

# Small Bodies in the Solar System

## BEFORE YOU READ

After you read this section, you should be able to answer these questions:

- What are comets?
- What are asteroids?
- What are meteoroids?

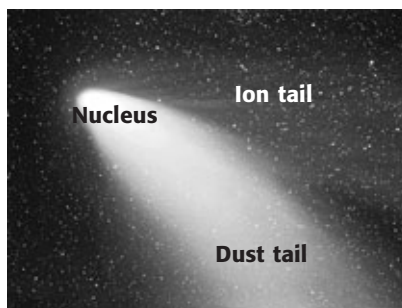
## What Are Comets?

The sun, the planets, and their moons are not the only objects in our solar system. There are also a large number of smaller bodies, including comets, asteroids, and meteoroids. Scientists study these objects to learn about the formation and composition of the solar system.

A **comet** is a small, loosely packed body of ice, rock, and dust. The *nucleus*, or core, of a comet is made of rock, metal, and ice. A comet's nucleus can range from 1 km to 100 km in diameter. A spherical cloud of gas and dust, called a *coma*, surrounds the nucleus. The coma may extend as far as 1 million kilometers from the nucleus. ✓

### COMET TAILS

A comet's tail is its most spectacular feature. Sunlight changes some of the comet's ice to gas, which streams away from the nucleus. Part of the tail is made of *ions*, or charged particles. The *ion tail*, pushed by the solar wind, always points away from the sun, no matter which way the comet is moving. A second tail, the *dust tail*, follows the comet in its orbit. Some comet tails are more than 80 million kilometers long, glowing brightly with reflected sunlight.



This image shows the physical features of a comet when the comet comes close to the sun. The nucleus of the comet is hidden by the brightly lit gases and dust of the coma.



## Say It

**Compare** In your notebook, create a table that compares comets, asteroids, and meteoroids.



## READING CHECK

**1. Describe** What are comets made of?

---



---

## TAKE A LOOK

**2. Identify** Draw an arrow from the nucleus label showing the direction the comet is moving.

**SECTION 5** Small Bodies in the Solar System *continued*

**COMET ORBITS AND ORIGINS**

Remember that the planets move in *elliptical*, or oval-shaped, orbits. Comets also move in elliptical orbits. However, the orbits of comets are much more stretched out than the orbits of planets.

Scientists think that many comets come from the Oort cloud. The *Oort cloud* is a spherical cloud of dust and ice. It surrounds the solar system, far beyond the orbit of Pluto. Pieces of the Oort cloud may fall into orbits around our sun and become comets. Some comets may also come from the *Kuiper belt*, a flat ring of objects just beyond Neptune’s orbit. ✓

**READING CHECK**

**3. Identify** Where is the Oort cloud located?

\_\_\_\_\_

\_\_\_\_\_

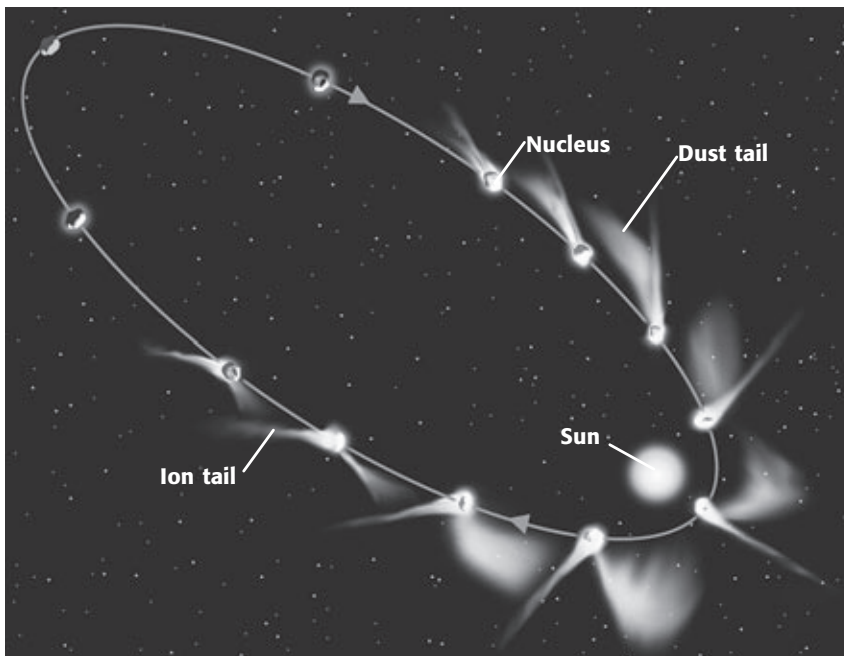
**TAKE A LOOK**

**4. Explain** Why does the ion tail extend in different directions during most of the comet’s orbit?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



Comets have very long orbits that take them close to the sun and well beyond Pluto.

