

Comets, Asteroids, and Meteors

Reading Preview

Key Concepts

- What are the characteristics of comets?
- Where are most asteroids found?
- What are meteoroids and how do they form?

Key Terms

- comet • coma • nucleus
- Kuiper belt • Oort cloud
- asteroid • asteroid belt
- meteoroid • meteor
- meteorite

Target Reading Skill

Comparing and Contrasting

As you read, compare and contrast comets, asteroids, and meteoroids by completing a table like the one below.

Comets, Asteroids, and Meteoroids

Feature	Comets	Asteroids
Origin	Kuiper belt and Oort cloud	
Size		
Composition		

FIGURE 23



Structure of a Comet

The main parts of a comet are the nucleus, the coma, and the tail. The nucleus is deep within the coma. Most comets have two tails—a bluish gas tail and a white dust tail.

Lab
zone

Discover Activity

Which Way Do Comet Tails Point?

1. Form a small ball out of modeling clay to represent a comet.
2.  Using a pencil point, push three 10-cm lengths of string into the ball. The strings represent the comet's tail. Stick the ball onto the pencil point, as shown.
3.  Hold the ball about 1 m in front of a fan. The air from the fan represents the solar wind. Move the ball toward the fan, away from the fan, and from side to side.



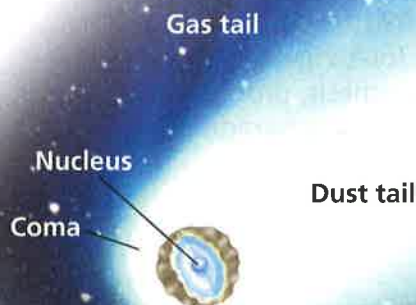
CAUTION: Keep your fingers away from the fan blades.

Think It Over

Inferring How does moving the ball affect the direction in which the strings point? What determines which way the tail of a comet points?

Imagine watching a cosmic collision! That's exactly what happened in July 1994. The year before, Eugene and Carolyn Shoemaker and David Levy discovered a comet that had previously broken into pieces near Jupiter. When their orbit passed near Jupiter again, the fragments crashed into Jupiter. On Earth, many people were fascinated to view images of the huge explosions—some were as large as Earth!

As this example shows, the sun, planets, and moons aren't the only objects in the solar system. There are also many smaller objects moving through the solar system. These objects are classified as comets, asteroids, or meteoroids.



Comets

One of the most glorious things you can see in the night sky is a comet. But what exactly is a comet? You can think of a **comet** as a “dirty snowball” about the size of a mountain. **Comets are loose collections of ice, dust, and small rocky particles whose orbits are usually very long, narrow ellipses.**

A Comet’s Head When a comet gets close enough to the sun, the energy in the sunlight turns the ice into gas, releasing gas and dust. Clouds of gas and dust form a fuzzy outer layer called a **coma**. Figure 23 shows the coma and the **nucleus**, the solid inner core of a comet. The brightest part of a comet, the comet’s head, is made up of the nucleus and coma.

A Comet’s Tail As a comet approaches the sun and heats up, some of its gas and dust stream outward, forming a tail. The name *comet* means “long-haired star” in Greek. Most comets have two tails—a gas tail and a dust tail. Both tails usually point away from the sun, as shown in Figure 24.

A comet’s tail can be more than 100 million kilometers long and stretch across most of the sky. The material is stretched out very thinly, however, so there is little mass in a comet’s tail.

Origin of Comets Most comets are found in one of two distant regions of the solar system: the Kuiper belt and the Oort cloud. The **Kuiper belt** is a doughnut-shaped region that extends from beyond Neptune’s orbit to about 100 times Earth’s distance from the sun. The **Oort cloud** is a spherical region of comets that surrounds the solar system out to more than 1,000 times the distance between Pluto and the sun.



Reading Checkpoint

What is the Oort cloud?



