

Name: \_\_\_\_\_ School: \_\_\_\_\_

Grade or Level: \_\_\_\_\_ Lesson Plan #: \_\_\_\_\_ Date: \_\_\_\_\_

## How the Moon Affects the Tides

### Abstract

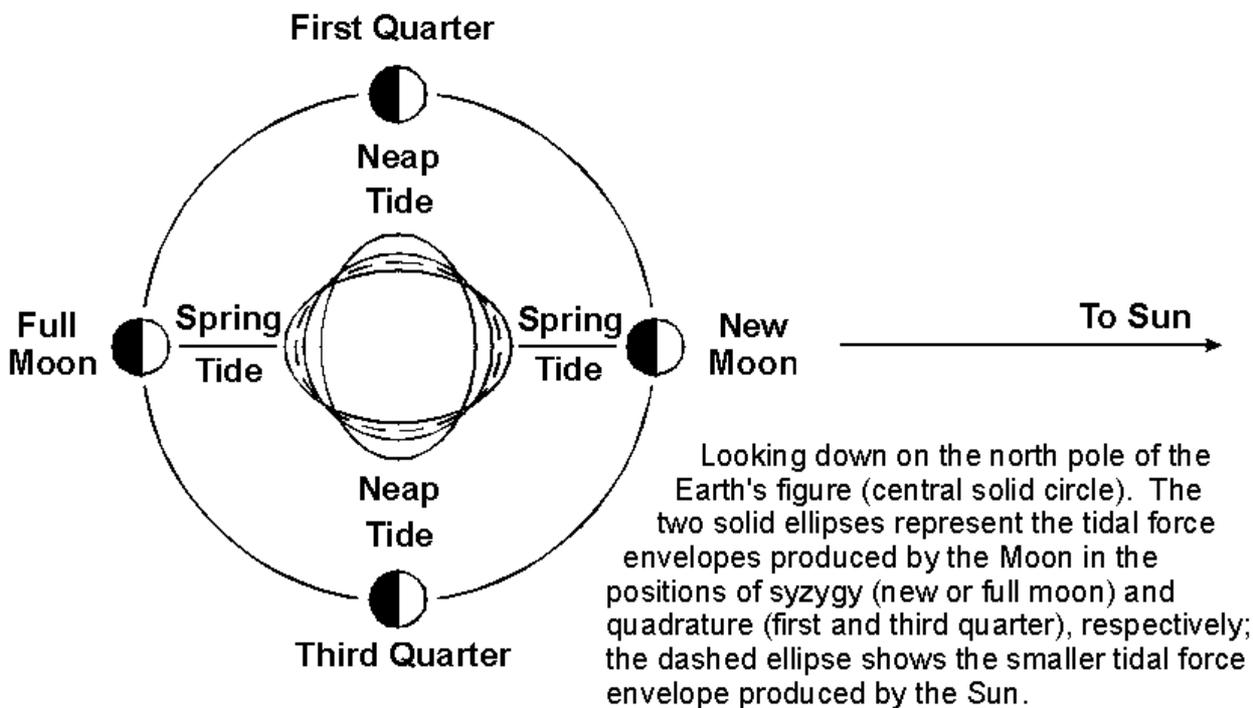
Do you like looking out at the full moon? When it comes to the ocean, the moon is a powerful force that coordinates the tides. Are the phases of the moon important for coordinating the tides? Which phase of the moon is most powerful?

### Objective

In this experiment you will investigate how the phases of the moon correspond to the changing tides.

### Introduction

You may have heard that the tide comes in and the tides goes out, but in fact a tide is the vertical movement of water and only goes up and down. Current is the horizontal or sideways flow of water. The current floods in which makes the tide rise and ebbs out which makes the tide fall. A tide is the rise and fall of water caused by gravitational forces of the moon and sun on the oceans of the earth.



How do the movements of the sun and the moon affect tide? The gravitational pull of the moon tugs on the surface of the ocean until its surface mounds up and outward in the direction of the moon. When the mound of water has reached its highest point it is called high tide. On the opposite side of the earth from the moon, the centrifugal force caused by the earth's rotation produces another

mound of water and high tide. Between these two high tides are two flat areas on the surface of the ocean which are the low tides.

Each day there are two high tides and two low tides. The time between high and low tide is a little over 6 hours and the entire tidal cycle repeats itself four times each day. The regularity of the tides corresponds to the regular orbit of the moon around the earth and the rotation of the earth as it orbits around the sun.

Depending upon the position of the moon relative to the earth and sun, a moon can have different phases. The phases of the moon are also very regular, and have been used for thousands of years to keep track of time using the lunar calendar. In addition to the daily movements of the moon, these monthly lunar cycles can also impact the tides.

In this experiment, you will compare the heights of high and low tide during the full moon and the new moon to determine if the phases of the moon affect the tides. You will use data that has been generated by a computer database to predict the timing and height of the tides. You will also use the lunar calendar to compare your tidal data to the lunar cycle.

### **Related URL's:**

<http://www.space-exploratorium.com/tides.htm>

<http://aa.usno.navy.mil/data/docs/MoonPhase.html>

[http://www.co-ops.nos.noaa.gov/tide\\_predictions.shtml](http://www.co-ops.nos.noaa.gov/tide_predictions.shtml)

### **Pre-teaching for Background Knowledge**

To do this type of experiment you should know what the following terms mean. Have an adult help you search the internet, or take you to your local library to find out more!

