eclipses happen about twice a year, but because a lunar eclipse can be seen from half of Earth, there is a better chance that you will see one when it happens.



A lunar eclipse occurs when the orbit of Earth places it between the Sun and the Moon. This casts a shadow on the Moon, which we see on Earth as an eclipse.

Time-lapse photo of a lunar eclipse

As you can see, we have learned a lot about the motions of Earth, the Sun, and the Moon since humans first started studying the sky. Night and day, the seasons, and solar and lunar eclipses are all caused by the motions of our planet and the Moon as they orbit the Sun.

Glossary

lunar eclipse the passing of the Moon through Earth's shadow, causing Earth's shadow to fall on the Moon

orbit the path of an object as it revolves around another object

revolve to move in a path around another object

rotate to spin on an axis

solar eclipse the passing of the Moon between the Sun and Earth causing the Moon to cast its shadow on Earth

What did you learn?

1. Why does the Sun look like the largest star in the sky?
2. Does the Moon give off light? Why does the Moon seem to be lit?
3. What causes the Moon to appear to be different shapes during a month?
4. **Writing** in Science The tilt of Earth on its axis causes the seasons. Write to explain how seasons change because of Earth's tilt. Use details from the book to support your answer.
5. **Main Idea and Details** Reread page 7. Write a sentence that gives the main idea of the page. Under that sentence, list two supporting details.