

The Solar System

Observing the Solar System

Guide for Reading

- What are the geocentric and heliocentric systems?
- How did Copernicus, Galileo, and Kepler contribute to our knowledge of the solar system?
- What objects make up the solar system?

Observers in ancient Greece noticed that although the stars seemed to move, they stayed in the same position relative to one another. These patterns of stars, called constellations, kept the same shapes from night to night and from year to year.

The Greeks thought that Earth was inside a rotating dome called a celestial sphere. Since the word *geo* is the Greek word for Earth, an Earth-centered explanation is known as a **geocentric** system. **In a geocentric system, Earth is at the center of the revolving planets and stars.** About A.D. 140, the Greek astronomer Ptolemy further developed the geocentric model. Like the earlier Greeks, Ptolemy thought Earth was at the center of a system of planets and stars. In Ptolemy's model, however, the planets moved on small circles that moved on bigger circles. Copernicus was able to work out the arrangement of the known planets and how they move around the sun.

A Greek scientist developed the **heliocentric** system. **In a heliocentric system, Earth and the other planets revolve around the sun.**

In the early 1500s, the Polish astronomer Nicolas Copernicus developed a new model for the motions of the planets. His sun-centered system is also called **heliocentric**. *Helios* is Greek for "sun." Copernicus was about to work out the arrangement of the known planets and how they move around the sun. **Later, Galileo used the newly invented telescope to make discoveries that supported the heliocentric model.**

Copernicus thought that the planets' orbits were circles. He based his conclusions on observations made by the ancient Greeks. In the late 1500s, Tycho Brahe made more accurate observations of the planets' orbits. Johannes Kepler analyzed Brahe's data. **Kepler found that the orbit of each planet is an ellipse.** An **ellipse** is an oval shape, which may be elongated or nearly circular. Kepler used the new scientific evidence gathered by Brahe to disprove the long-held belief that the planets moved in perfect circles.

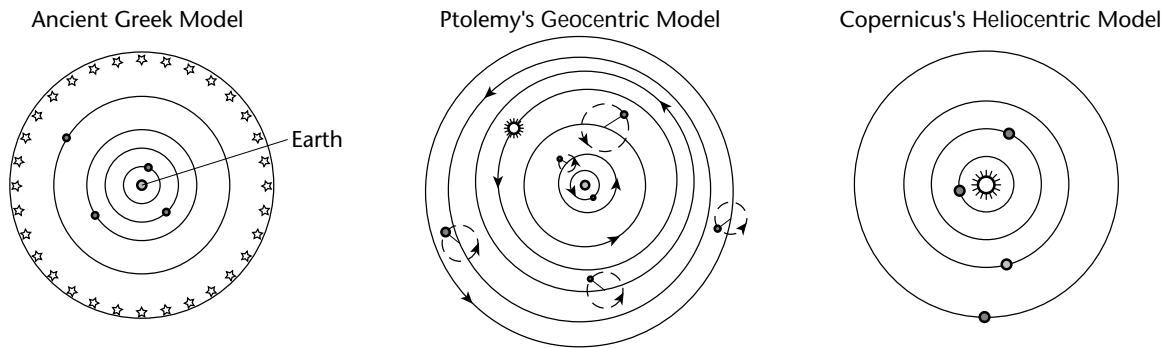
Since Galileo's time, our knowledge of the solar system has increased dramatically. **Today we know that the solar system consists of the sun, eight planets and their moons, and several kinds of smaller objects that revolve around the sun.**

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Understanding Main Ideas

Answer the following questions in the spaces provided.



1. What is the main difference between the geocentric and heliocentric models of planetary motion?

2. How did the Greek model and Ptolemy's model differ?

3. How did Galileo's observations of Jupiter and Venus support Copernicus's model?

Building Vocabulary

Fill in each blank to complete each statement.

4. The sun-centered system of planets developed by Copernicus is an example of a(n) _____ model.
5. Kepler discovered that the orbit of each planet is a(n) _____, rather than a perfect circle.
6. An Earth-centered system of planets is known as a(n) _____ model.

The Solar System

The Sun

Guide for Reading

- What are the three layers of the sun's interior?
- What are the three layers of the sun's atmosphere?
- What features form on or above the sun's surface?

The sun's mass is 99.8 percent of all the mass in the solar system. Because the sun is so large, its gravity is strong enough to hold all of the planets and other distant objects in orbit.

Unlike Earth, the sun does not have a solid surface. Like Earth, the sun has an interior and an atmosphere. **The sun's interior consists of the core, radiation zone, and convection zone.** Each layer has different properties.