**What Are Asteroids?**

**Asteroids** are small, rocky bodies that revolve around the sun. They range from a few meters to almost 1,000 km in diameter. More than 50,000 asteroids have been discovered. None of them can be seen from Earth without a telescope. In fact, scientists didn’t know that asteroids exist until 1801.

Most asteroids orbit the sun in the **asteroid belt**. This is a region that is 300 million km wide and is located between the orbits of Mars and Jupiter. Astronomers think that asteroids are made of material from the early solar system. The pull of Jupiter’s gravity prevented this material from coming together to form a planet. ✓

**READING CHECK**

**5. Identify** Where is the asteroid belt?

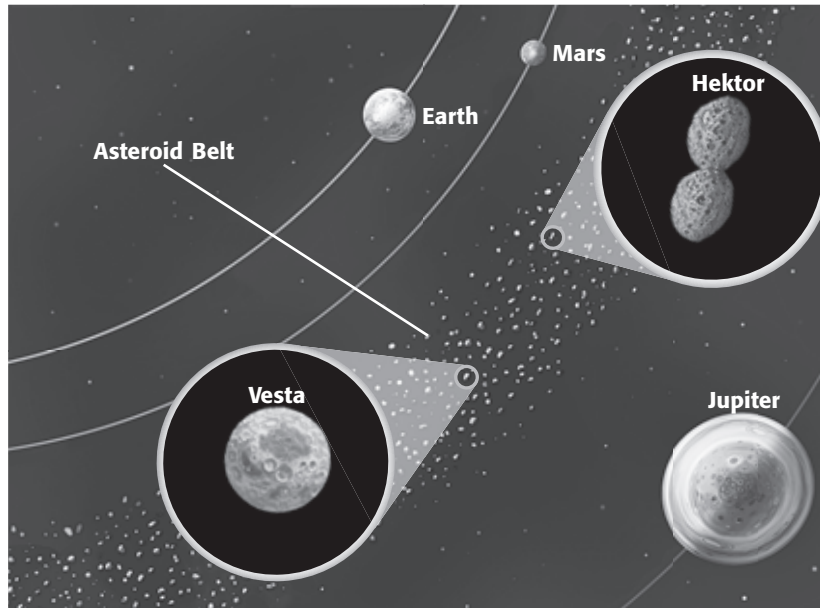
\_\_\_\_\_

**SECTION 5** Small Bodies in the Solar System *continued*

**COMPOSITION OF ASTEROIDS**

It is hard to determine what asteroids are made of. This is because they are small and usually far away from Earth. Mostly, they are composed of either rock or metal. Some asteroids may contain carbon and carbon compounds.

In general, asteroids do not have a spherical shape because of their small size. Gravity must be very strong to pull matter together into a spherical shape. Only the largest asteroids are spherical.



**What Are Meteoroids?**

Pieces of dust and debris from asteroids and comets, called **meteoroids**, are scattered throughout the solar system. Most meteoroids are about the size of a grain of sand. When a meteoroid enters Earth’s atmosphere, it can reach a speed of up to 250,000 km/h.

Friction with the atmosphere heats meteoroids and the air around them, causing them to glow brightly. The glowing trails that form when meteoroids burn up in the atmosphere are called **meteors**. A meteor can be a few hundred meters in diameter and tens of kilometers long before it fades.

Sometimes, a larger meteoroid enters the atmosphere. Some of these meteoroids pass through the atmosphere without burning up completely. When they reach Earth’s surface, they are called **meteorites**. ✓

*Critical Thinking*

**6. Make Inferences** How do you think scientists know what asteroids are made of?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**TAKE A LOOK**

**7. Compare** How do asteroid sizes compare to planet sizes?

\_\_\_\_\_

\_\_\_\_\_

**READING CHECK**

**8. Compare** What is the difference between a meteoroid and a meteorite?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**SECTION 5** Small Bodies in the Solar System *continued*

**TYPES OF METEORITES**

Scientists classify meteorites based on composition. There are three main types of meteorites: stony, metallic, and stony-iron. *Stony meteorites* are similar to rocks on Earth. Some of them contain carbon compounds similar to those found in living organisms. Stony meteorites probably come from carbon-rich asteroids. ✓

*Metallic meteorites* have a distinctive metallic appearance and do not look like terrestrial rocks. They are made mainly of iron and nickel. *Stony-iron meteorites* are made of a combination of rocky material, iron, and nickel.

