

# The Solar System

## Dwarf Planets and Other Objects

### ..... Before You Read .....

**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.

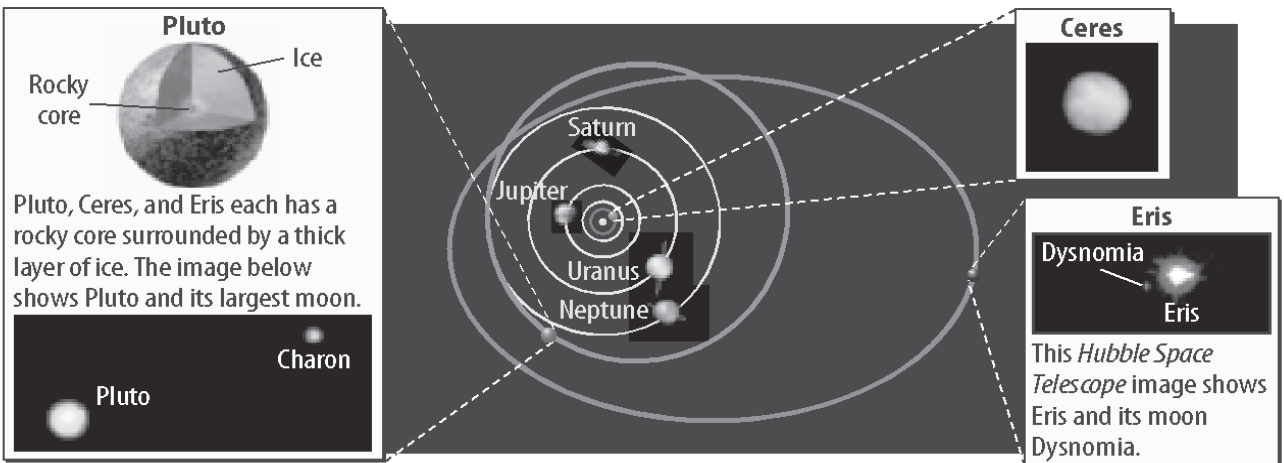
Before	Statement	After
	7. Asteroids and comets are mainly rock and ice.	
	8. A meteoroid is a meteor that strikes Earth.	

### ..... Read to Learn .....

## Dwarf Planets

Pluto once was classified as a planet, but it is now classified as a dwarf planet. In 2006, the International Astronomical Union (IAU) adopted “dwarf planet” as a new category. The IAU defines a dwarf planet as an object that orbits the Sun, has enough mass and gravity to form a sphere, and has objects similar in mass orbiting near it or crossing its orbital path. Astronomers classify Pluto, Ceres, Eris, MakeMake (MAH kay MAH kay), and Haumea (how May uh) as dwarf planets. The figure below shows four dwarf planets.

All dwarf planets are smaller than Earth’s moon. The figure below locates Ceres, Pluto, and Eris. These dwarf planets each have a rocky core surrounded by a thick layer of ice.



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### Key Concepts

- What is a dwarf planet?
- What are the characteristics of comets and asteroids?
- How does an impact crater form?

### Mark the Text

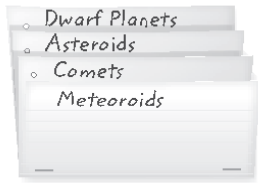
**Define Words** Skim the lesson and underline words that you do not know. Then read the lesson to see if you can define those words. If you cannot, look up the word and write its definition in the margin to use as you study.

### Visual Check

**1. Interpret** Which dwarf planet orbits closest to Earth?

## FOLDABLES®

Make a layered book to organize your notes on other objects in the solar system.



### ✓ Reading Check

**2. State** Which dwarf planet is the largest? Which dwarf planet is the smallest?

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### 🔑 Key Concept Check

**3. Specify** Where do the orbits of most asteroids occur?

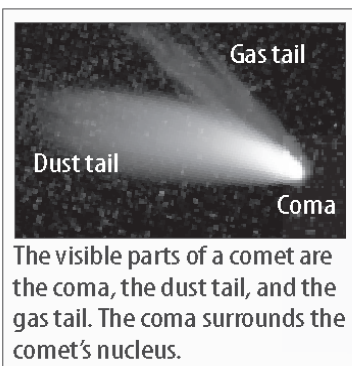
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### 👁 Visual Check

**4. Identify** In the figure, highlight the comet's elliptical orbit.



## Ceres

Ceres is the smallest dwarf planet. It orbits the Sun in the asteroid belt. It might have a rocky core. A thin, dusty crust covers a layer of water ice that surrounds the core.

