

Purpose: The purpose of this assignment is to help you learn how to make observations of Luna (Earth's Moon), and to correlate the time, its position and phase into a model of how Luna orbits Earth. You may be surprised at what else you learn!

What to do:

- Make **twelve** (12) observations - see Rules below, VERY IMPORTANT!! - of the moon over its next lunar cycle starting with the 1st Quarter Moon (which officially occurs at 16:15 on Monday, Sept 17).
- **Each** observation **MUST** include:
 1. (Military) **Time** of observation – **NOTE PDT or PST!!** Example: 6pm = 1800 (or 18:00)
PDT - You may have to correct for time!
 2. **Date** of observation
 3. Your **Location** at the time of observation
 4. **Altitude** of the Moon
 5. **Azimuth** of the Moon
 6. Name the **Phase** of the Moon
 7. **Draw a sketch (no photos) showing its phase, orientation, and features** (dark vs. light surface areas etc.)

You may want to make and use an Excel (or similar) spreadsheet to report these observations – or download and print the **ObsSheet.pdf** from the web. **KEEP A COPY** of the observations you make. This may prove valuable in several ways – one is that you'll be able to look at it often to get a feeling for trends. It is also very important to make sure your observations are both COMPLETE and ACCURATE – you'll have trouble if they're not.

Location can be the name of your town, but you could be more precise if you want and look up the latitude and longitude (see the link on the class web site to find yours). Recall that Altitude is the angle (degrees) above the horizon. Azimuth is the direction, measured clockwise from North = 0°, so East = 90°, South = 180°, and west = 270°.

The easiest way to do an observation is first to do it from the same location each time, especially so that you have visual markers that correspond to direction. Next, **write down the date and time – use military time** (24-hr clock), be consistent and note whether PDT or PST! Then stand and face the moon as directly as you can; imagine that there is a line that drops down from the moon. Where it hits the horizon is the spot that represents the azimuth. Use a compass (the Azimuth tool on the **ObsGadget.pdf** page to help you visualize the appropriate angle.) Measuring the altitude can be done with the Altitude tool (best way), or by using your fist (~10°) and width of a finger (1°); be sure to hold your fist/finger at arm's length. Line up the horizon with the bottom of your fist to start. Lastly, draw the phase, in its PROPER ORIENTATION. Make sure your drawing includes any features you can see on the surface (dark spots, etc.) so that you can orient the moon properly and see how Luna rotates.

Rules:

- Remember to include all parts of the observations! Many students forget to use military time (NOTE PDT or PST), to draw the surface features that are visible, and to record the proper orientation in the sky. DO NOT use a computer or app to do your observations – the point(s) of the exercise will be lost.
- Turn in your observations **each MONDAY at the beginning of class**. Late observations ***will not be accepted***; time is important here!! You can ALWAYS email a picture of your observations by the due date/time!
- All observations will be returned to you by Oct 31st so that you can **complete and turn in the project by Nov 14th**.

FIRST WEEK – SPECIAL INSTRUCTIONS

This first week, you should try your best to make three observations on three different nights, all at almost exactly the SAME TIME. All three observations should be within 15 minutes of each other, not 15 minutes apart! Make a note to yourself about what you learn from this (hopefully something interesting) – it might come in handy later. TURN IN A COPY OF YOUR OBSERVATION SHEET at the beginning of class on Monday. Note that Week #2 set should begin on Monday, Sept 24th.

Instructions for the Second Week of Viewing

For the second week you should once again view Luna and record the observations on the sheet as you did for the first week. However, this week the challenge is to **make three observations that occur when Luna should be in almost exactly the same location** in the sky! This means you will have to go out at DIFFERENT times (hint: probably in the late evening), rather than at the same time as for the first week.

It is strongly suggested that you try this early in the week, so that you can get three observations in that fit the criteria, and record the proper times. You might need to make more than three observations, if you didn't guess the time correctly. Please turn in the three observations that best fulfill the challenge (the ones for which Luna's altitude and azimuth occur closest together); you don't need to turn in observations that didn't work. HOWEVER, if you weren't able to make three observations that fit the criteria, TURN IN 3 OBSERVATIONS ANYWAY and try to make this set work during week 3 or 4.

