Be a Scientist!

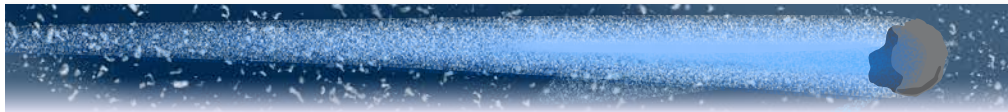
You have discovered a new comet! Give it a name and decide where it came from in the solar system. Also decide how long it takes to complete one orbit around the Sun. Is it a short- or long-period comet?

Now draw a diagram of the solar system and show your comet's orbit. Label its place of origin and its orbital period. Finally, add a flyby schedule on your diagram. If your comet passes by Earth this year, when will its next four visits take place?

Beyond the Book

Go online to follow the journey of space probes, such as *Rosetta,* that are exploring comets.

Notes



COMETS

FOCUS Question

What are comets, and how do they move through the solar system?

Patterns

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Comets
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Written by Rhonda Lucas Donald

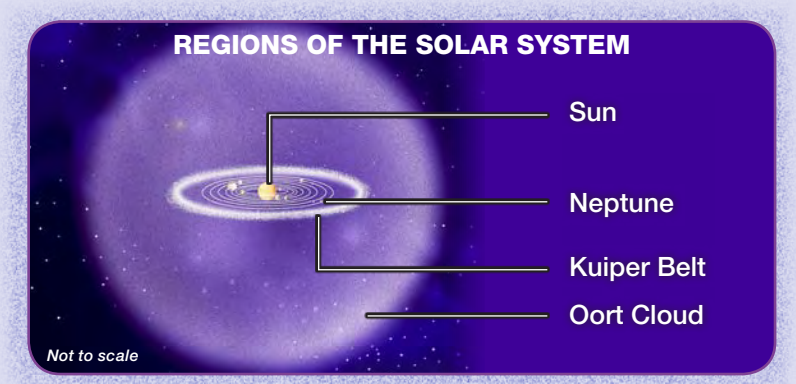
www.sciencea-z.com

What Is a Comet?

What is the difference between a comet and a big rock? Not much! Comets are icy rocks flying through space. They are best known for their long tails visible in the night sky.

Comets have been around since the solar system formed 4.6 billion years ago. They are leftovers from materials that formed the planets. Their long orbits take them to the farthest reaches of the solar system and also bring them dangerously close to the Sun.

Some comets orbit in the Asteroid Belt between Mars and Jupiter. But most come from much farther away. Beyond Neptune is the Kuiper (KY-pur) Belt. It contains billions of comets. Even farther out is the Oort Cloud. It is home to trillions of comets!



The Kuiper Belt lies beyond Neptune. At the farthest edge of the solar system is the Oort Cloud.

Notes

Read-Think-Write

Write your answers on separate paper. Use details from the text as evidence.

1. Look at the images and data on pages 2 and 3. How does the place where a comet comes from relate to its orbital period around the Sun?
2. What are the three main parts of a comet?
3. Like a comet, Earth and Mars have rock and ice. Why don't these planets break up and leave a tail behind them as they orbit the Sun?
4. What do you think happens to comets after they orbit the Sun many times?
5. How can fictional stories about comets throughout history help modern-day scientists?

FOCUS Question

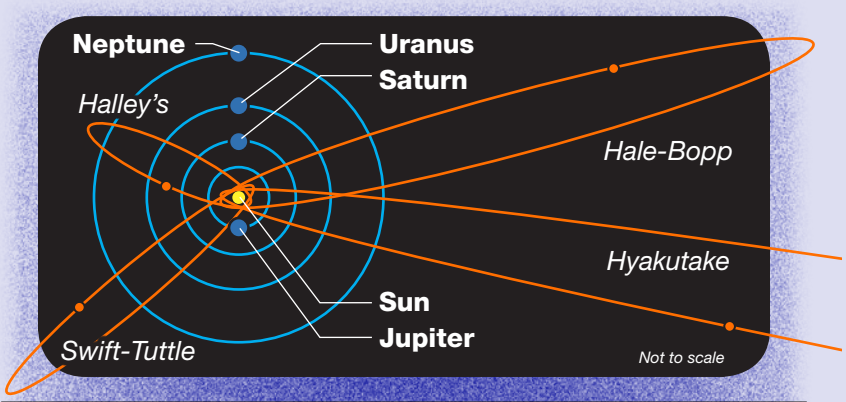
What are comets, and how do they move through the solar system? Use what you know about planets to compare a comet with a planet. Consider what they are made of, where they are found, their orbits, and how they change over time.

