

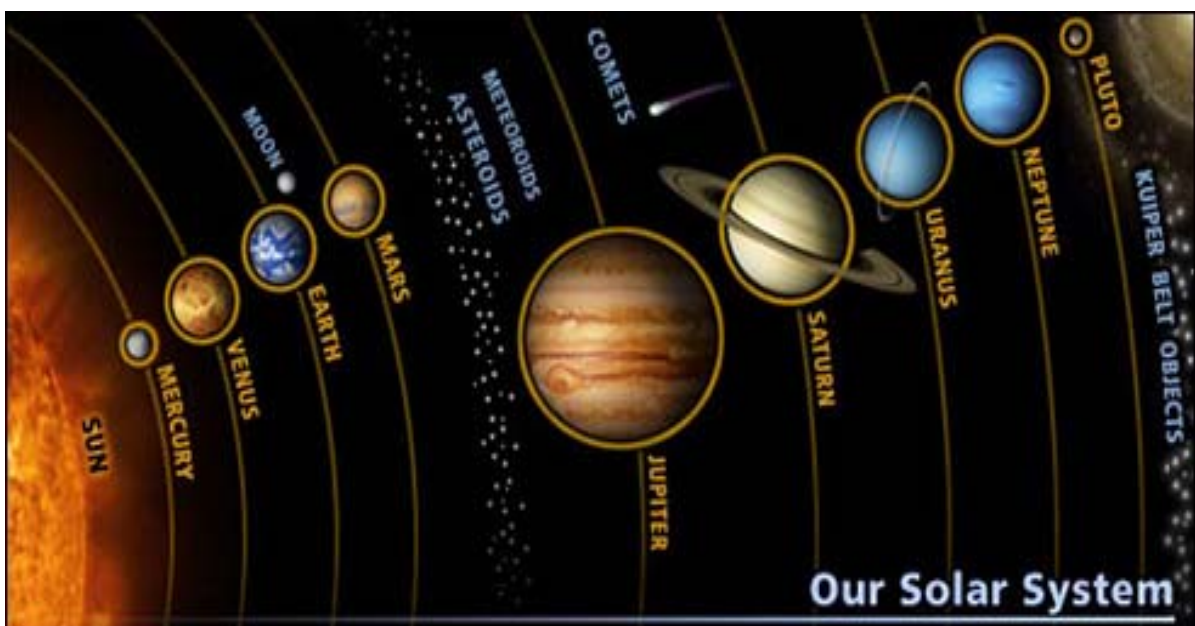
THE EARTH'S MOVEMENTS

Unit Overview

In previous units, you have studied about galaxies, nebulas, the solar system and the introduction to the rotation of the earth. In this unit you will look more deeply into the rotation of the earth, the relationship of the earth to other parts of the solar system, and the characteristics of the earth and its orbit around the sun. Good luck as you experience the wonder of the earth and its intricate movements.



For thousands of years, people have watched the stars at night. The stars appear to rise and set slowly as the night goes by. From night to night, some points of light seem to move among the stars. These points of light are the planets. Like the earth and the moon planets do not make their own light, but rather reflect light from the sun. People have known for five thousand years that planets are satellites of the sun. This means that they revolve around the sun. A **satellite** is an object that revolves around another object. Our moon is a satellite of the earth. As you studied in detail in a previous unit, the nine planets that orbit the sun from the sun outward are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, and Pluto. These planets and the sun make up most of the **solar system**.





Solar System

The earth like the other planets travels in a path around, **orbit**, the sun. Their orbital paths are in the shape of an **ellipse**, which is a circle that has been flattened a little. It is more oval shaped. The movement of the earth around the sun is called a **revolution** because the earth is revolving around the sun. It takes the earth 365 days to travel once around the sun. Why does the earth do this? **GRAVITY!** The gravity of the sun pulls the earth nearer and that keeps the earth from traveling out into space.

The earth revolving around the sun is not the only motion of the earth! The earth also spins. Imagine spinning a basketball on your finger. Now, imagine a line drawn from your finger up through the basketball. The ball is rotating around this line, called an axis. Each time the ball makes one full spin around its axis, it has made one rotation. The earth spins on its axis. As the earth spins part of the earth faces the sun.

This part of the earth is lit by the sun and experiences daylight. The part of the earth which is facing away from the sun is in darkness. Can you guess how long it takes the earth to make one rotation on its axis? If you said 24 hours, you are correct.