For: Links on comets, asteroids, and meteors

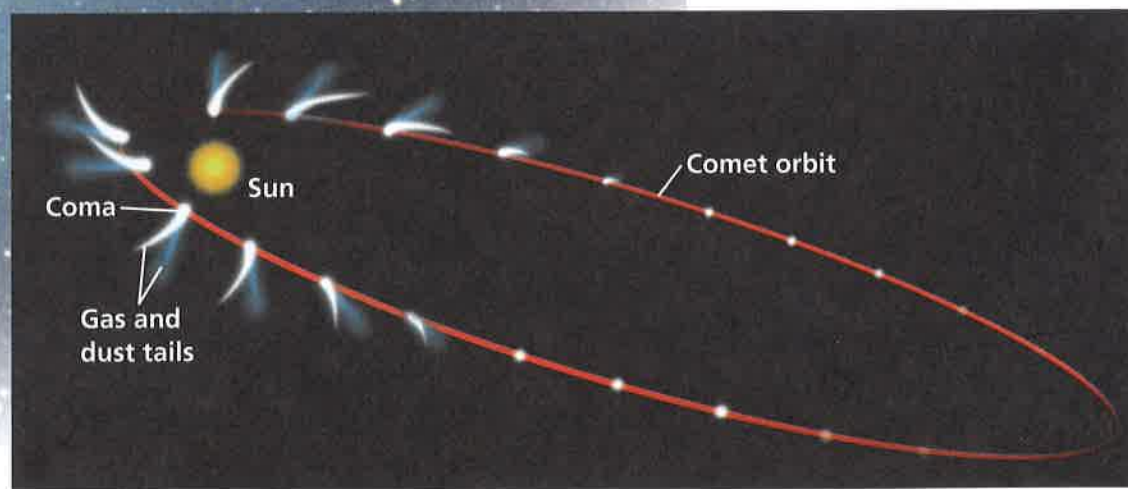
Visit: www.SciLinks.org

Web Code: scn-0635

FIGURE 24

Comet Orbits

Most comets revolve around the sun in very long, narrow orbits. Gas and dust tails form as the comet approaches the sun. **Observing** What shape is a comet’s orbit?



Lab zone Try This Activity

Micrometeorites

An estimated 300 tons of material from space fall on Earth each day. Much of this is micrometeorites, tiny, dust-sized meteorites.

1. To gather magnetic micrometeorites, tie a string to a small, round magnet and place the magnet in a plastic freezer bag. Lower the magnet close to the ground as you walk along sidewalk cracks, drain spouts, or a parking lot.
2. To gather nonmagnetic and magnetic micrometeorites, cover one side of a few microscope slides with petroleum jelly. Leave the slides outside for several days in a place where they won't be disturbed.
3. Use a microscope to examine the materials you have gathered. Any small round spheres you see are micrometeorites.

Estimating Which technique allows you to gather a more complete sample of micrometeorites? Were all the particles that were gathered in Step 2 micrometeorites? How could you use the method described in Step 2 to estimate the total number of micrometeorites that land on Earth each day?

Asteroids

Between 1801 and 1807, astronomers discovered four small objects between the orbits of Mars and Jupiter. They named the objects Ceres, Pallas, Juno, and Vesta. Over the next 80 years, astronomers found 300 more. These rocky objects, called **asteroids**, are too small and too numerous to be considered full-fledged planets. **Most asteroids revolve around the sun between the orbits of Mars and Jupiter.** This region of the solar system, shown in Figure 25, is called the **asteroid belt**.

Astronomers have discovered more than 100,000 asteroids, and they are constantly finding more. Most asteroids are small—less than a kilometer in diameter. Only Ceres, Pallas, and Vesta are more than 300 kilometers across. At one time, scientists thought that asteroids were the remains of a shattered planet. However, the combined mass of all the asteroids is too small to support this idea. Scientists now hypothesize that the asteroids are leftover pieces of the early solar system that never came together to form a planet.

Some asteroids have very elliptical orbits that bring them closer to the sun than Earth's orbit. Someday, one of these asteroids could hit Earth. One or more large asteroids did hit Earth about 65 million years ago, filling the atmosphere with dust and smoke and blocking out sunlight around the world. Scientists hypothesize that many species of organisms, including the dinosaurs, became extinct as a result.

