LUNAR FEATURES

7

OBJECTIVES

After completing this exercise the student should be able to:

1. use a lunar photograph to find examples of features such as maria, mountains, and basic crater types.
2. use a lunar map to identify, by name, features visible on a lunar photograph.
3. estimate the diameters of craters and maria visible on a lunar photograph.
4. determine the height of a lunar mountain when the moon is photographed near one of its quarter phases.

STUDENT MATERIALS

a pencil
mm ruler
calculator

LAB MATERIALS

Each lab setup needs:

meter stick
large poster or photograph of a quarter moon (with corners weighted down, if necessary)

STUDENT REQUIREMENTS

This lab is to be done with a lab partner. All calculations are to be completed individually. Turn in only the answer sheet.

INTRODUCTION

The moon has a large number of features on its surface. Some of these features, such as the maria, appear as dark patches to the naked eye. A few of the largest craters can be viewed with binoculars. Many more surface features, such as mountains and smaller craters, can be viewed with a telescope. The height of the features can be calculated by analyzing their shadow length. In this exercise you will learn how to identify some lunar features and how to estimate their diameter and height.

PROCEDURE

A. Lunar Map

A lunar map from Sky Publishing has been provided in the packet at the back of this book. So that you can find craters and other features you will want to use the selenographic coordinate grid which is drawn on your map. Lunar longitude is the distance in degrees east (+) or west (–) of the meridian passing through the center of the moon as observed from Earth. Lunar latitude is the distance in degrees north (+) or south (–) of the moon's equator. Notice that east is to the left and south is to the top of your map, so it conforms to the moon's orientation as viewed through an astronomical telescope.

On the back of your lunar map each crater is listed by number (1 to 300) along with a selenographic longitude and latitude of the coordinate grid intersection that is ***nearest*** each crater. Thus, to find the crater Abenezra **(1)** on your map, locate longitude +10° and latitude –20°. What is the name of the crater located at –20° and +10°? Write your answer on the report form.

B. Identification of Lunar Features

1. At each lab table is a photograph of the moon, taken at either first quarter or third quarter. On your data sheet indicate which lunar phase your photograph represents.
2. Compare the lunar photograph to your map and orient the photograph to match the map. Locate five maria on the photograph and list their names

on your report form. These will be different for first-quarter moon and third-quarter moon. (**Note:** third-quarter moon photos have a large mare named Oceanus Procellarum. This is one mare, not two.)

3. Locate any mountain ranges visible on the photograph. Use your map to find out the names of these mountains and list three of them on your report form.

4. Inspect the craters on the photograph. Some craters have flat or smooth bottoms that have been filled with lava. Other craters have a central mountain peak that was probably caused by the meteor impact which formed the crater. Still other craters have prominent ray systems emanating from them which may stretch for hundreds of kilometers over the lunar surface. These rays may be thought of as the material splashed from the crater during meteor impact. On your report form name at least three examples of these types of craters seen on the photograph.

C. Size of Lunar Features

1. To determine the size of any lunar feature you must first determine the scale of the photograph. Use a meter stick to measure the diameter of the lunar image to the nearest millimeter. The moon's actual diameter is known to be 3476 km. Determine the scale of your photograph, in km/mm, by dividing the moon's actual diameter by the measured diameter of your photograph. Record the scale on your report form.

2. On the chalkboard, your instructor will make a short list of lunar features visible on your photograph. Measure each feature's diameter in millimeters. To determine the feature's true diameter, multiply the measured diameter by the scale of your photograph. On your report form, record the name of each feature and its calculated diameter in km.

D. Height of a Lunar Mountain

The height of certain lunar features such as mountains can be calculated by analyzing the length of their shadows. In **Fig. 1** you are viewing the moon from above one of its poles.

In this diagram **MB** represents the height of the mountain, **CB** is the moon's radius, **SM** is the length of the shadow as seen from Earth, and **TB** is the distance of the mountain from the terminator. By inspection it can be seen that the triangle **CTB** and **SBM** are similar right triangles (*i.e.*, they have equal

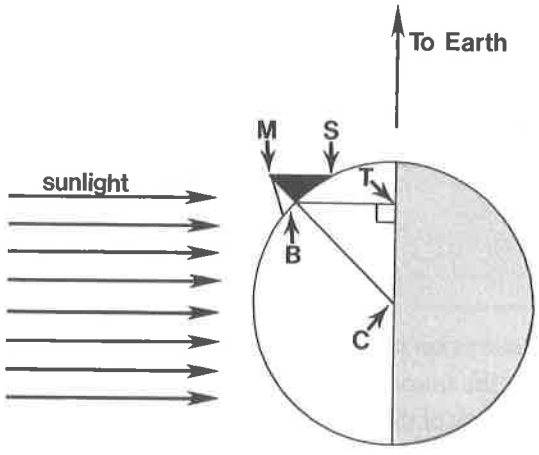

Fig. 1: Geometry used to determine the height of a lunar mountain.

angles). Therefore, the ratios of the sides must be equal. So it can be written that

$$\frac{MB}{SM} = \frac{TB}{CB} \qquad (1)$$

Rearranging terms, this can be solved for the height of the mountain, **MB**, and written as

$$MB = \frac{(SM)\,(TB)}{CB} \qquad (2)$$

The moon's radius, **CB** in km, is already known. Both **TB** and **SM**, the distance of the mountain from the terminator and the shadow's length, can be measured on your photograph. Thus, you have all the needed information to calculate a mountain's height, **MB**, using equation 2.

Your instructor will give you the name of a mountain whose height you are to estimate.

1. Locate this mountain peak on your photograph and record its name on your report form.
2. Measure the length of its shadow in millimeters. Multiply by the scale factor and record the answer in kilometers.
3. Measure the distance from the mountain's center to the terminator. Multiply by the scale factor and record the result in kilometers.
4. Calculate the moon's radius in km and record this on your report form.
5. Use equation 2 to calculate the height of the mountain in kilometers and record your answer on the report form. Does your answer seem reasonable to you? If not, ask for some help and try again.

Turn in your lab report form. Be sure to clean up your table and leave it in better condition than you found it.

LUNAR FEATURES

NAME: _____

SECTION: _____

A. Lunar Map

Crater at –20° and +10° is _____

B. Lunar Features

1. Phase of photograph: _____
2. Maria visible
   a. _____ d. _____
   b. _____ e. _____
   c. _____
3. Mountain ranges
   a. _____ b. _____ c. _____
4. Craters

	flat bottoms	central peaks	rays
a.	_____	_____	_____
b.	_____	_____	_____
c.	_____	_____	_____

C. Size of Lunar Features

1. Scale of photo = _____
2.

	Feature Name	Diameter in mm	Diameter in km
a.	_____	_____	_____
b.	_____	_____	_____
c.	_____	_____	_____

D. Height of Lunar Mountains

1. Name of mountain _____
2. Length of shadow, SM = _____
3. Distance to terminator, TB = _____
4. Moon's radius, CB = _____
5. Height of mountain, MB = _____