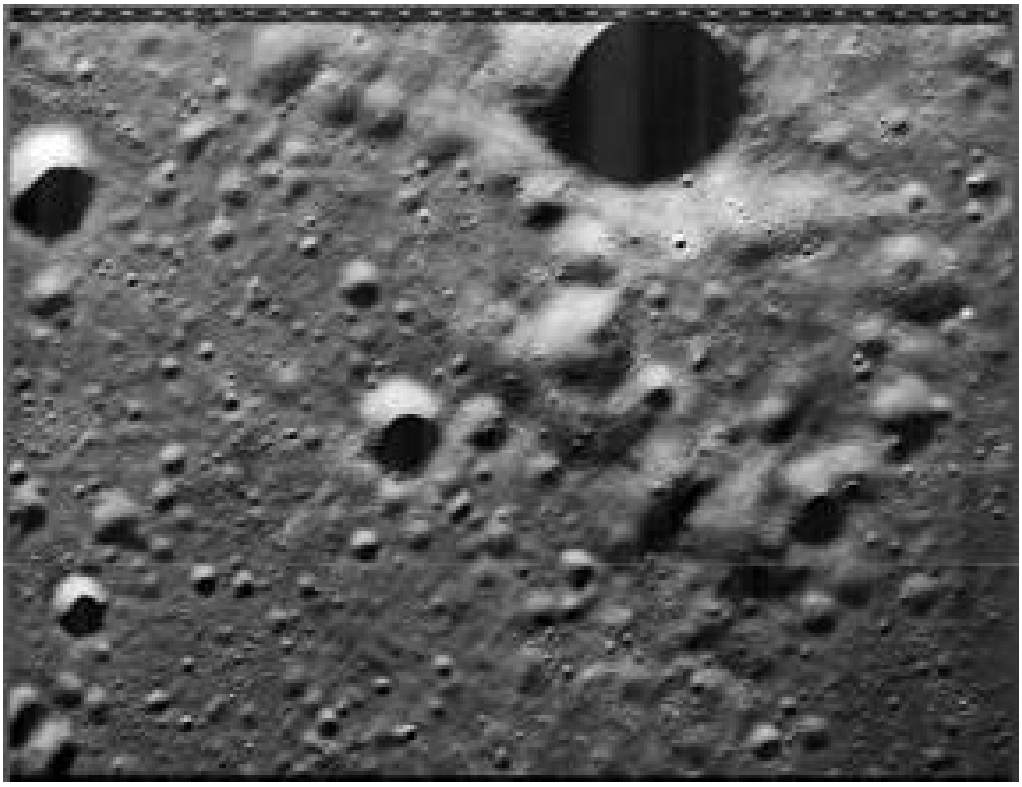
Craters on the Moon



This is a high resolution image of the lunar surface taken by NASA's Lunar Orbiter III spacecraft in February 1967 as it orbited at an altitude of 46 kilometers. It is located near the lunar equator. The field of view is 16.6 kilometers x 4.1 kilometers. Additional Orbiter images can be found at the Lunar Orbiter Gallery (http:// www.lpi.usra.edu/resources/lunarorbiter/). Because of the low sun angle, craters look like circles that are half-black, half-white inside!

The scale of an image is found by measuring with a ruler the distance between two points on the image whose separation in physical units you know. In this case, we are told the field of view of the image is 16.6 kilometers x 4.1 kilometers.

Step 1: Measure the width of the lunar image with a metric ruler. How many millimeters long is the image?

Step 2: The information in the introduction says that the image is 16.6 kilometers long. Convert this number into meters.

Step 3: Divide your answer to Step 2 by your answer to Step 1 to get the image scale in meters per millimeter to the nearest significant figure.

Once you know the image scale, you can measure the size of any feature in the image in units of millimeters. Then multiply it by the image scale from Step 3 to get the actual size of the feature in meters to the nearest significant figure.

Question 1: How big is the largest crater in the image?
Question 2: How big is the smallest crater in the image, in meters?
Question 3: About what is the typical distance between craters in the image?
Question 4: How far would you have to walk between the largest, and next-largest craters?

Answer Key:

The scale of an image is found by measuring with a ruler the distance between two points on the image whose separation in physical units you know. In this case, we are told the field of view of the image is 16.6 kilometers x 4.1 kilometers.

Step 1: Measure the width of the lunar image with a metric ruler. How many millimeters long is the image?
Answer: 134 millimeters.

Step 2: The information in the introduction says that the image is 16.6 kilometers long. Convert this number into meters.
Answer: 16600 meters.

Step 3: Divide your answer to Step 2 by your answer to Step 1 to get the image scale in meters per millimeter to the nearest significant figure.
Answer: 16600 meters / 134 millimeters = 124 meters / millimeter.

Once you know the image scale, you can measure the size of any feature in the image in units of millimeters. Then multiply it by the image scale from Step 3 to get the actual size of the feature in meters to the nearest significant figure.

Question 1: How big is the largest crater in the image?
Answer: The one at the top is about 25 millimeters across. 25 mm x 124 meters/mm = 3,100 meters or 3.1 kilometers.

Question 2: How big is the smallest crater in the image, in meters?
Answer: The largest number of features are about 1 millimeter across or 100 meters to one significant figure. Students may also go for the recognizable craters which are about 2 millimeters across or about 200 meters.

Question 3: About what is the typical distance between craters in the image?
Answer: The answer may vary, but the distance between obvious craters (about 2 mm in diameter) is about 5 millimeters or 5 mm x 124 meters/mm = 600 meters to one significant figure.

Question 5: How far would you have to walk between the largest, and next-largest craters?
Answer: The crater rims are about 35 millimeters apart or 35 mm x 124 meters/mm = 4,340 meters or 4.3 kilometers to two significant figures.