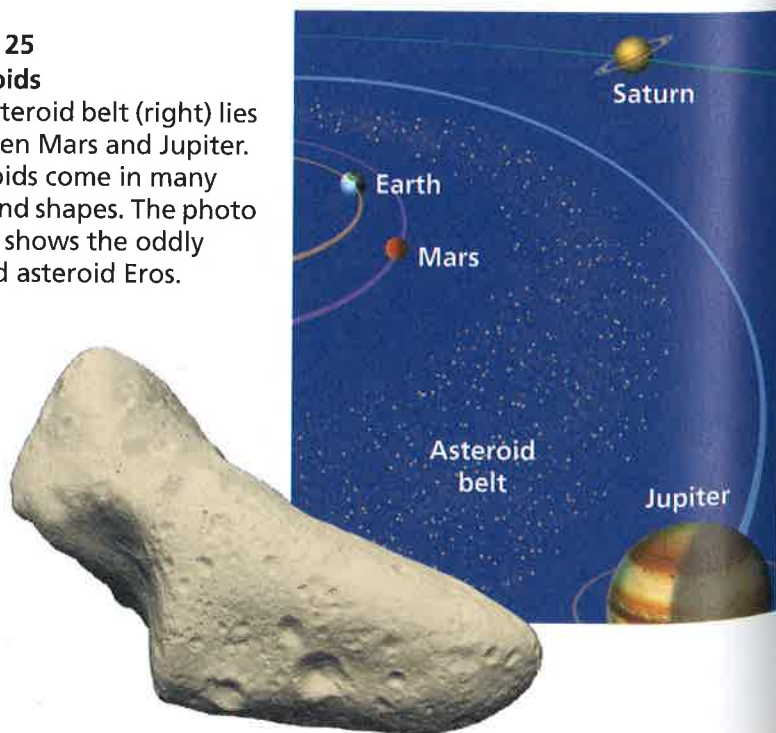


Reading
Checkpoint

Name the three largest asteroids.

FIGURE 25
Asteroids

The asteroid belt (right) lies between Mars and Jupiter. Asteroids come in many sizes and shapes. The photo below shows the oddly shaped asteroid Eros.



Meteors

It's a perfect night for stargazing—dark and clear. Suddenly, a streak of light flashes across the sky. For an hour or so, you see a streak at least once a minute. You are watching a meteor shower. Meteor showers happen regularly, several times a year.

Even when there is no meteor shower, you often can see meteors if you are far from city lights and the sky is not cloudy. On average, a meteor streaks overhead every 10 minutes.


A **meteoroid** is a chunk of rock or dust in space. **Meteoroids come from comets or asteroids.** Some meteoroids form when asteroids collide in space. Others form when a comet breaks up and creates a cloud of dust that continues to move through the solar system. When Earth passes through one of these dust clouds, bits of dust enter Earth's atmosphere.

When a meteoroid enters Earth's atmosphere, friction with the air creates heat and produces a streak of light in the sky—a **meteor**. If the meteoroid is large enough, it may not burn up completely. Meteoroids that pass through the atmosphere and hit Earth's surface are called **meteorites**. The craters on the moon were formed by meteoroids.



FIGURE 26 Meteors
Meteoroids make streaks of light called meteors as they burn up in the atmosphere.

Section 5 Assessment

 **Target Reading Skill Comparing and Contrasting** Use the information in your table about comets, asteroids, and meteoroids to help you answer the questions below.

Reviewing Key Concepts

- Defining** What is a comet?
 - Listing** What are the different parts of a comet?
 - Relating Cause and Effect** How does a comet's appearance change as it approaches the sun? Why do these changes occur?
- Describing** What is an asteroid?
 - Explaining** Where are most asteroids found?
 - Summarizing** How did the asteroids form?
- Describing** What is a meteoroid?
 - Explaining** What are the main sources of meteoroids?
 - Comparing and Contrasting** What are the differences between meteoroids, meteors, and meteorites?

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At-Home Activity

Observing Meteors Meteor showers occur regularly on specific dates. (The Perseid meteor shower, for example, occurs around August 12 each year.) Look in the newspaper, on the Internet, or in an almanac for information about the next meteor shower. With adult family members, go outside on that night and look for meteors. Explain to your family what causes the display.