OBSERVING PHASES OF THE MOON

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OBJECTIVES

The objectives of this activity are intended to meet the following course goals:

G2. Students will develop critical and/or analytical thinking skills.
G5. Students will have an appreciation and knowledge of what can be seen in the night sky.
G6. Students will learn how to make basic astronomical observations.
G8. Students will learn the big concepts in astronomy.

After completing this series of observations the student will be able to:

1. Determine the time of day that lunar phase can be observed.
2. Construct and use a quadrant to measure altitude of the moon.
3. Estimate the time of day when they can take pictures of each lunar phase.
4. Take pictures of each lunar phase.
5. To arrange a series of photographs of the moon in correct order by phase.

STUDENT MATERIALS

The student will need the following items:

Digital camera with a zoom lens
Quadrant (see section on Constructing a Quadrant.)
Watch or clock
Calendar that indicates dates of the lunar phases.

INTRODUCTION

The Moon is a dark rocky object that is illuminated by reflected sunlight. It is this reflected light which we see as moonlight. Because the Moon orbits our Earth we cannot always see its illuminated face. For example, when the Moon is between the Earth and Sun we can't see the Moon at all because none of the illuminated part is facing the Earth (Fig. 1), we "see"

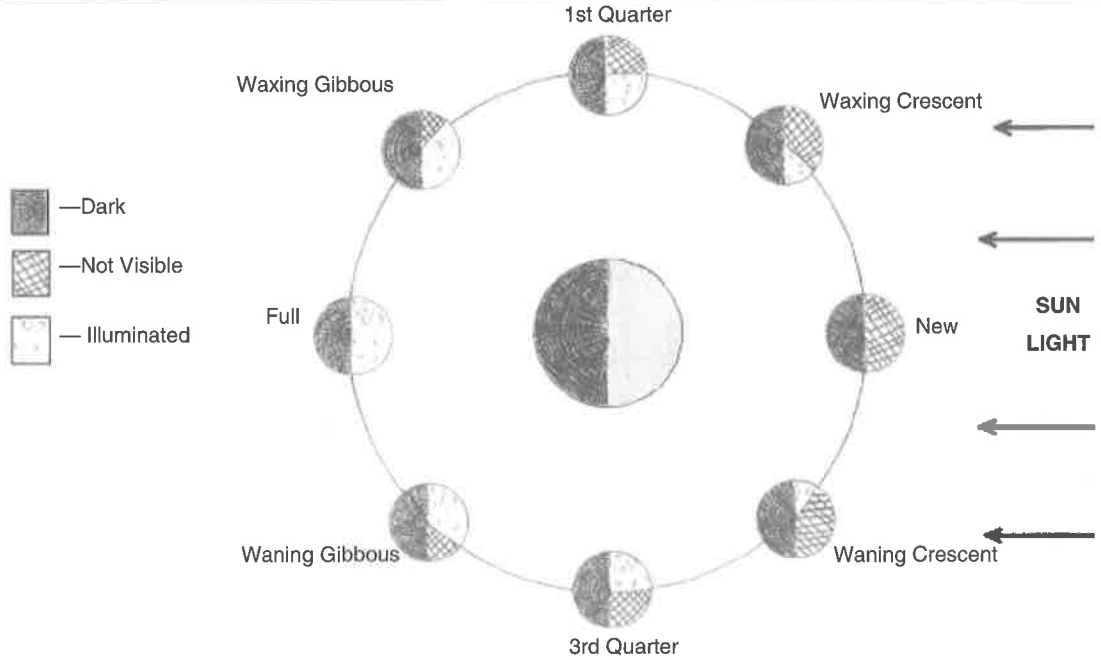

Figure 1: Phases of the Moon.

only the dark side. This New Moon phase is important in many religions around the world, because it symbolizes rebirth. As the Moon orbits the Earth more and more of its illuminated surface can be seen (Fig. 1), which produces the phases of waxing crescent, 1st quarter, waxing gibbous, and full moon. At full moon, the Moon is directly opposite to the Sun in the sky, and so its entire illuminated face can be viewed from Earth (Fig.1). After full moon less and less of the illuminated portion is visible as the Moon passes through the phases of waning gibbous, 3rd quarter, waning crescent, and back to new moon. At this point the cycle of phases repeats.

CONSTRUCTING A QUADRANT

On the last page is a quadrant template (Fig. 3.) Remove this page and glue it to a piece of lightweight card stock like a small piece of poster board, cereal box, a manila file folder, etc. After the glue dries cut out the quadrant using a pair of scissors or a Xacto knife (padded underneath so you do not cut up the table.) Cut a large diameter straw, such as a milk shake straw, to the same length as the side of the quadrant. Then glue, or tape it along the straight edge as indicated on the template. Use a straight pin, or pencil, to punch a small hole at the point marked with a + sign. Run a string through this hole and tie a knot in the string on the backside of the template so that the string will not pull out of the tiny hole. Be sure to cut the string long enough so that you can tie a small weight to the end of it so that it can be used like a plum bob.

