Chapter 11: Measuring Vesta

Student Worksheet

Objective:

Measure the size of Vesta from an image.

Engage:

You are probably in a classroom. That classroom is probably on a floor with other classrooms. Without using a ruler, or any other tool, estimate the area of the floor. Note your process.

Introduction:

Vesta is one of the largest objects in the asteroid belt between Mars and Jupiter, making up about 9% of the mass of the entire asteroid belt. The NASA spacecraft, Dawn, spent most of 2011 orbiting and gathering data from Vesta. After the trip to Vesta, DAWN traveled to the Asteroid Belt's dwarf planet, Ceres, to collect data.

Your teacher will provide you with 3 images that are labeled Figure 1, Figure 2, and Figure 3. Here is some information about those images:

Figure 1 Near the south pole of Vesta is a very large crater called Rheasilvia, which measures 505 km in diameter. The depth of Rheasilvia is about 13km below the surface of the asteroid. It has a central peak that rises 25 km above the floor of the crater. It is estimated that Vesta lost 1% of its entire mass during the impact that resulted in the Rheasilvia crater. The high central peak can be seen in the attached image of Vesta, Figure 1, as a bulge near the South Pole.

Figure 2 A grouping of three craters on Vesta called the Snowman Crater is also pictured in detail in Figure 2. The image is edited to be very near to the coloring we would see with our eyes. The snowman craters are visible in Figure 1 as well.

Figure 3 The image in Figure 3 presents another, more familiar cratered body, our Moon. It may look a little different to you because it is an image of the far side of the Moon – the side that never faces the Earth. The Lunar Reconnaissance Orbiter can see it as it orbits the Moon.

Your Task:

Calculate the diameter of Vesta using only the attached images and a ruler. First, you will need to calculate the average diameter. To find the average diameter, estimate the north to south diameter, then estimate the east to west diameter, then calculate the average of the two estimated diameters. Use the information in the image captions to help you.

Procedure:

Describe step-by-step how you will determine the diameter of Vesta. There is more than one correct way to go about this task. Show your steps, measurements, and calculations in the space below.

Conclusion:

1. How accurate do you think your result is? Do you think you have estimated to 90% accuracy?

2. Compare your estimated diameter with the actual diameter of Vesta, given by your instructor. Was your result more accurate or less accurate than you thought it might be?

3. Calculate your percent error: Divide the difference between your value and the accepted value by the accepted value.

4. Describe an alternate way to complete this task.

5. Are you happy with your procedure, or would you have preferred the method you described in answer 4?

6. Do you think craters on the Moon and craters on Vesta average the same sizes? What could cause a difference?

7. Without knowing anything about Vesta, which method used by you or the other students in the class would work to estimate the size of Vesta?

Extend:
- Follow NASA's DAWN Mission. What has been learned? What is left to learn?

- Draw a scale size diagram of Vesta, Ceres, Pallas, and our Moon.

- Study more about the asteroid belt: Why are the asteroids not gravitationally bound as a planet? How many asteroids do we know of? What is the relative spacing between asteroids?

- Vesta is often referred to as (4) Vesta. What does this mean? How are asteroids named? Letters also classify asteroids, how does the letter classification system work? What are Trojans? What are NEAs?