PLEASE remember to follow the guidelines for observations - go through the "checklist" on the first page, and/or use the ObsSheet table! You might remember that I mentioned in class that some people forget to draw the orientation, or what they see for features on Luna. You don't need to spend too much time, just get a good idea of what Luna looks like (where the dark areas are). Another problem is not recording complete time data (not military, no am/pm), or identifying the phase.

Instructions for the Third and Fourth Weeks of Viewing

For the last two weeks of the set, you just need to make three observations on different days. HOWEVER, if you were not able to complete either of the first or second week special instructions, then you should follow those rules until you've gotten a satisfactory data set!

There is a fifth week to the observation window; you may use this final week to make up for any observations/sets that you didn't make, or even to earn a few extra credit points (up to 5 points each for up to 3 extra observations). These need to be turned in by Monday, Oct 22nd at the beginning of your class period.

Final Report

The last part of this assignment is to turn in a NICE **report by the beginning of class time on Monday, May 21st** (points deducted for turning it in later than collection time – “1 point per minute!!!”). The report should assimilate all of your observations in order to make sense of them, and should be something that you can be proud of. Your report should be spell-checked, include the following items, and *be in the following order (follow these directions!!)*:

1. Title / cover sheet.
2. One-page spreadsheet, containing all the observations you made, on a single page – the redundancy of this statement is done on purpose!
3. Summary diagram. This is something NEW to construct, and is perhaps the most important for you to do in terms of understanding the data you have collected. Start by drawing a view of the Earth-Luna system as seen by an observer looking down from WAY above the North Pole. The Earth should be a circle (about the size of a half-dollar?), and its North Pole would be a point at its center. Indicate a direction toward the Sun (such as “far to the right”). So far, this is very similar to what we constructed in class so long ago. Next, complete steps (A – D) for *each observation*, compiling all observations on the same drawing (remember the class demo!).
 - A. Assuming your observation was done from a position on the edge of the circle (Earth), put a small dot in a position consistent with the time at which it was recorded. See the figure (3-2, p. 47 of 4th edition or p. 49 of 5th edition) in your book for hints! Rotate the page so that the point is on the circle’s edge farthest from you.
 - B. Position a protractor with its point of origin on the dot you drew, and its flat edge tangent to the circle of the Earth. Then mark the angle you recorded for Altitude; use the Azimuth recorded for that observation to determine whether you should measure from the East side or the West side of the protractor!
 - C. Draw a thin line from your observation position out through the angle mark that you just made, out to a circle (perhaps the size of a penny?) in which you draw the phase of the moon *as you saw it*.
 - D. Near this lunar phase drawing, write in the **date and time** that you made that observation.
4. Discussion/Conclusion. **Write (type) approximately one page** in which you make conclusions about this Lunar Observation assignment. This may include, for example: what you have learned, what fact you have learned that was surprising to you, if any part of this assignment helped you understand the movement of Luna, etc. **DO NOT write that you learned things like Luna has phases!!** The font of your report should not exceed 12 point pitch, and should be DOUBLE-SPACED (UNLIKE this document!).
5. Attach ALL the ORIGINAL observation sheets that you had already turned in, and any extra credit observations you made; be sure they are in order of the date you turned it in.

Your work must be “nice, neat and presentable” - an example of the high-quality collegiate work that *you can do*. Your overall grade for the project will be based on your ability to follow these directions as well as the information, accuracy of your observations, number of observations, presentation of your data, and overall quality of your presentation.

Point Distribution: up to 5 points each for your observations (should have at least 12) + up to 80 points for report = 140 points total for the project. The latter 80 points are divided like this: 10 points simply for putting the report in the order requested (!); 20 points for your write-up; 20 points for compiling your one-page spreadsheet; and 30 points for drawing the Summary Diagram properly.