

# Honors Astronomy S/G

## The Moon Project

### **The Moon** by Mary Barrett<sup>1</sup>

*The Moon is really just one size  
It always stays the same,  
But here on Earth before our eyes,  
We see it wax and wane.*

*The new moon we don't see at all,  
But then there is a sliver,  
The crescent moon is what we call  
This slice that makes us quiver.*

*The light grows larger every day  
Exactly as it ought'er,  
But logic tells us we must say  
What looks like half is quarter.*

*And then there's gibbous on its way  
To full, the brightest face,  
Then swiftly it begins to wane  
'Til gone without a trace.*

*These changes happen every night;  
Each month we see each phase  
The moon intrigues us with its light  
It truly does amaze.*

<sup>1</sup> Mary Barrett is a school teacher in Berkeley, CA. This poem appeared in the Fall/Winter 1999 GEMS Network News.

### **Expectations and Rubric**

This observing activity is worth 150 points, broken down as follows:

- |  |                  |
|--|------------------|
| ○ Observations   | 50 Points        |
| ○ Graph  | 50 Points        |
| ○ Explanation of Concepts (the questions listed below)   | 50 Points        |
| ○ Completed Lab Report, including a Proper Conclusion<br>(Separate Rubric for this part is found on the next page) | <u>50 Points</u> |
| ○ TOTAL  | 200 points       |

### **Objectives and Purpose**

This project is designed to give you real observing opportunities! Upon completion, you will be able to:

1. Become familiar with the various changes that the Moon goes through each month and season.
2. Conduct a genuine scientific research project – to make systematic accurate observations and to use those observations to derive scientific conclusions **WITHOUT** looking it up somewhere.
3. Reflect and report on your efforts, including documenting successes, failures, and areas of improvement.
4. Write a clear, complete, well-illustrated lab report.

# Grading Rubric For Report

## Timeliness

Description	Points Possible	Points Earned
Project was turned in complete and on time (additional penalties may apply)	2	

## APA Style

Description	Points Possible	Points Earned
Running head and page numbers present and properly formatted	2	
Cover page properly formatted	1	
Abstract page properly formatted	1	
Main body properly formatted	1	
Works Cited page properly formatted	2	

## Paper Mechanics

Description	Points Possible	Points Earned
Margins and type within APA guidelines	1	

## Content

Description	Points Possible	Points Earned
Abstract summarizes the paper and work	5	
Paper offers an introduction to the material	5	
Project observation details presented	5	
Conclusion offered summarizing the paper	5	
Conclusion presents sources of error	5	
Observations referenced in text	5	
Graphs referenced in paper	10	

## Score

Description	Points Possible	Points Earned
Total	50	

## **Questions**

The following questions are to be answered in your lab reports. Use complete sentences and proper paragraph form.

1. What causes phases of the Moon? Include a diagram.
2. What causes solar and lunar eclipses? How are they related to the phases of the Moon? Why don't we get eclipses every month?
3. Does the Moon rise in the East and set in the West like the Sun? Or, since the Moon revolves around Earth from West to East, does the Moon rise in the West and set in the East? Prove your answers using only your observations, and explain why the Moon rises where it does and sets where it does.
4. The Sun defines daytime by always rising in the morning and setting in the evening. However, the Moon rises and sets at any and all times of the day and night. Why is this? Is there any pattern to the changes in the times of Moon rise and set? What is that pattern? Why does that pattern exist?
5. Is there any correlation between the times of moonrise/moonset and the phases of the Moon? If so, clearly explain that correlation and explain and illustrate WHY this correlation exists.

## **Observations**

**WHERE TO MAKE YOUR OBSERVATIONS** – The best place to make your observations is a large open area, such as a parking lot or sports field.

**REQUIRED NUMBER OF OBSERVATIONS** – You must observe the Moon on at least 20 different dates. On 10 of these days, you will observe the Moon twice on its journey across the sky. At least 7 of these observations must be made during the waning phases of the Moon (early in the morning is best – remember: It does not have to be dark to see the Moon). You should begin your observations immediately.

**SUGGESTED TIMES OF OBSERVATIONS** – Your observations must be made when the Moon is actually out – guesswork is not the same as actual observations. The time period when the Moon is out changes from day-to-day. The following website can help with moonrise/moonset data:

<https://www.timeanddate.com/moon/@4160023>

For your double observations, make sure to plan ahead to determine good dates and times for making two observations at least four hours apart. For example, on a Saturday, observe in the afternoon and then evening.

The longer the time lapse between your observations, the better, but it can sometimes be difficult to find the Moon in the middle of the day. So plan for opportunities to make two observations in the dark. For example, you could observe the Moon at 11:00 pm and then again at 7:00 am the following morning while getting ready for school.

Note that both observations may or may not be on the same calendar date, like making an observation before bed and the second the following morning. That does not matter. What matters is that the observations are made on the same “Moon day” (between a single moonrise and moonset).