Trips Around Sun

The time it takes a comet to orbit the Sun is called a *period*. Short-period comets orbit the Sun in 200 or fewer years. They come from the Kuiper Belt. Long-period comets usually come from the Oort Cloud.

Why do comets orbit the Sun? As they fly, comets are pulled toward the Sun because of its powerful gravity. But instead of crashing into the Sun, comets usually curve around it. Their speed propels them back out to distant places in the solar system.

COMET ORBITS IN THE SOLAR SYSTEM



Comet	Type	Period (years)	Year of next pass around the Sun
Halley's	short-period	75	2061
Swift-Tuttle	short-period	133	2126
Hale-Bopp	long-period	2,530	4527
Hyakutake	long-period	17,000–70,000	72,000+

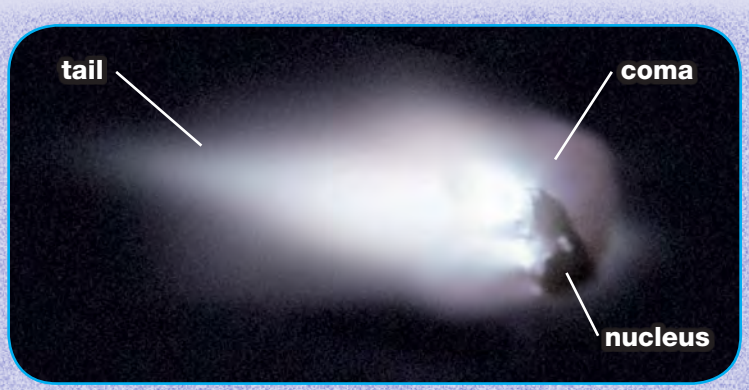
Parts of a Comet

What happens when a comet comes close to the Sun? To answer this question, it helps to know the parts of a comet. The main part is the *nucleus*, which is made up of rock, dust, and ice. The nucleus may be 1 to 40 kilometers (0.6 to 25 mi.) across.

When a comet nears the Sun, the intense heat melts some of the ice and burns off tiny bits of the rock and dust. The water vapor and burning bits combine to form an atmosphere called a *coma* (KO-muh).

Even closer to the Sun, the comet develops a *tail*—a trail of dust and gas. The tail always points away from the Sun. This is due to *solar wind*, a nonstop flow of particles speeding away from the Sun.

PARTS OF A COMET

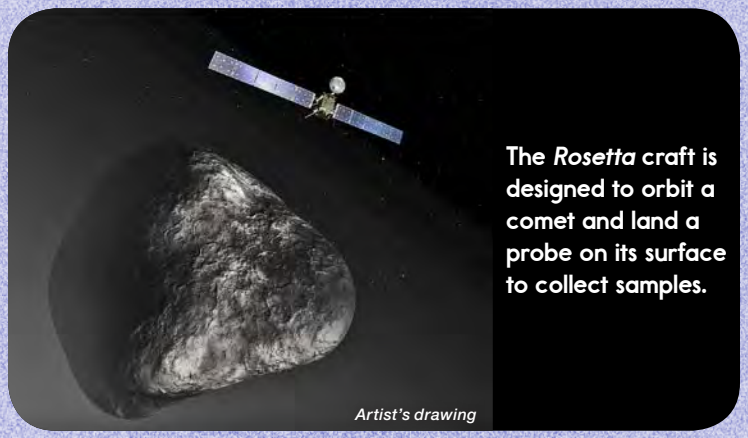


Comet Landings and Future Missions

Stardust paved the way for a comet landing. In 2005, the *Deep Impact* space probe crashed into comet Tempel 1. Scientists studied the crater made by the space probe. They found that the comet's surface was not as solid as we thought.

In 2014, for the first time in history, the *Rosetta* spacecraft entered a comet's orbit. *Rosetta* was designed to follow comet 67P as it orbits the Sun. A lander was sent to sample the comet's core.

Luckily, you don't have to go into space to see a comet! Comets are visible by telescope. Sometimes you can see one with your unaided eyes.



The *Rosetta* craft is designed to orbit a comet and land a probe on its surface to collect samples.

