

## Moon Phases

**Description:** In this lab you will observe the changing phase of the moon nightly for two weeks.

**Materials needed:** Astrolabe, large piece of sketch paper, compass, camera (optional)

### Instructions:

- (1) Use the sun and moon calendar for the semester and carefully choose a time and date to begin observing. You need to choose a starting date when the moonrise time is equal to the time you want to do your observations. You will need to observe the moon at exactly this time (+/- 10 minutes) for the next 14 days, so choose carefully according to your schedule.
- (2) Find a place to do your observations where the horizon is relatively unobscured toward the south. Come back to this place each time you do an observation.
- (3) Face south and sketch the horizon along the bottom of a large piece of paper all the way from East to West. Use a compass to find the exact location of East, West and South on the horizon and label them on your sketch. Divide the horizon you've sketched into 18 segments (East to West is 180 degrees, so each of the 18 segments represents 10 degrees along the horizon). Number these ten degree increments starting at zero on the western horizon and ending at 180 on the eastern horizon (due South should therefore be 90, halfway in between).
- (4) A fist held at arms length takes up about ten degrees, so you can use that to make sure that the labels on your sketch are accurate relative to the true horizon. For example, if a tree on your horizon is at the "30" mark on your sketch, then starting at due west, you should be able to stack three fists side by side to get to the house.  
\*\*Take the time to make this sketch carefully. You only have to do it once and doing it carefully the first time will save you a lot of frustration later and give you a better result!
- (5) Beginning at the moon phase and time you chose above, record **on the same sketch** the following things each day for the next 14 days:
  - a. Sketch the moon as it appears to you. Be as accurate as possible in drawing its size, location and orientation relative to objects on the ground on your sketch. Make sure to distinguish between the light and dark portions by shading or using color. Sketch and features that you see on the lunar surface as well.
  - b. Record the date and exact time of your observation in a table, and write down the date next to the moon on your sketch each day.
  - c. Find the nearest point on the horizon to the moon (straight down from the moon) and mark that location on your sketch with the date. Use the degree labels that you added when you first sketched the

horizon to estimate the so-called “azimuth angle” of the moon. Record this value in the table.

- d. Use your astrolabe to calculate the altitude (or elevation) of the moon. This should be a number between 0 and 90 degrees each time. Record this number in the table as well. You may wish to use the “fist and finger method” to estimate first. That number should be in the same ballpark as the number you measure with your astrolabe. If it’s not, you’re probably using your astrolabe incorrectly.
- e. Use a clear ruler held at arm’s length or the fist and finger method to record the size of the moon (note: even in it’s crescent phase you can still make out the outline of the entire moon). Add this number to your table
- f. If you don’t see the moon or it’s too cloudy to see it, make a note of that. You have to have seen the moon on at least 10 of the 14 days for this project.

**Data Table**

	Date	Time	Azimuth Angle	Altitude	Size	Phase
Day 1						
Day 2						
Day 3						
Day 4						
Day 5						
Day 6						
Day 7						
Day 8						
Day 9						
Day 10						
Day 11						
Day 12						
Day 13						
Day 14						

*Note: You may also choose to photograph the moon each night. This can be a good backup to tweak your sketch when you’ve collected all of your data and also a good visual aid for your presentation. Make sure to include the horizon and the moon in at least one picture each night (zoomed all the way out) so that you have a good reference point.*

**Data:** Your final products will be:

- (1) A sketch or composite photograph showing the moon moving in the sky over the course of two weeks.

(2) A data table showing the time, direction, altitude and phase of the moon each day you observed it.

**Questions to Address in Your Poster's Data Analysis Section:**

- (1) How many degrees did the moon move along the horizon (east/west) each day? Describe the range and the average.
- (2) How many degrees did the moon move vertically (in altitude as measure by your astrolabe) each day? Describe the range and the average.
- (3) How many total degrees did the moon move each day? Describe the range and the average.

$$Total\ Degrees = \sqrt{(degrees\ along\ horizon)^2 + (vertical\ degrees)^2}$$

- (4) Using your moon size measurements, calculate the percentage change in the size of the moon over the course of your observations. There are several correct ways to do this. See me if you have trouble.
- (5) In your own words, describe why the location of the moon changes in the sky as viewed at the same time over the course of its monthly cycle.
- (6) Which direction do the "horns" of the moon point and why?
- (7) Why was this project assigned for a two week period and not for an entire monthly cycle of the moon?
- (8) Which moon phases are you unable to observe at this time and why?