## **Data to Record**

Your data is to be recorded in the tables provided.

1. Record the time of each observation. Be sure to include a.m. or p.m. as appropriate.
2. Under “Sketch of Moon,” sketch the Moon the way you see it in the sky by blackening the part of the moon that you can NOT see; leave the visible part of the Moon white. Be sure to clearly show how the visible portion is “tilted” relative to the horizon (on the data table, imagine the horizon as a horizontal line on the bottom of the page).
3. Note the compass direction of the Moon (is it in the NE, E, SE, S, SW, W or NW part of the sky?). To assure accuracy, use your compass app.
4. On at least 10 days (or nights), observe the moon twice on the same “moon day,” at least four hours apart. In other words, after a given moon rise, observe the moon twice before it sets again. Each time, draw the Moon exactly as you see it, record the position of the Moon in the sky (relative to N, S, E, W and “up”) and make a sketch of the trees and houses in the foreground.
5. If it is cloudy out or if you forget to look, make a note of that, but do not sketch the Moon unless you actually observe it and do not record any observations that you have not personally made of the real sky (the internet is NOT the real sky). The worst sin that a scientist can commit is to falsify data. Such a “sin” will be reflected in your grade.
6. Record your observations as neatly as possible.

## **What to Graph**

Use the website offered above to complete the graphs for September through December, recording the time when the Moon is out for much of this semester. An example of a graph is provided at the end of this packet. This graph is not dependent on your observations and can be worked on independently of your observation data.

## **Due Date**

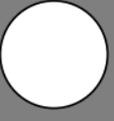
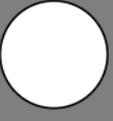
Your project report, including data observation tables and completed graphs, are to be turned in on **December 13, 2019**.

	Date and Time of 2nd Observation (Include am/pm)	Sketch of Moon	Location of Moon (sketch showing moon, objects in foreground and compass directions)	Date and Time of 2nd Observation (Include am/pm)	Sketch of Moon	Location of Moon (sketch showing moon, objects in foreground and compass directions)
1						
2						
3						
4						
5						

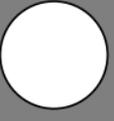
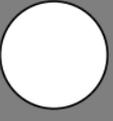
Shade in the portion of the moon you CANNOT see. Leave the visible portion white

	Date and Time of 2nd Observation (Include am/pm)	Sketch of Moon	Location of Moon (sketch showing moon, objects in foreground and compass directions)	Date and Time of 2nd Observation (Include am/pm)	Sketch of Moon	Location of Moon (sketch showing moon, objects in foreground and compass directions)
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1						
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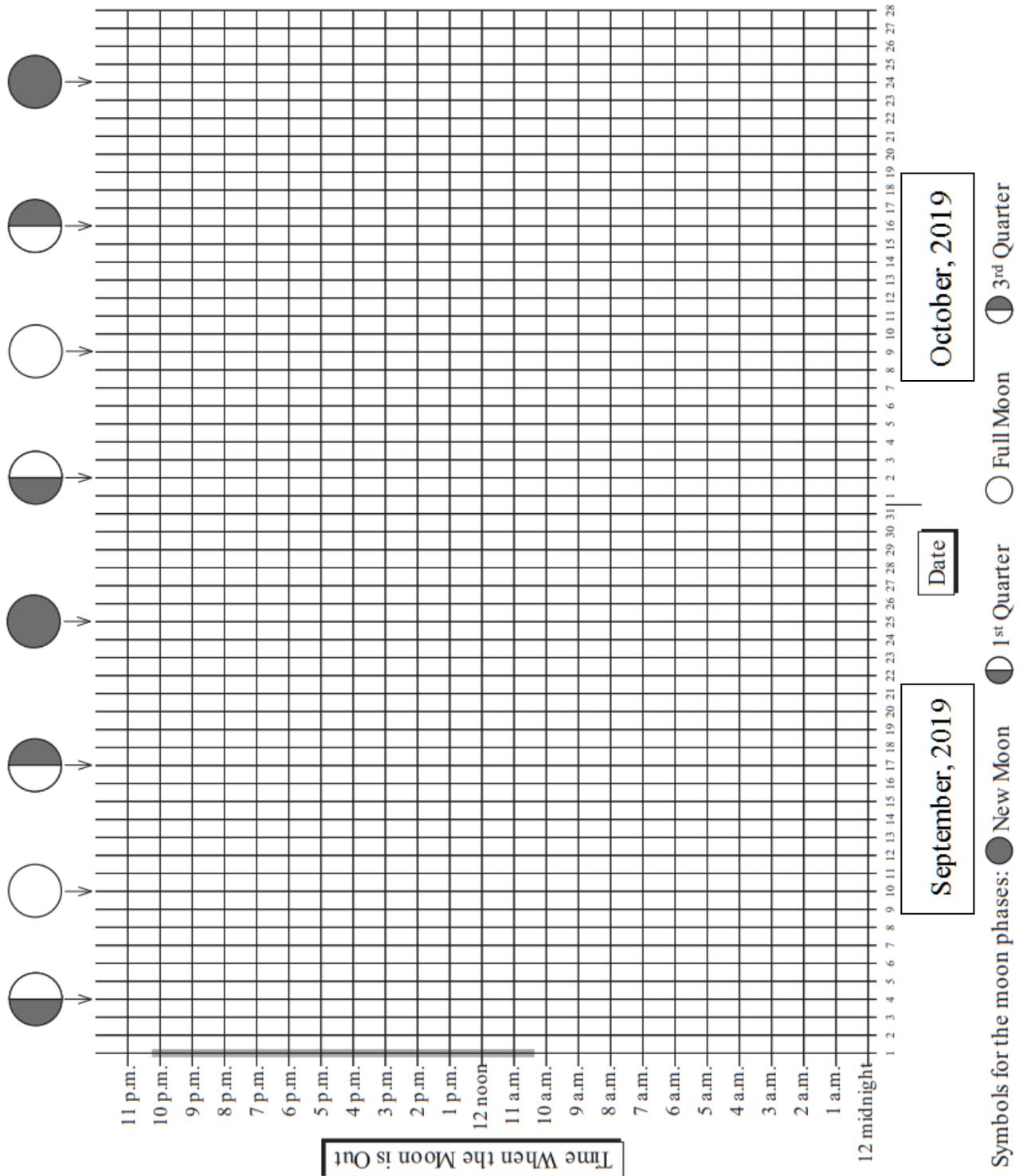
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1						
2						
3						
4						
5						

