

Name \_\_\_\_\_



**Background Information:** Throughout history, people have been both awed and alarmed by comets, stars with "long hair" (Comets get their name from the Greek word "kometes" (long hair) - a reference to their tails) that appeared in the sky unannounced and unpredictably. We now know that comets are dirty-ice leftovers from the formation of our solar system around 4.6 billion years ago. They are among the least-changed objects in our solar system and, as such, may yield important clues about the formation of our solar system. We can predict the orbits of many of them, but not all.

Around a dozen "new" comets are discovered each year. **Short-period comets** are more predictable because they take less than 200 years to orbit the Sun. Most come from a region of icy bodies beyond the orbit of Neptune. These icy bodies are called Kuiper Belt Objects,

Less predictable are **long-period comets**, many of which arrive from a distant region called the Oort cloud about 100,000 astronomical units (that is, 100,000 times the mean distance between Earth and the Sun) from the Sun. These comets can take as long as 30 million years to complete one trip around the Sun. (It takes Earth only 1 year to orbit the Sun.) As many as a trillion comets may reside in the Oort cloud, orbiting the Sun near the edge of the Sun's gravitational influence.

Each comet has only a tiny solid part, called a nucleus, often no bigger than a few kilometers across. The nucleus contains icy chunks and frozen gases with bits of embedded rock and dust. At its center, the nucleus may have a small, rocky core.

As a comet nears the Sun, it begins to warm up. The comet gets bright enough to see from Earth while its atmosphere - the coma - grows larger. The Sun's heat causes ice on the comet's surface to change to gases, this is called sublimation - when the ice goes from solid to gas without turning into a liquid. "Vents" on the Sun-warmed side may release fountains of dust and gas for tens of thousands of kilometers. The escaping material forms a coma that may be hundreds of thousands of kilometers in diameter.

The sunlight and the solar wind, blow the coma materials away from the Sun, forming the comet's long, bright tails, which are often seen separately as straight tails of

electrically charged ions and an arching tail of dust. The tails of a comet always point away from the Sun.

Most comets travel a safe distance from the Sun itself. Comet Halley comes no closer than 89 million kilometers from the Sun, which is closer to the Sun than Earth is. However, some comets, called **sun-grazers**, crash straight into the Sun or get so close that they break up and vaporize.

### Materials:

Plastic tub  
2 cups of dry ice (frozen CO<sub>2</sub>)  
4 plastic garbage bags  
2 rubber gloves (one for each hand)  
1 hammer  
1 large wooden spoon  
Paper towels  
2 cups of water  
2 tablespoons of potting soil  
1 dash of ammonia  
1 dash of cola  
1 ice chest

### Procedure:

1. Keep the dry ice in the ice chest until you're ready to use it.
2. Line the plastic tub with one of the garbage bags.
3. Put 2 cups of water in the plastic tub.
4. Add the potting soil and stir.
5. Add a dash of cola and ammonia and mix well.
6. Put 3 garbage bags inside each other to insulate the dry ice.
7. Using your gloves to avoid burns, put the dry ice inside the three bags.
8. Using the hammer, crush the dry ice.
9. Add the dry ice to the plastic tub and stir until the mixture is almost frozen.
10. Using the plastic, remove the mixture from the bowl and form it into a ball.
11. Remove the comet from the plastic wrapping once it is frozen enough to stay round.

Observations of the comet:

Questions:

1. What celestial body do comets orbit?
2. What is the nucleus of a comet made of?
3. Is a comet's coma solid, liquid, or gaseous?
4. When is the tail of a comet visible?
5. Are comets in circular or elliptical orbits?
6. What is the name for the process in which a solid matter (like a comet's nucleus) goes directly to a gaseous state?
7. Does a comet's tail ever face the Sun?
8. What happens when the Earth crosses a comet's orbit and encounters comet debris?
9. What is the name of a comet that crashes into the sun (or gets so close that it burns up)?
10. Why is using a model a good way to investigate comets? What are some disadvantages to using a model?