Planetary Science Course, 5.1: Moon Craters
Review Moon questions

Just about everyone wanted to know more about all the circles on the Moon. You asked how many there are, how big they are, and where they came from.

Think about this last question, and share your ideas with a partner.
Focus question

• Are Moon craters the result of volcanoes or impacts?
Lunar surface and meteoroid

The flour is simulated *regolith* (lunar soil).

Any smallish object flying through space is called a meteoroid. Marbles will act as the meteoroids that are on a collision course with the Moon.
Lunar Crater Formation

Procedure
1. Get a basin with 1.5 liters of flour. This is your small area of lunar regolith.
2. Smooth the surface with a ruler or a small piece of cardboard, but do not put down the flour.
3. Sprinkle a thin layer of cocoa on the surface of the flour.
4. Put the basin on the floor on a sheet of newspaper. A place next to a wall is best.
5. Drop meteorites onto the lunar surface, and observe.
6. After several drops, smooth the surface, and sprinkle on a little more cocoa.

What crater features can you measure to compare craters?

NOTE: Do not throw the marbles into the flour—just drop them.
Safety rules and procedures

- Marbles will be dropped into the basin, not thrown! Gravity alone will speed the marbles on their way.
- Place the basin on newspaper to catch any wayward flour.
Safety rules and procedures

• Level the surface of the flour by gently scraping it with a piece of cardboard. The flour should **not** be patted down.
• Sprinkle a thin layer of cocoa powder on top of the flour surface. This will help us see the result of the impact.
**Ejecta and rays**

The impact sites are called craters, and the material thrown out is called *ejecta*, which is sometimes thrown out in lines called rays.
Discuss an experiment

- What factors might affect the size and shape of craters on the Moon?
Discuss an experiment

Each group will come up with an experiment that would provide more information about the relationship between the incoming meteoroid and the size and shape of the resulting crater.
Plan experiments

Notebook sheet 31, *Crater-Investigation Planning*

**Crater-Investigation Planning**

1. What variable will you investigate?

2. What procedure will you use?

3. What will you measure?

4. How will you record your data? How many trials will you do? (Set up a table.)

5. How will you display your results? (Design a graph on the next page in your notebook.)

*Planetary Science Course, 5.1: Moon Craters*

*Step 12*
Experiment planning

1. What variable will you investigate?
2. What procedure will you use?
3. What will you measure?
4. How will you record your data?
   How many trials will you do?
5. How will you display your results?
Experiment planning

Notebook sheets 32–33, **Model Impact Craters—Speed** and **Model Impact Craters—Mass**

**Model Impact Craters—Speed**
1. In your group, prepare the lunar surface.
2. Set up your station to measure the height from which you will drop the objects. (Remember, higher drop heights = faster impact speeds.) Speed is your **independent variable** because you are changing it.
3. Record your **dependent variable** in the table below: diameter, depth, or ray length.
4. Drop objects, record data, calculate averages, and graph the results.

<table>
<thead>
<tr>
<th>Drop height (cm)</th>
<th>Dependent variable:</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>Trial 1</td>
</tr>
<tr>
<td>100</td>
<td></td>
</tr>
<tr>
<td>150</td>
<td></td>
</tr>
<tr>
<td>200</td>
<td></td>
</tr>
</tbody>
</table>

**Model Impact Craters—Mass**
1. In your group, prepare the lunar surface.
2. Determine the mass of your four objects. Mass is your **independent variable** because you are changing it.
3. Set up your station to measure the height from which you will drop the four objects. (150 cm is a good height.)
4. Record your **dependent variable** in the table below: diameter, depth, or ray length.
5. Drop objects, record data, calculate averages, and graph the results.

<table>
<thead>
<tr>
<th>Object mass (g)</th>
<th>Dependent variable:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trial 1</td>
<td></td>
</tr>
<tr>
<td>Trial 2</td>
<td></td>
</tr>
<tr>
<td>Trial 3</td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td></td>
</tr>
</tbody>
</table>
Measuring tools

Teacher master M, **Millimeter Rulers**
Teacher master N, **Tagboard-Divider Construction**

<table>
<thead>
<tr>
<th>millimeters (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
</tbody>
</table>

Planetary Science Course, 5.1: Moon Craters
Step 15
Measuring tools

a. Open the divider until the points just span the distance to be measured.

b. Pinch the two divider arms securely so the distance doesn’t change.

c. Use a millimeter ruler to determine the distance between the points.
Graph your data prior to the next class.
Real versus simulated craters

• How are the craters we made with marbles and flour the same as craters on the Moon? How are they different?
Impact vocabulary

There are several kinds of objects moving around in space that might hit the Moon: comets, asteroids, and meteoroids.

The marbles and rocks in our models represent meteoroids heading toward the Moon.
1. Some groups investigated the variable of meteoroid speed. How did you test that variable?

2. If you increase the drop height of the impacting object (marble), what happens to the crater size?
Sense-making discussion

3. Some groups investigated the variable of meteoroid size. How did you test that variable?

4. If you increase the mass of the impacting object (rock), what happens to the crater size?

5. For both rocks and marbles, what was the ratio of the crater to the impactor?
View simulation

“Crater Formation on the Moon”

Planetary Science Course, 5.1: Moon Craters
Step 26
Mare formation

Teacher master H, *Moon Photo*

*Planetary Science Course, 5.1: Moon Craters*

*Step 27*
Answer the focus question

• Are Moon craters the result of volcanoes or impacts?
Answer the focus question

• Introduce your claim, distinguish it from alternate claims, and organize the reasons and evidence logically.
• Support your claim with logical reasoning and relevant data gathered from the investigation and the simulation models.
Answer the focus question

- Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.
- Provide a concluding statement.
Read “Craters: Real and Simulated” on page 49.

Tape the black and white copies of the article into your notebook.
Reading comprehension strategy

1. How is it organized?
2. Do I know what the bold words mean?
3. Which images look familiar and which are new to me?
Discuss the reading

1. Is it a simple or complex crater?
2. How old do you think it might be? Why?
3. Why do you think Earth has so few craters and the Moon has so many?
Review vocabulary

Spend a few minutes reviewing the vocabulary for this part. Update the vocabulary index and table of contents in your notebook.

- asteroid
- comet
- complex crater
- ejecta
- flooded crater
- impact
- meteoroid
- regolith
- simple crater
Review notebook entries

Share your answer to the focus question with a partner.

• Are Moon craters the result of volcanoes or impacts?
Review notebook entries

Discuss what information from the reading could be added as evidence to support your claims. Add improvements to your notebook entry.