To use the quadrant (Fig. 2) you hold the side labeled 90 degrees up to your eye and look through the straw. For practice go to a window or outside and look at the horizon through the straw. While viewing the horizon use you finger to press on the string to hold it in place. Now you can move the quadrant from the viewing position and read the degree position of the horizon, which should be close to zero degrees. If you do this for the zenith, straight overhead you should get 90 degrees. All the stars, planets, and the moon should have altitude between zero and 90 degree.

Throughout these observations you will use your quadrant to measure the nightly altitude of the Moon. You should be able to estimate the Moon's height above the horizon to the nearest few 2 or 3 degrees.

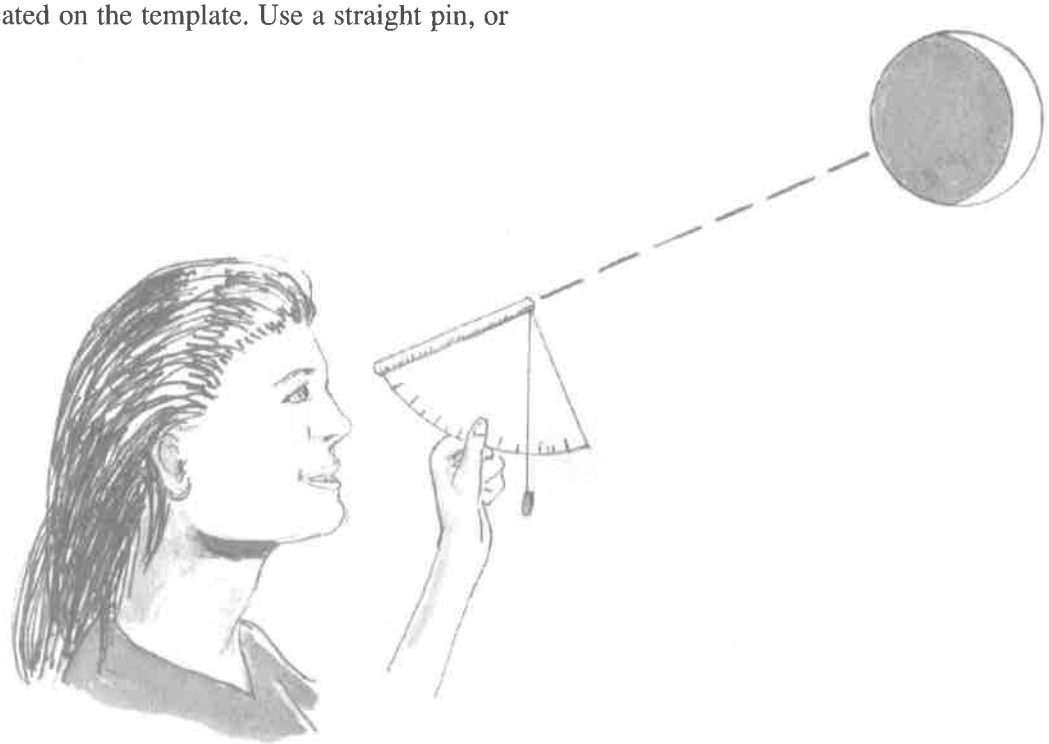

Figure 2: Using a quadrant to measure the altitude of a celestial object.

OBSERVING PROCEDURE

Throughout the term you are to use a digital camera to take photographs of the moon during each of its phases. Disposable film cameras do not work well for the purpose.

1. On your own time and using your own materials construct a simple quadrant as described above. There is a cutout provided on the last page of this lab to be used to construct your quadrant.

2. Use a calendar to determine the current phase of the moon.

3. Decide when you might be able to observe the moon at a convenient time. For example you can observe a 3rd quarter moon after midnight and before noon. So you might find in more desirable to take a picture of 3rd quarter at 9:00 am, or at 3:00 am depending upon your lifestyle. At least **one** picture of the moon should be taken during **daylight** hours.

4. Go outside when you think the moon is visible and take a digital photograph of it. You will need to zoom in as much as possible. These pictures will not show much lunar detail, but they will show the moon's shape as crescent, gibbous, full. etc. It is aesthetically more pleasing of some of you pictures include some foreground objects like trees, houses, or whatever.

5. Immediately before or after you take the picture use your homemade quadrant to measure the altitude of the moon above the horizon. These values should be good to within 5 degrees.

6. Write down the date, time, camera, and weather conditions when you take each photograph and copy this information onto the data sheet for each phase.

7. Place your best photograph of each phase in the Lunar Observation Data Table and record all requested information. These pictures are to be arranged in phase sequence not in the chronological order the pictures were taken. Therefore, you may have a picture of waxing crescent taken in April ahead 1st quarter picture taken in February.

NAME: _____

LAB SECTION: _____

Lunar Observation Data

WAXING CRESCENT Date: Time: Altitude: Telescope/Camera: Weather Conditions:	**Student Picture**
1st QUARTER Date: Time: Altitude: Telescope/Camera: Weather Conditions:	**Student Picture**

Lunar Observation Data (cont.)

