

The Solar System

The Structure of the Solar System

..... Before You Read

Key Concepts

- How are the inner planets different from the outer planets?
- What is an astronomical unit and why is it used?
- What is the shape of a planet's orbit?

What do you think? Read the two statements below and decide whether you agree or disagree with them. Place an A in the Before column if you agree with the statement or a D if you disagree. After you've read this lesson, reread the statements to see if you have changed your mind.

Before	Statement	After
	1. Astronomers measure distances between space objects using astronomical units.	
	2. Gravitational force keeps planets in orbit around the Sun.	

Study Coach

K-W-L Fold a sheet of paper into three columns. In the first column, write what you know about the structure of the solar system. In the second column, write what you want to know. In the third column, write what you have learned after reading this lesson.

..... Read to Learn

What is the solar system?

The Sun and the group of objects that move around it make up the solar system. A few of the tiny specks of light that you can see in the night sky are planets in the solar system, but most are stars. It is hard to tell the difference. Stars are not part of the solar system. They are much farther away than any objects in our solar system.

Objects in the Solar System

The invention of the telescope in the 1600s led to the discovery of several planets and many other space objects. Before then, observers had seen only five planets—Mercury, Venus, Mars, Jupiter, and Saturn.

The Sun

The Sun is a star and is the largest object in the solar system. Its diameter is about 1.4 million km. The Sun is made mostly of hydrogen gas. The Sun's mass makes up about 99 percent of the mass of the entire solar system.

Inside the Sun, a process called nuclear fusion produces a huge amount of energy. The Sun emits some of this energy as light. This light shines on all of the planets every day. The Sun's gravitational force causes the planets and other objects in the solar system to move around, or orbit, the Sun.

SCIENCE USE V. COMMON USE

star

Science Use an object in space made of gases in which nuclear fusion reactions occur that emit energy

Common Use a shape that usually has five or six points around a common center

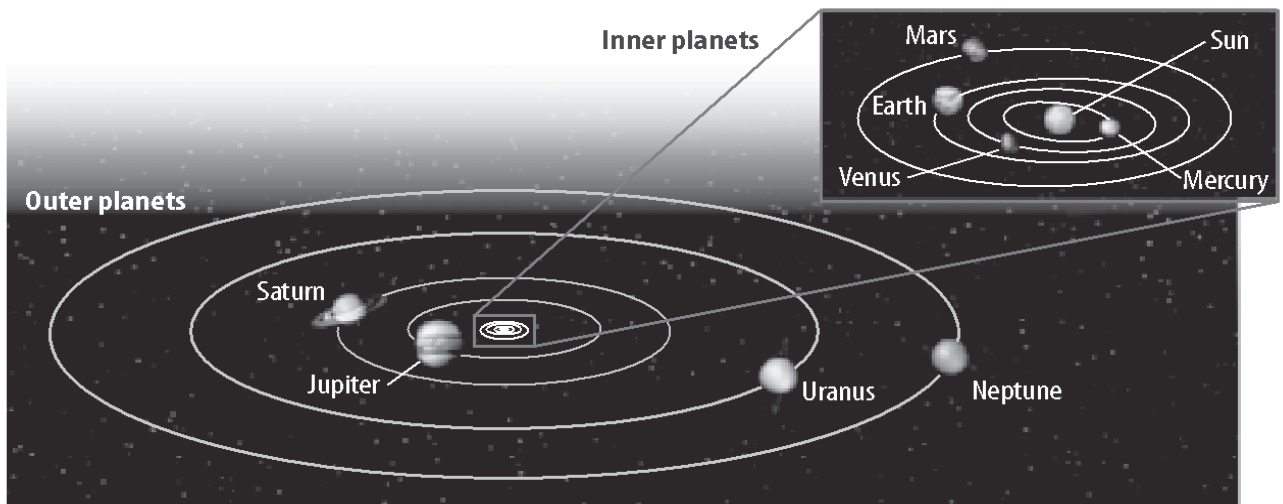
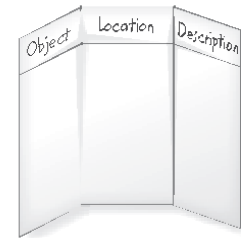
Objects That Orbit the Sun

Planets, dwarf planets, asteroids, and comets orbit the Sun. These objects do not emit light. Instead, they reflect the Sun's light.