Why Study Comets?

Planets, moons, and asteroids formed from dust and gas swirling around the newborn Sun. So did comets. They are all made of the same materials. By studying comets, scientists can learn more about how the solar system formed.

Some comets reach deep space on their long journeys around the Sun. They can help us understand what lies at the edges of the solar system and beyond.

Scientists are using space probes to study comets. The *Stardust* space probe scooped up a sample of comet particles and returned them to Earth in 2006.

Wowser!

Here's one theory about how life began on Earth. Comets from the Asteroid Belt may have crashed into Earth, delivering water and the building blocks of life.

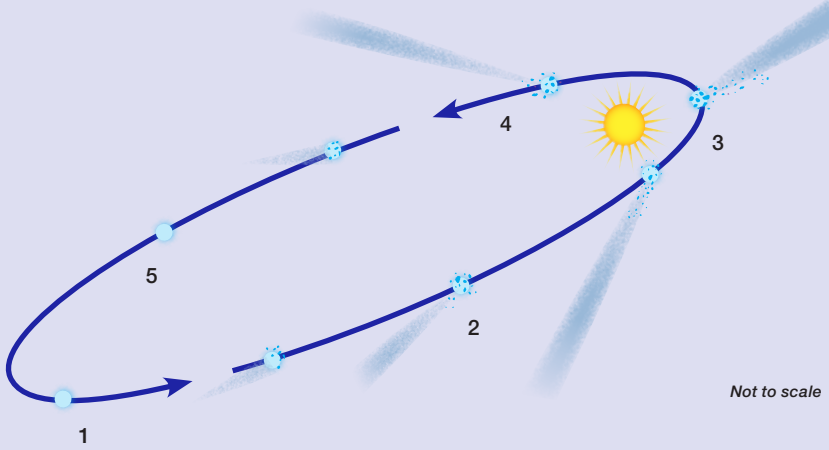
This artist's drawing shows *Stardust* as it neared a comet called Wild 2. Samples showed that comets contain the building blocks of life.

It's a Comet's Life

Each time a comet nears the Sun, it loses some of its ice and dust. Once all the ice is gone, the comet becomes more like an asteroid. Without the ice to hold it together, it may break into smaller pieces.

Some comets meet a more dramatic end. They may get pulled into the gravity of a planet and burn up in its atmosphere. Others may survive to impact the surface. Still other comets are completely destroyed when they travel too close to the Sun.

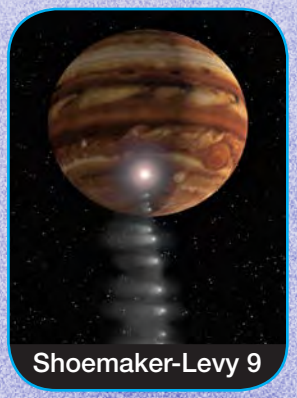
LIFE CYCLE OF A COMET



1. A comet begins one of many orbits around the Sun.
2. As the comet nears the Sun, its ice begins to melt, creating the tail.
3. The comet's tail grows longer as it nears the Sun.
4. Due to solar wind, the comet's tail always faces away from the Sun.
5. The comet loses its tail as it moves away from the Sun.

Famous Comets

In 1994, astronomers observed a comet's doom—and power! Comet Shoemaker-Levy 9 was in close orbit around Jupiter. That July, it began to break up. Pieces crashed into the massive planet. The impacts formed dark spots on the planet's surface.


Shoemaker-Levy 9

Comet Hale-Bopp was a bright spot in Earth's skies in 1997. Its orbit takes over 2,500 years. The last people who saw it may have been ancient Egyptians!


Hale-Bopp

But the real comet superstar is Halley's Comet. It is well known because about every 75 years, right on schedule, it streaks past Earth.


Halley's

Comets Blaze Through History

Records of Halley's Comet are found throughout history. Chinese stories first mention it in 239 BC. In 1066, it flew by during a war in England. In 1665, it visited just before a deadly plague in England. Some blamed it for the fall of the Alamo mission in Texas, in 1835.

In the past, people did not understand comets. Some thought they were bad luck. However, even made-up tales help today's scientists. These old stories show the patterns of comets over time.


Chinese astronomers drew pictures of comets in 300 BC.

William the Conqueror invaded England in 1066. He thought Halley's Comet brought him success. You can see the comet in this tapestry made about the event.