WAXING GIBBOUS Date: Time: Altitude: Telescope/Camera: Weather Conditions:	**Student Picture**
FULL MOON Date: Time: Altitude: Telescope/Camera: Weather Conditions:	**Student Picture**

NAME: _____

LAB SECTION: _____

Lunar Observation Data (cont.)

WANING GIBBOUS Date: Time: Altitude: Telescope/Camera: Weather Conditions:	**Student Picture**
3rd QUARTER Date: Time: Altitude: Telescope/Camera: Weather Conditions:	**Student Picture**

Lunar Observation Data (cont.)

WANING CRESCENT	**Student Picture**
Date: Time: Altitude:	
Telescope/Camera: Weather Conditions:	

NAME: _____

LAB SECTION: _____

QUESTIONS

Answer the follow questions based on your observations.

1. Why did the Moon's illuminated shape appear to change over the course of a month?

2. During a single night, how did the moon appear to generally move across the sky with respect to the horizon? From east to west, or from west to east? What causes this apparent motion?

3. During a month, how did the moon appear to generally move with respect to the background stars? From east to west or from west to east? What causes this apparent motion?

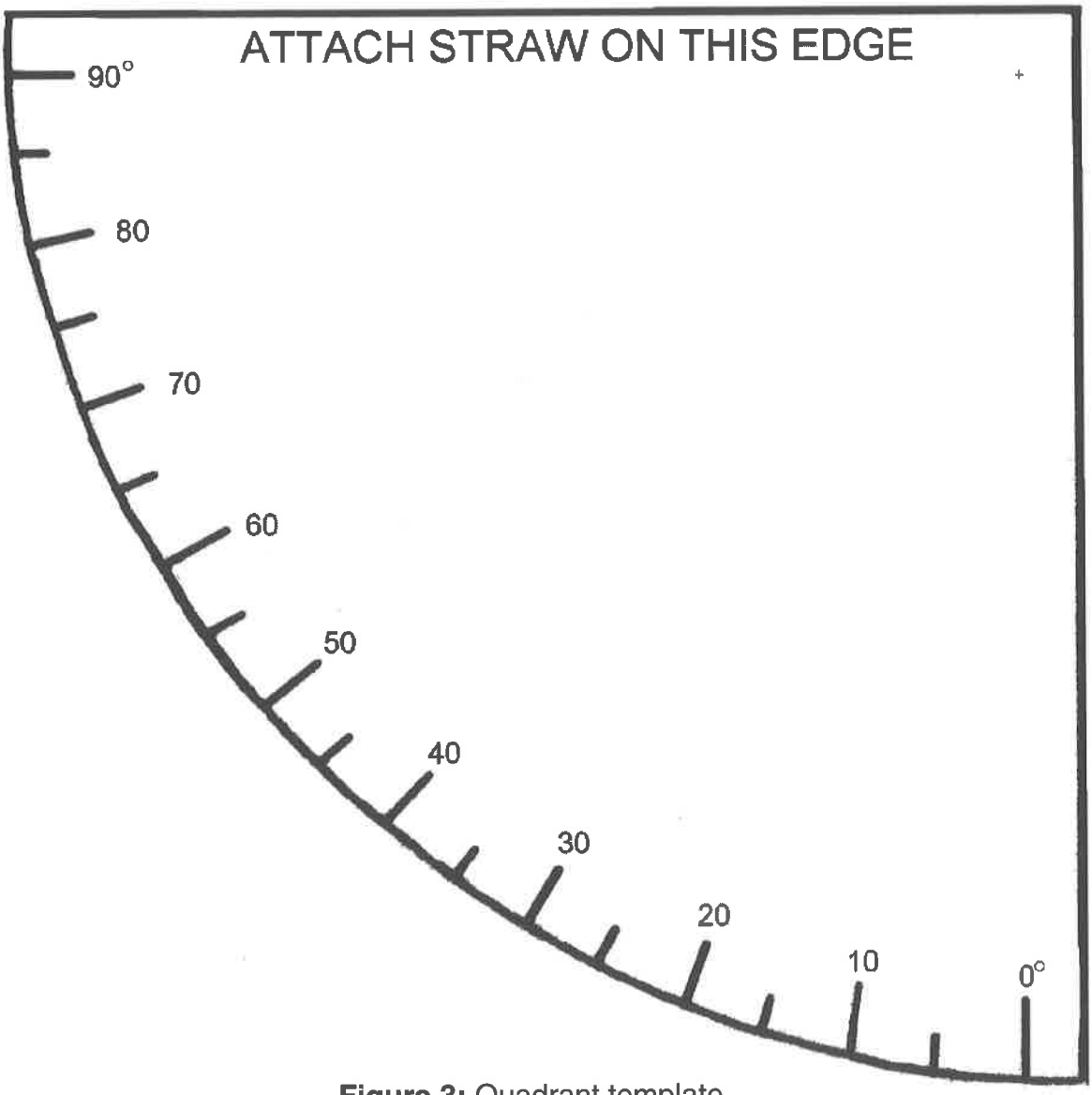

Figure 3: Quadrant template.