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## Example Graph for Topic #1

The example graph is on the next page; the data used for this graph are listed below. They are from January and February of 2002. Note especially the method for handling those dates when the moon does not rise or does not set.

Date	Time of Moonset	Time of Moonrise
1-Jan	9:34 AM	7:48 PM
2-Jan	10:17 AM	9:01 PM
3-Jan	10:54 AM	10:13 PM
4-Jan	11:27 AM	11:22 PM
5-Jan	11:57 AM	*

Date	Time of Moonrise	Time of Moonset
6-Jan	12:31 AM	12:27 PM
7-Jan	1:38 AM	12:58 PM
8-Jan	2:45 AM	1:32 PM
9-Jan	3:51 AM	2:08 PM
10-Jan	4:56 AM	2:50 PM
11-Jan	5:58 AM	3:38 PM
12-Jan	6:54 AM	4:31 PM
13-Jan	7:45 AM	5:27 PM
14-Jan	8:28 AM	6:26 PM
15-Jan	9:05 AM	7:25 PM
16-Jan	9:37 AM	8:24 PM
17-Jan	10:06 AM	9:21 PM
18-Jan	10:32 AM	10:18 PM
19-Jan	10:56 AM	11:14 PM
20-Jan	11:21 AM	**

Date	Time of Moonset	Time of Moonrise
21-Jan	12:12 AM	11:47 AM
22-Jan	1:10 AM	12:15 PM
23-Jan	2:12 AM	12:48 PM
24-Jan	3:15 AM	1:26 PM
25-Jan	4:21 AM	2:12 PM
26-Jan	5:25 AM	3:08 PM
27-Jan	6:26 AM	4:13 PM

Date	Time of Moonset	Time of Moonrise
28-Jan	7:21 AM	5:24 PM
29-Jan	8:09 AM	6:39 PM
30-Jan	8:50 AM	7:55 PM
31-Jan	9:25 AM	9:08 PM
1-Feb	9:58 AM	10:20 PM
2-Feb	10:29 AM	11:29 PM
3-Feb	11:00 AM	*

Date	Time of Moonrise	Time of Moonset
4-Feb	12:38 AM	11:33 AM
5-Feb	1:45 AM	12:09 PM
6-Feb	2:50 AM	12:49 PM
7-Feb	3:52 AM	1:34 PM
8-Feb	4:50 AM	2:25 PM
9-Feb	5:41 AM	3:20 PM
10-Feb	6:26 AM	4:18 PM
11-Feb	7:05 AM	5:17 PM
12-Feb	7:38 AM	6:15 PM
13-Feb	8:08 AM	7:13 PM
14-Feb	8:34 AM	8:10 PM
15-Feb	8:59 AM	9:07 PM
16-Feb	9:24 AM	10:03 PM
17-Feb	9:49 AM	11:01 PM
18-Feb	10:15 AM	**

Date	Time of Moonset	Time of Moonrise
19-Feb	12:00 AM	10:45 AM
20-Feb	1:01 AM	11:20 AM
21-Feb	2:04 AM	12:01 PM
22-Feb	3:07 AM	12:50 PM
23-Feb	4:08 AM	1:49 PM
24-Feb	5:05 AM	2:56 PM

\* The moon does not set on this date. It sets early the next day.

\*\* The moon does not rise on this date. It rises early the next day.

# Example Graph for Topic #1

