Name _____ Class _____ Date _____

Inquiry Lab

Using Scientific Methods

Comet Meets Jupiter

When scientists observed the collision of comet Shoemaker-Levy 9 (SL9) with Jupiter in 1994, they witnessed a rare event—a comet 8 km in diameter hits Jupiter only about once every 2,000 years! Comets are loosely assembled balls of ice and rock. When their large, looping orbits take them too close to a planet, the planet's gravitational pull begins to gradually alter the comets' orbits. When SL9 wandered too close to Jupiter in its orbital pass, Jupiter's gravitational pull "captured" the comet. SL9 then became one of only two comets ever to be observed orbiting a planet. Gradually, the unlucky comet was pulled closer and closer to Jupiter, until the inevitable happened—SL9 was ripped into more than 20 comet chunks, all of which slammed into the gaseous planet with great fanfare.

What happens when a comet, or its cousin, the more solid meteor, hits a rocky planet such Earth or Mars, or a body like the moon? You've seen the resulting craters when you look at a close-up photograph of the moon. In this lab, you will be able to see firsthand what happens when a comet or meteor comes face to face with a planet.

OBJECTIVES

Analyze how mass affects the appearance of impact craters.

Model the process of a comet or meteor colliding with a planet.

Measure the diameter and depth of model craters.

Record data on a chart and a graph.

MATERIALS

- balance, metric
- flour
- pan, aluminum, 23 cm × 33 cm × 7.5 cm or larger, 1
- paper, graph
- marbles of different masses, 4
- ruler
- sieve or flour sifter
- tempura paint powder, dry

SAFETY

ASK A QUESTION

1. How do you think mass affects the characteristics of an impact crater?

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FORM A HYPOTHESIS

2. Form a hypothesis that answers your question. Explain your answer.

_____

_____

_____

TEST THE HYPOTHESIS

3. To create your model of the surface of a planet, fill the aluminum pan with flour to a depth of about 3 cm. Smooth the surface with the ruler, and then tap the pan lightly to make sure all materials have settled evenly.

4. Sprinkle a fine layer of tempura paint powder evenly over the flour. Use the sieve or flour sifter to create an even layer.

5. What does your planet surface look like at this point?

_____

_____

_____

6. Use a balance to determine the mass of each marble. Place the marbles on a table in order from the one with the smallest mass to the largest mass. Label the marble with the smallest mass as Impactor A, the next largest, Impactor B, and so on.

7. Drop Impactor A from a height of 1 m onto your planet.

8. Measure the diameter and depth of the crater it makes.

9. Examine the ejecta (rays) that surround the crater. Count, measure, and figure the average length of all ejecta.

10. Record the measurements you made as well as any other observations about the crater's size, shape, or appearance in Table 1.

11. Repeat Steps 7 through 10 using Impactors B, C, and D.

TABLE 1

	Impactor A	Impactor B	Impactor C	Impactor D
Crater diameter				
Crater depth				
Average ejecta Length				
Other features				

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12. Construct two line graphs based on the data in Table 1. On both graphs, label the *x*-axis *Mass*. On one graph label the *y*-axis *Average Crater Diameter* and on the other graph label the *y*-axis *Average Ejecta Length*. Use a different symbol (dots, dashes, asterisks, etc.) to represent each impactor. The line graphs will help you answer the questions that follow.

ANALYZE THE RESULTS

1. Making Comparisons What do the graphs reveal about the relationship between crater size and the mass of an impactor?

2. Evaluating Results According to your graphs, do your test data support your hypothesis? Explain your answer.

3. Making Comparisons What do the graphs reveal about the relationship between crater size and ejecta length?

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DRAW CONCLUSIONS

3. **Making Predictions** Imagine that you are an astronaut who has been sent to the moon. While on your moonwalk you observe two craters of different sizes. How did these craters form? What would account for their difference in size?

EXTENSION

1. **Research and Communication** Research some well-known impact craters, such as Copernicus and the Barringer Meteorite Crater. Find their dimensions, and research how they formed.