NASA's EPOXI Mission Modeling Comets

Comet on a Stick!

ACTIVITY

Created for the Deep Impact Mission,
A NASA Discovery Mission
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Adapted by EPOXI E/PO

Purpose:
Develop a model of a comet by implementing the same thought processes a mission science and engineering team might use. Test your ideas about comets and then evaluate the strengths and weaknesses of your comet model.

Brainstorm Comet Characteristics:

1. With your classmates, brainstorm a list of what you already know about comets. Add to that list the things you would like to know about comets.

2. Review your *Comet Facts To Model* list on the last page. Choose three facts about comets you would like to demonstrate through your model.

3. Brainstorm how proximity to the Sun might affect a comet.

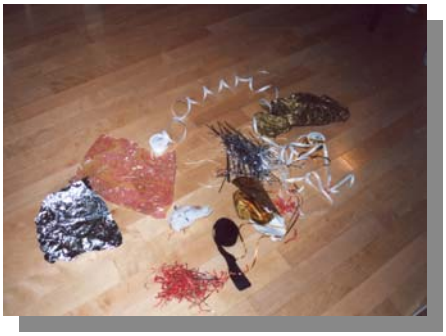
4. Brainstorm ways that your team can work together while building the model.

5. Consider the facts about comets you wish to demonstrate through your model. Choose materials you think will best help show those characteristics.

6. Now, build a "Comet on a Stick."

Materials:

- One 2" styrofoam or other ball or an 8 ½" X 11" piece of paper
- Two 1–2' lengths of mylar gift strips, raffia, or ribbon
- Transparent tape and/or white glue
- One wooden skewer (shish kabob type)
- Optional: An electric hairdryer (with electrical power available) if you want to model how the tail forms
- One marker
- Miscellaneous household or art supplies



Sample materials for Comet on a Stick

Build your comet model:

1. With a marker pen, assign a "front" for your comet and represent it with the letter "H" for head. On the opposite side, mark the letter "T" for tail of the comet.
2. Place the mylar strips, raffia, or ribbon on top of the ball or paper nucleus so the strips hang down. Attach the strips to the ball or paper with a strip of tape.
3. Glue or tape cotton or other materials around your nucleus to make the coma.
4. Be sure to demonstrate three facts about comets in your model (see below).
5. Make a tiny hole in the ball so it can be mounted tightly on the skewer. If you use paper instead, mold it to the shape you believe should represent your comet nucleus.

Test your comet model:

1. Have someone be the "Sun" and stand in place with the hairdryer. The hairdryer simulates the energy that forms the comet "tail" in a direction away from the Sun.
2. Aim the hairdryer at the head of the comet as it approaches and then as it moves away from the Sun. You will need to turn in a circle to do this.
3. Have a second person hold the comet model by the stick and walk in an oval (elliptical) orbit around the Sun.

Review your comet model:

1. Describe your comet model.

2. Explain how your model shows three facts about comets.

3. What are the strengths of your model for showing the proper influence of the Sun?

4. How can your model be improved?

Improve Your Model:

1. Use this space to write your plan to improve your model.

2. Once your team has designed your comet model, show it to the other teams without explanation. See if they can identify what characteristics you were trying to show about a comet.

3. Was the other team able to correctly identify the comet characteristics you were trying to demonstrate with your model? If not, how would you change your model?

Team Evaluation: Rate how well your team collaborated*, worked to improve your model, and now understand comets*.

Rating: 1 is outstanding, 2 is good, 3 is needs improvement
(Circle your answer)

We worked and planned together	1	2	3
We shared ideas and took turns	1	2	3
We checked that everyone understood	1	2	3
We divided roles and responsibilities	1	2	3
We presented our model as a group	1	2	3
Our model displays three characteristics of a comet	1	2	3
We understand the relationship between parts of the model and actual comets	1	2	3
We provided suggestions for improving our model	1	2	3
We understand the effect of the Sun on comets	1	2	3

How could your team improve next time?

What did you learn from this activity

a) about comets?

b) about models?

c) about teamwork?

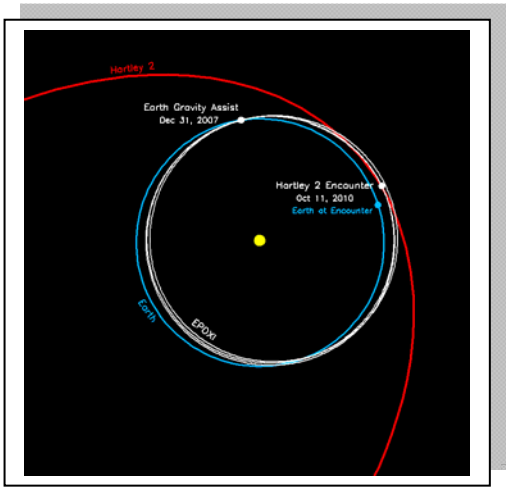
What is a comet?

Comets are remnants from the cold, outer regions of the solar system. They are generally thought to come from two areas: the Kuiper Belt and the Oort Cloud. Both of these are areas where materials left over from the formation of our solar system have condensed into icy objects. Both regions extend beyond the orbits of Neptune and Pluto but are still part of our solar system and much closer to us than the closest star.

Most of the time, when a comet is very far from the Sun, it is just a frozen lump of ice and dust called the nucleus. They are very hard to see because they are so small. However, as they move through the Solar System and get closer to the Sun, interesting things start to happen. The heat radiated from the Sun warms the surface causing a cloud of gas and dust called the coma to form around the nucleus hiding it from view. Some of the bigger bits of dust get left behind like a trail of crumbs and form a dust tail. The gas is blown away from the nucleus by the solar wind and always points away from the Sun.

Comet Facts to Model:

1. Like our planets, comets are in orbit around the Sun.
2. Comets are composed of gas, ice, and dust left over from the early formation of the solar system about 4.5 billion years ago.
3. The orbit of a comet is elliptical (oval) with the Sun closer to one end of the oval. As the comet travels on its path, (see red line at right) it will sometimes be closer to the Sun and sometimes farther away.
4. Short period comets orbit the Sun every 20 years or less. Long period comets orbit the Sun every 200 years or longer. Those comets with orbits in between are called Halley-type comets.
5. Comets have three parts: the nucleus, the coma, and the tails.
    a. The nucleus is the solid center of the comet made of gas, ice, and dust.
    b. The coma is the gas and dust cloud that surrounds the nucleus. The coma is formed when sunlight warms the surface and causes gas and dust to spew forth in all directions.
    c. Comets have two tails:
        i. A dust tail which is like a trail of crumbs left behind the comet. The dust tail is yellowish in color because sunlight reflects off the dust grains.
        ii. The ion tail is mostly gas and always points away from the Sun. In addition, the ion tail appears bluish because the gas is glowing.
6. Scientists have seen the nucleus of comets range in size from less than 1 km to as much as 40 kilometers, the approximate diameter of Comet Hale-Bopp.
7. The coma of a comet can extend for tens of thousands of kilometers while the tails can extend for millions of kilometers.
8. A comet nucleus has a dark surface with cliffs, circular features, raised hills, and other structures on its surface. The nucleus of a comet is not visible when it is close to the Sun because it is usually very small and hidden inside the much larger and brighter coma.



The EPOXI spacecraft will be in an orbit (white circles) that will intersect with comet Hartley 2 (red arc) in 2010.