**Three Major Types of Meteorites**

**Stony Meteorite:**  
rocky material

**Metallic Meteorite:**  
iron and nickel

**Stony-iron Meteorite:**  
rocky material, iron,  
and nickel



Scientists study meteorites to learn about the early solar system.

Remember that asteroids and comets are probably made of debris from the formation of our solar system. Meteorites are easier for scientists to study than asteroids and comets. Because meteorites are pieces of asteroids and comets, scientists study meteorites to learn about the early solar system.

**METEOR SHOWERS**

Meteors can be seen on most clear nights. When many small meteoroids enter the atmosphere in a short period, it is called a *meteor shower*. During some meteor showers, several meteors are visible every minute. Meteor showers happen at the same time each year. These showers happen when Earth passes through orbits of comets that have left a dust trail.

**READING CHECK**

**9. List** What are the three types of meteorites?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**TAKE A LOOK**

**10. Identify** What two metals are found in metallic meteorites?

\_\_\_\_\_

*Critical Thinking*

**11. Infer** Why are meteorites easier to study than asteroids or comets?

\_\_\_\_\_

\_\_\_\_\_

**SECTION 5** Small Bodies in the Solar System *continued***IMPACTS IN OUR SOLAR SYSTEM**

Impacts are common in our solar system. An *impact* happens when an object in space collides with another object. In many cases, impacts produce impact craters. Many of the planets and moons in our solar system, including Earth, have visible impact craters.

Planets and moons with atmospheres have fewer impact craters than those without atmospheres. For example, there are only a few visible impact craters on Earth. However, the surface of our moon is covered with impact craters. Earth has fewer craters because the atmosphere acts as a shield. Most objects that enter Earth's atmosphere burn up before they reach the surface. ✓

Another reason that there are few visible impact craters on Earth is that Earth has a very active surface. Plate tectonics, weathering, erosion, and deposition act to smooth out and change Earth's surface. These processes are less common on other planets and moons.

Most objects that enter Earth's atmosphere are small and burn up completely before reaching the surface. However, scientists think that impacts powerful enough to cause a natural disaster happen every few thousand years. An impact large enough to cause a global catastrophe may happen once every 50 to 100 million years.

**THE TORINO SCALE**

Scientists can track objects that are close to Earth to learn whether they might hit Earth. Scientists use the *Torino scale* to rate the chance that an object will hit the Earth. The Torino scale ranges from 0 to 10. Zero indicates that an object has a very small chance of hitting the Earth. Ten indicates that the object will definitely hit the Earth. The Torino scale is also color coded, as shown in the table below.

Color	Number	Hazard level
White	0	very low; almost certainly will not hit the Earth
Green	1	low
Yellow	2, 3, or 4	moderate
Orange	5, 6, or 7	high
Red	8, 9, or 10	very high; almost certainly will hit the Earth

 **READING CHECK**

**12. Identify** Why do fewer meteorites hit Earth's surface than the surface of the moon?

---



---



---



---

**TAKE A LOOK**

**13. Identify** Which color on the Torino scale is used to describe an object that will probably hit the Earth?

---

# Section 5 Review

## SECTION VOCABULARY

<p><b>asteroid</b> a small, rocky object that orbits the sun; most asteroids are located in a band between the orbits of Mars and Jupiter</p> <p><b>asteroid belt</b> the region of the solar system that is between the orbits of Mars and Jupiter and in which most asteroids orbit</p> <p><b>comet</b> a small body of ice, rock, and cosmic dust that follows an elliptical orbit around the sun and that gives off gas and dust in the form of a tail as it passes close to the sun</p>	<p><b>meteor</b> a bright streak of light that results when a meteoroid burns up in Earth’s atmosphere</p> <p><b>meteorite</b> a meteoroid that reaches the Earth’s surface without burning up completely</p> <p><b>meteoroid</b> a relatively small, rocky body that travels through space</p>
--	---

**1. Describe** How can a comet become the source of meteoroids and meteors?

---



---

**2. Classify** Fill in the blanks to complete the table.

Object	Composition	Main Location
	Large chunk of rock or metal—much smaller than planets	
		Oort cloud and Kuiper belt
	small chunk of rock or metal	throughout the solar system

**3. Identify Connections** Why is information about comets, asteroids, and meteoroids important for understanding the development of the solar system?

---



---



---

**4. Apply Concepts** Why would scientists want to know if an asteroid is on a course to collide with Earth in 20 years?

---



---