The earth is constantly rotating on its axis and revolving around the sun at the same time. To understand this two-way movement of the earth, try this experiment:

A. Place a ball on the floor. Pretend this ball is the sun.

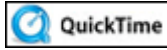
B. Pretend you are the earth.

C. As you stand in place, begin to spin slowly round and round. *This spinning motion is like the earth rotating.*

D. Next, while you continue to spin move in a path around the ball. *This circular movement around the ball is like the earth's revolution around the sun.*

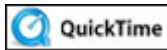
As the tilt of the earth changes, parts of the earth are closer to the sun. The seasons occur as a result of the earth's tilt on its axis. During the six months that the North Pole is tilted toward the sun, the Northern Hemisphere gets more sunlight than the Southern Hemisphere does. The atmosphere is warmer in the Northern Hemisphere, resulting in warmer weather. During this time the North Pole is tilted toward the sun, the Northern Hemisphere experiences late spring, summer, and early fall. In the Southern Hemisphere the result is late fall, winter, and early spring. The

Northern Hemisphere experiences its cooler weather when the North Pole is tilted away from the sun.



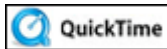
[Why is the Summer Sun So Powerful? \(02:39\)](#)

The summer and winter solstice occur in late June and December each year. The **summer solstice** is the day your hemisphere of the earth is tilted most toward the sun. This day had the greatest number of hours of daylight. The **winter solstice** is the day your hemisphere is tilted most away from the sun. This day has the fewest hours of daylight.

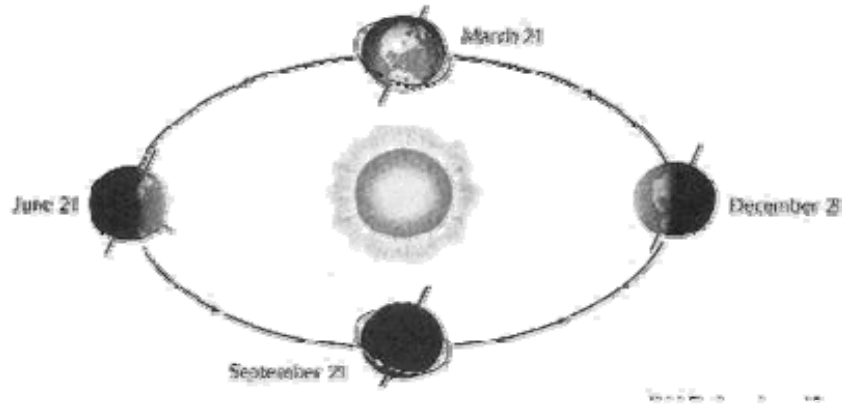


[The Summer Solstice \(02:04\)](#)

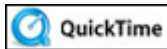
The spring (*vernal*) and fall (*autumnal*) **equinoxes** occur in late March and September each year. At the time of these two equinoxes, the sun is directly above the Equator, and each hemisphere of the earth receives equal numbers of hours of sunlight and darkness.



[The Vernal Equinox \(03:16\)](#)



Look carefully at the diagram above; then in questions #1 - #4 identify the *summer solstice*, *winter solstice*, *spring equinox* and *fall equinox*.



[Spring's Unreliable Weather](#) (03:09)

People Used to Believe...

For a long time no one knew that the Earth revolved around the sun. People thought the sun moved around the earth. In fact astronomers have been working on space theories for thousands of years. The ideas of many astronomers over the centuries have helped to explain what we now know about our solar system. Below is a group of astronomers who helped form these truths.

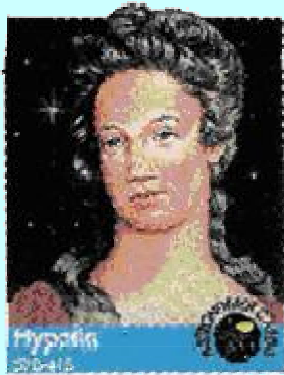
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About 300 B.C., Zhou Yue from China made a model of how the moon moves.



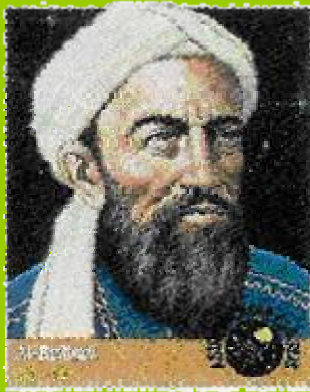
Around A.D. 150 Ptolemy, while living in Egypt, made a model of how the sun, Earth, and moon work together. He stated that the earth is at center of everything. In his diagram the sun, moon, and stars all moved around Earth.