The sun produces an enormous amount of energy in its **core**, or central region. The sun's energy comes from nuclear fusion. In the process of **nuclear fusion**, hydrogen atoms in the sun join to form helium.

The light and heat produced by the sun's core first pass through the middle layer of the sun's interior, the radiation zone. The **radiation zone** is a region of very tightly packed gas where energy is transferred mainly in the form of electromagnetic radiation.

The **convection zone** is the outermost layer of the sun's interior. Hot gases rise from the bottom of the convection zone and gradually cool as they approach the top. Cooler gases sink, forming loops of gas that move heat toward the sun's surface.

The sun's atmosphere consists of the photosphere, the chromosphere, and the corona. The inner layer of the sun's atmosphere is called the **photosphere**. *Photo* means "light," so the photosphere is the sphere that gives off visible light.

At the beginning and end of a solar eclipse, you can see a reddish glow around the photosphere. This glow comes from the middle layer of the sun's atmosphere, the **chromosphere**. *Chromo* means "color," so the chromosphere is the "color sphere."

During a total solar eclipse, a fainter layer called the **corona** is visible. The corona sends out a stream of electrically charged particles called **solar wind**.

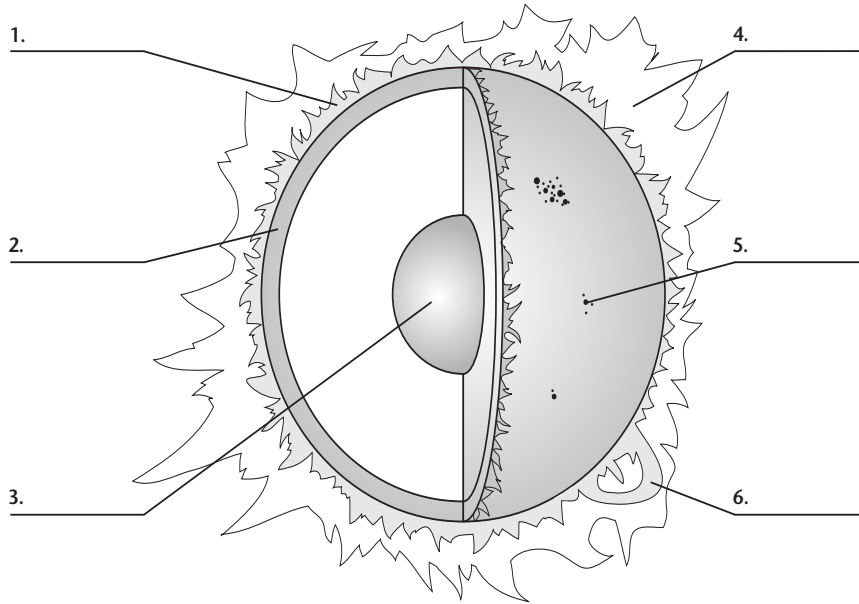
Features on or above the sun's surface include sunspots, prominences, and solar flares. **Sunspots** are areas of gas on the sun that are cooler than the gas around them. Sunspots usually occur in groups. Reddish loops of gas called **prominences** link different parts of sunspot regions. Sometimes the loops in sunspot regions suddenly connect, releasing large amounts of energy. The energy heats gas on the sun to millions of degrees Celsius, causing the gas to explode into space. These explosions are known as **solar flares**. Solar flares can greatly increase the solar wind.

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The Sun

Understanding Main Ideas

Label the diagram of the sun below.



Building Vocabulary

Match each term with its description by writing the letter of the correct description in the right column on the line next to the term in the left column.

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|-------------------------|--|
| ___ 7. solar flare | a. the layer of the sun's atmosphere that gives off visible light |
| ___ 8. core | b. the layer of the sun's atmosphere that has a reddish glow |
| ___ 9. chromosphere | c. the layer of the sun's atmosphere that looks like a halo during an eclipse |
| ___ 10. sunspot | d. areas of gas on the sun's surface that are cooler than the gases around them |
| ___ 11. corona | e. reddish loops of gas that link parts of sunspot regions |
| ___ 12. nuclear fusion | f. eruptions that occur when the loops in sunspot regions suddenly connect |
| ___ 13. photosphere | g. a stream of charged particles produced by the corona |
| ___ 14. solar wind | h. the center of the sun |
| ___ 15. prominence | i. the outermost layer of the sun's interior |
| ___ 16. radiation zone | j. the joining of hydrogen atoms to form helium |
| ___ 17. convection zone | k. the layer of the sun's interior where energy is transferred mainly by electromagnetic radiation |