Planets The figure below shows the eight planets in the solar system. An object is a planet only if it orbits the Sun and has a nearly spherical shape. The object must also have a mass that is much larger than the total mass of all other objects in orbits nearby.

FOLDABLES®

Make a tri-fold book to summarize information about the types of objects that make up the solar system.



Inner Planets and Outer Planets The inner planets are the four planets closest to the Sun—Mercury, Venus, Earth, and Mars. The inner planets are made of solid, rocky materials. The outer planets are the four planets farthest from the Sun—Jupiter, Saturn, Uranus (YOOR uh nus), and Neptune. The outer planets are made of ice and gases. 🔑

Dwarf Planets A dwarf planet is a spherical object that orbits the Sun and is not a moon of another planet. Unlike a planet, a dwarf planet does not have more mass than all the objects in nearby orbits. The figure on the next page locates the dwarf planets Ceres (SIHR eez), Eris (IHR is), Pluto, and Makemake (MAH kay MAH kay). Dwarf planets are made of rock and ice and are much smaller than Earth.

Asteroids Millions of small, rocky objects called **asteroids** orbit the Sun in the asteroid belt between the orbits of Mars and Jupiter. Unlike planets, asteroids usually are not spherical.

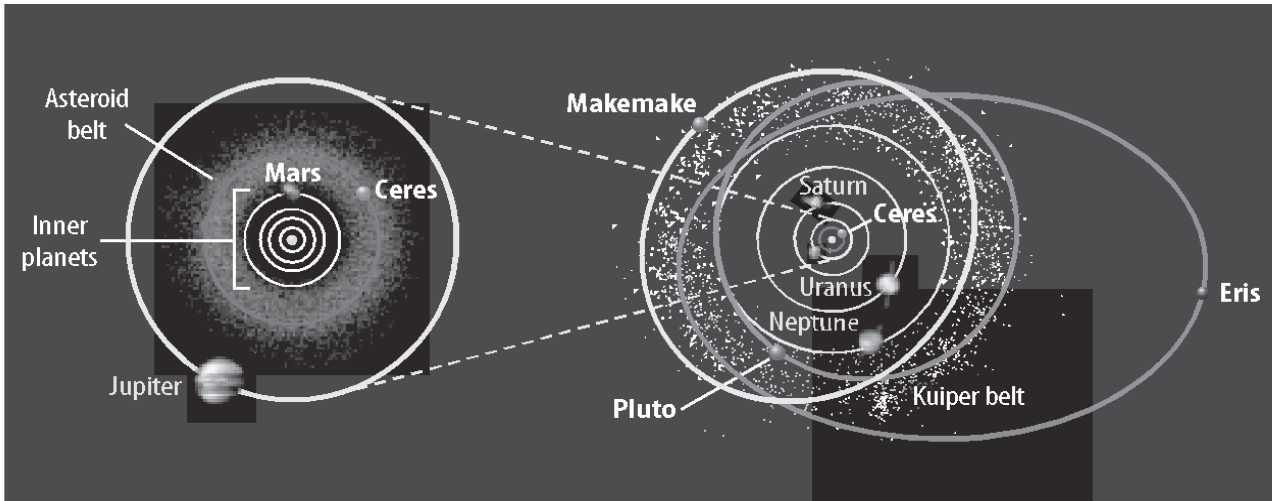
Comets A **comet** is made of gas, dust, and ice and moves around the Sun in an oval-shaped orbit. Comets come from the outer parts of the solar system. Possibly, 1 trillion comets orbit the Sun.