Around A.D. 400, Hypatia, a mathematician in Alexandria, Egypt, developed an instrument that measured the positions of the stars and planets.



In 497, Aryabhata the First from India added his idea that Earth rotates.

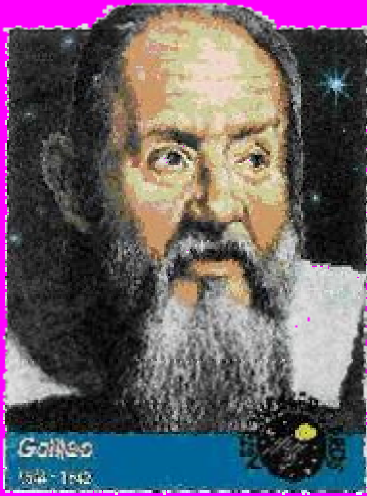


During 880-909, Al-Battani from turkey calculated out the length of a year and the seasons. He also improved Ptolemy's model.

Copernicus 1473-1543



In 1543, a Polish astronomer, Nicolus Copernicus, made a different model. In it, the sun is at the center. Earth revolves around the sun, rotating as it goes.



Galileo was an astronomer in Italy in the 1600s. He had studied other astronomers work. He knew about an instrument called a telescope that makes far away objects look brighter and clearer. He used a telescope and made observations about the sky.

Read More about Galileo.....

One night in 1610 Galileo looked into his telescope at the planet Jupiter. He noticed Jupiter had four tiny moons. Galileo watched the sky and observed that the positions of these moons changed each night. The moons were revolving around the planet. He wondered if the earth's moon also revolved around the earth. Could it be the earth revolves around the sun? Today we know Galileo's theory was correct. You have read above about the earth's rotation and revolution. You have read that each one of these movements affects our day and night cycle as well as our seasonal cycles. Now let us take a look at the moon's movements.

The Moon's Movements

The moon is a satellite of the earth. It is about one fourth the size of the earth, with a diameter of about 2,100 miles. The moon appears about the same size as the sun in the sky, but that is only because the moon is so much closer than the sun. The moon is about 240,000 miles from the earth whereas the sun is 93,000,000 miles away. The moon orbits the earth much like the earth orbits the sun. However, the moon completes its orbit around the earth about once every 28 days. This orbit cause the phases of the moon. The phases of the moon determine the amount of the moon you see at night. For example, a full moon appears as a complete round circle. A new moon occurs when you see no moon. There are eight phases of the moon that appear as the moon completes its orbit around the earth. For a specific review of those phases, go back to the previous unit.

For a view of the moon actually orbiting the earth visit the following web site.

<http://www.chabotspace.org/vsc/planetarium/themoon/moonphases/default.asp> and/or to view the Home Page click on the [PDF File](#).

To explore a model of Earth's yearly revolution around the sun click on this link

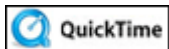
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The moon has no light of its own, but it seems to shine because it reflects the sun's light. The moon has no atmosphere and no life. The gravity of the moon is about one sixth as strong as the earth's gravity. Therefore, a person who weights 60 pounds on earth would only weigh 10 pounds on the moon. The moon is covered with craters. These are large holes cause by collisions between the moon's surface and asteroids or other large bodies. These craters cause a pattern to appear on the surface which is why you may have heard the phrase, "the man in the moon". This "face" is called a characteristic of the moon. Now, we will take a closer look at Earth and its many characteristics.

Characteristics of Earth



[What is Inside Our Planet? \(01:16\)](#)

As you have learned, Earth is the only planet in the solar system on which life is known to exist. It is the largest of the inner planets and is the third planet from the sun. Earth's atmosphere is about 78 percent nitrogen and 21 percent oxygen with traces of other gases. Our planet has a core of molten metal and rock, with just a thin crust of solid rock.

We can see the moon and the sun with our naked eyes, but we cannot see the earth in the same way. Have you ever wondered how it must look?

Well, it is one of the most beautiful planets. Since $\frac{3}{4}$ of Earth is covered with water, it appears a very pretty blue color. The entire planet is covered by a swirling, thin blanket of air with scattered white clouds. An artist would paint its appearance as a sphere covered mostly in blue with some darker colored land masses surrounded by thin, white swirling air and clouds. You can be very proud of its looks.



Now answer questions 5-24.

