1. A group of students did an experiment to find out if the angle of impact affects the size of crater formed. They filled a basin with flour, covered the surface with cocoa, and dropped marbles along a 100 cm ramp. They recorded the size of the craters. Look at their data table.

<table>
<thead>
<tr>
<th>Angle of impact</th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>90°</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>3.7</td>
</tr>
<tr>
<td>70°</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>4.3</td>
</tr>
<tr>
<td>50°</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>3.3</td>
</tr>
<tr>
<td>30°</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4.0</td>
</tr>
</tbody>
</table>

a. Based on this data, what can students conclude about the effect of drop-angle on the size of crater formed?

*(Mark the one best answer.)*

- **A** The larger the angle the smaller the crater.
- **B** The larger the angle the larger the crater.
- **C** The angle does not make much difference in crater size.
- **D** There is not enough data to draw a conclusion.

b. The students in this class used a model to simulate what happens when meteoroids hit the Moon’s surface. How are these craters and the way they are formed different from what actually happens on the Moon?
2. Another group of students did an experiment to find out how the height at which a marble is dropped affects the size of impact crater formed. They filled a basin with flour and covered the surface with cocoa. They decided to change the marble size and the marble height each time. They measured the size of the craters.

<table>
<thead>
<tr>
<th>Variable 1</th>
<th>Variable 2</th>
<th>Dependent variable: Size of crater (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marble diameter (mm)</td>
<td>Marble height (cm)</td>
<td>Trial 1</td>
</tr>
<tr>
<td>2</td>
<td>50</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>100</td>
<td>9</td>
</tr>
<tr>
<td>4</td>
<td>150</td>
<td>15</td>
</tr>
<tr>
<td>5</td>
<td>200</td>
<td>21</td>
</tr>
</tbody>
</table>

**Conclusion:** The marbles we dropped from higher heights made much bigger craters than the ones we dropped from lower heights. This is evidence that the farther the marble falls, the bigger the crater is.

a. Is this a valid conclusion for these students to draw from the experiment they conducted? Why or why not?

b. How would you improve the experiment?
3. The image below shows the surface of the Moon. Identify the lunar feature indicated by each arrow.

![Image of the Moon surface with arrows]

- a. ________________
- b. ________________
- c. ________________

- d. Looking at lunar features b and c above, which one must have formed first? _______
  How can you tell?

4. a. What was the likely size of the impact object that created a crater 100 km in diameter on the Moon?  
   (Mark the one best answer.)
   - A  100 km
   - B  50 km
   - C  5 km
   - D  0.2 km

   b. What mathematical ratio did you use to determine the above answer?

   ________________________________
5. Look at the images of two of Jupiter’s moons, taken from the same altitude. The moons are approximately the same age, but moon X has more visible craters than moon Y. Explain why that might be.

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6. A student said, “Galaxy, solar system, universe. Why do they have three names for the same thing? I don’t get it!” How would you respond to this student’s comment?

(Mark the one best answer.)

- **A** There are many words in English that mean the same thing; it’s just like you can call a car an automobile.

- **B** They are not the same thing, but they are all incredibly large.

- **C** They are three different things: our solar system is inside our galaxy, our galaxy is inside the universe.

- **D** They essentially mean the same thing, but a universe is a little bigger than a galaxy, a galaxy is a little bigger than a solar system.
7. Astronomers have found evidence of how stars and planets form. They believe that the many tiny particles in nebulae accrete. This process starts out very slowly and gradually gets faster and faster. What causes this to happen?

Write **Y** for yes next to the sentence(s) that help explain the cause; write **N** for no next to those that do not help explain the cause.

- _____ Each particle gravitationally pulls on nearby particles.
- _____ A mysterious unknown force draws the particles toward each other.
- _____ Particles collide and stick together making larger particles.
- _____ The natural tendency of particles to increase in gravity makes the process speed up.
- _____ Larger particles have more mass and more gravitational attraction.
- _____ Dark energy makes the particles move toward each other and stick together.

8. Most scientists now agree that the Impact Theory is the best theory for explaining how the Moon formed. Explain how gravity plays an important role in this theory.

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________
9. Scientists have concluded that Earth is at risk of future impacts with meteoroids. What are some criteria that engineers consider when they try to design technology to detect meteoroids and prevent collisions?