Visual Check

1. Interpret On the diagram, circle the inner planet that orbits the Sun closest to Earth.

Key Concept Check

2. Describe how the inner planets differ from the outer planets.



Visual Check

3. Specify Which dwarf planet is farthest from the Sun?

Key Concept Check

4. Identify Define what an astronomical unit is and explain why it is used.

Key Concept Check

5. Describe the shape of a planet's orbit.

The Astronomical Unit

Astronomers need a unit larger than the kilometer to measure the great distances between objects in the solar system. They use astronomical units. An **astronomical unit (AU)** is the average distance from Earth to the Sun—about 150 million km. For example, the average distance of Mercury from the Sun is 0.39 AU, or about 58 million km.

The Motion of the Planets

The Sun's gravitational force pulls each planet toward the Sun. This force keeps each planet moving along a curved path around the Sun.

Revolution and Rotation

Objects in the solar system move in two ways. The objects orbit, or revolve, around the Sun. *The time it takes an object to travel once around the Sun is its **period of revolution**.* Earth's period of revolution is one year. The objects also spin, or rotate, as they orbit the Sun. *The time it takes for an object to complete one rotation is its **period of rotation**.* Earth has a period of rotation of one day.

Planetary Orbits and Speeds

A planet's orbit is an ellipse—a stretched-out circle. Two special points, each called a focus, are inside the ellipse. The focus points, or foci, control the shape of the ellipse. The Sun is at one focus, and the other focus is empty space.

A planet's distance from the Sun changes as the planet moves along its elliptical orbit. A planet's speed also changes as it orbits. The closer the planet is to the Sun, the faster it moves. This also means that planets farther from the Sun have longer periods of revolution. For example, Jupiter takes 12 times longer than Earth to revolve around the Sun.

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..... After You Read

Mini Glossary

asteroid: one of millions of small, rocky objects that orbit the Sun in the asteroid belt between the orbits of Mars and Jupiter

astronomical unit (AU): the average distance from Earth to the Sun—about 150 million km

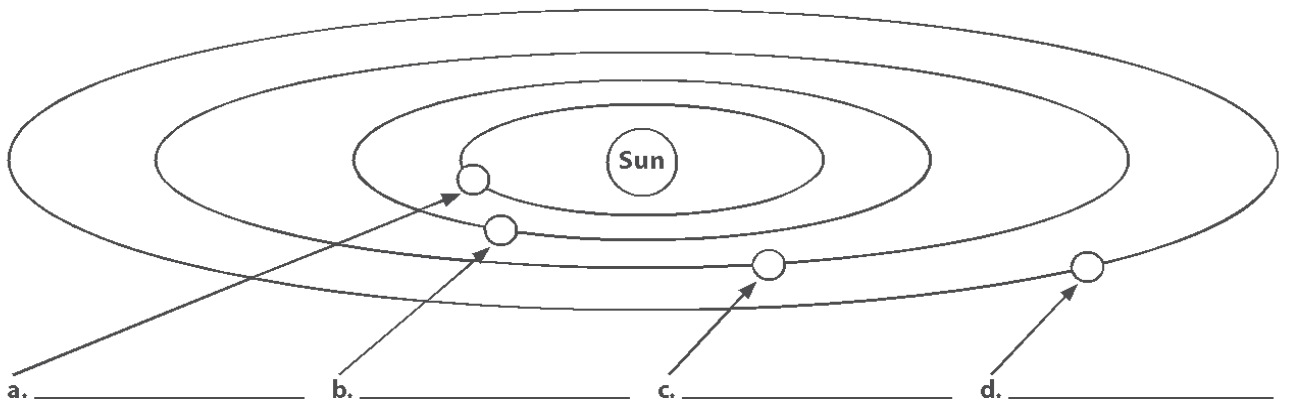
comet: a mixture of gas, dust, and ice that moves around the Sun in an oval-shaped orbit

period of revolution: the time it takes an object to travel once around the Sun

period of rotation: the time it takes an object to complete one rotation

1. Review the terms and their definitions in the Mini Glossary. Write a sentence that explains the difference between an asteroid and a comet.

2. Fill in the blanks below to identify the inner planets in the order of their distance from the Sun.



3. Based on your K-W-L chart, summarize the new facts you learned from this lesson.

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What do you think NOW?

Reread the statements at the beginning of the lesson. Fill in the After column with an A if you agree with the statement or a D if you disagree. Did you change your mind?



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END OF LESSON