## Pluto

Pluto is about two-thirds the size of the Moon. It is so far from the Sun that its period of revolution is about 248 Earth years. The surface of Pluto is so cold that it is covered with frozen nitrogen. Its average temperature is  $-230^{\circ}\text{C}$ . Pluto has three known moons: Charon, Hydra, and Nix. Charon is Pluto's largest moon.

## Eris

Eris is the largest dwarf planet. It was discovered in 2003. Eris takes about 557 Earth years to complete one orbit around the Sun. Dysnomia (dis NOH mee uh) is the only known moon of Eris. ✓

## Makemake and Haumea

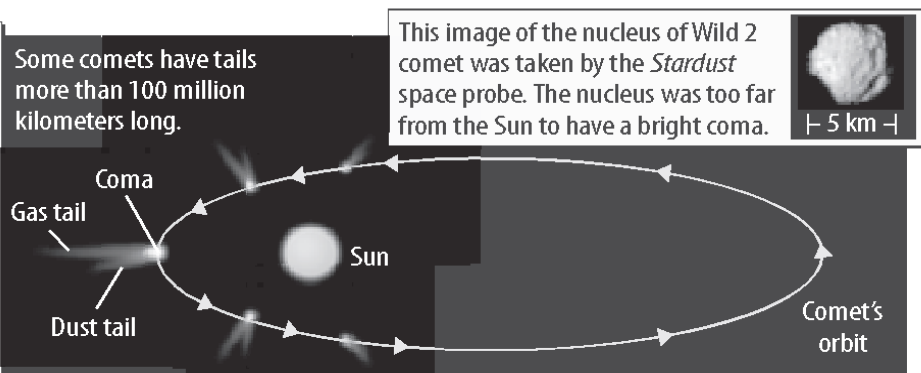
Makemake and Haumea, named dwarf planets in 2008, orbit in the Kuiper (KI puh-er) belt region of the solar system. Makemake is one of the largest objects in the Kuiper belt.

## Asteroids


Recall that asteroids are chunks of rock and ice that never clumped together to form a planet. Most asteroids orbit the Sun in the asteroid belt. The asteroid belt is between the orbits of Mars and Jupiter. There are hundreds of thousands of asteroids. Pallas is the largest asteroid. Some astronomers suggest that asteroids are very old objects left over from the formation of the solar system. 🔑

## Comets

Comets are mixtures of particles of rock, ice, and dust. The particles' gravity holds them loosely together. As shown below, comets orbit the Sun in stretched-out elliptical orbits.



## The Structure of Comets

The solid, inner part of a comet is its nucleus. As a comet moves closer to the Sun, it absorbs thermal energy. Higher temperatures change the ice in the comet into a gas. Energy from the Sun pushes some of the gas and dust away from the comet's nucleus and makes it glow. This produces the comet's bright tail and glowing nucleus, called a coma. The coma surrounds the comet's nucleus. When energy from the Sun strikes the gas and dust in the comet's nucleus, it can create a two-part tail—a dust tail and a gas tail. The gas tail always points away from the Sun. 


## Short-Period and Long-Period Comets

A short-period comet takes less than 200 Earth years to orbit the Sun. Most short-period comets come from the Kuiper belt. The Kuiper belt extends from about the orbit of Neptune to about 50 AU from the Sun.

A long-period comet takes more than 200 Earth years to orbit the Sun. Long-period comets come from an area at the outer edge of the solar system called the Oort cloud. The Oort cloud surrounds the solar system and extends about 100,000 AU from the Sun. Some long-period comets take millions of years to orbit the Sun.

## Meteoroids

Millions of particles called meteoroids enter Earth's atmosphere every day. A **meteoroid** is a small, rocky particle that moves through space. Most meteoroids are only about as big as a grain of sand. As a meteoroid passes through Earth's atmosphere, it creates friction. The friction makes the meteoroid and the air around it hot enough to glow. A **meteor** is a streak of light in Earth's atmosphere made by a glowing meteoroid. Most meteoroids burn up in Earth's atmosphere. Some are large enough that they reach Earth's surface before they burn up completely. When this happens, the meteoroid is then called a meteorite. A **meteorite** is a meteoroid that strikes a planet or a moon.

When a large meteorite strikes a moon or planet, it often forms a bowl-shaped impact crater. An **impact crater** is a round depression formed on the surface of a planet, moon, or other space object by the impact of a meteorite. Earth's surface has more than 170 impact craters. 

### Key Concept Check

**5. Describe** the characteristics of a comet.

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### **Think it Over**

**6. Apply** If you observed a long-period comet, would you ever be able to observe it again? Explain.

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### Key Concept Check

**7. Summarize** What causes an impact crater to form?

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