- new moon
- full moon
- phase of the moon
- high tide
- low tide
- neap tide
- spring tide
- gravitational force
- orbit
- rotation of the earth

### **Questions**

- When are tides high and low?
- Is there a relationship between the phase of the moon and position of the tide?
- Are tides high or low during a full moon? A new moon?

### **Materials and Equipment**

- computer
- Internet
- printer
- 2 highlighters in different colors
- graph paper

## Experimental Procedure

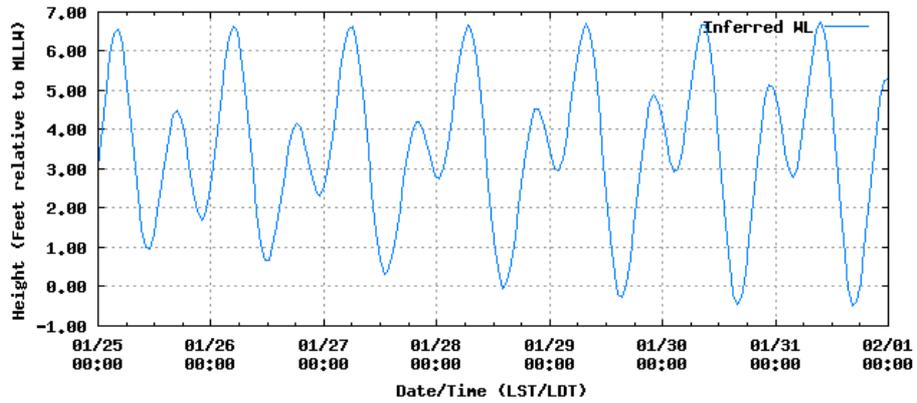
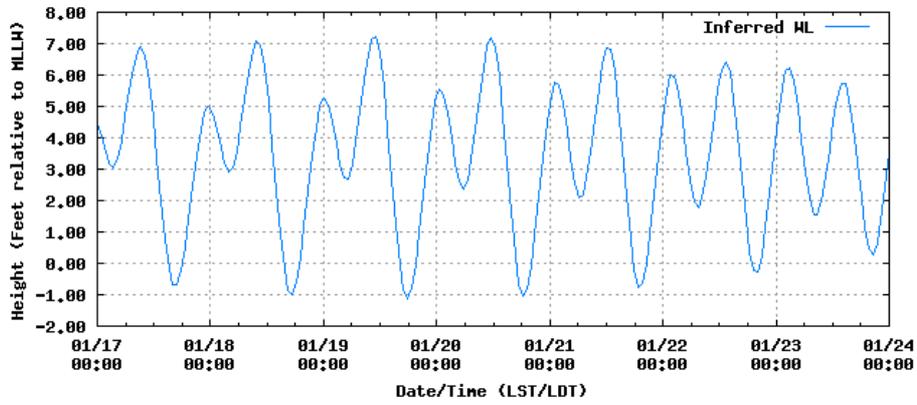
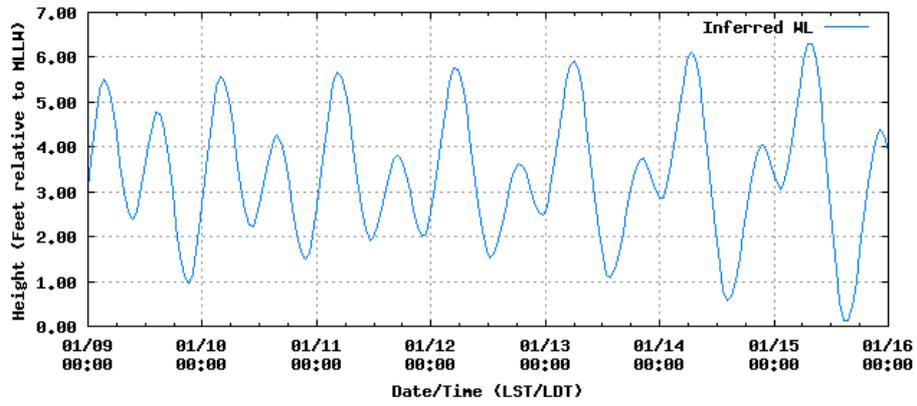
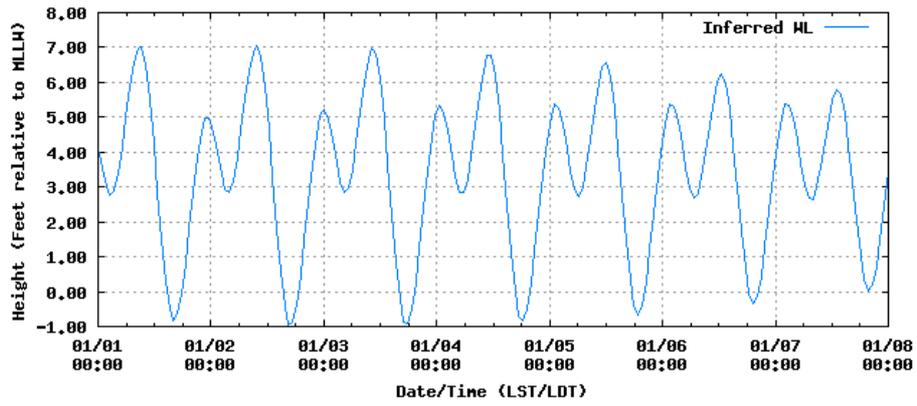
1. First, get on your computer, connect to the Internet and open up your web browser.
2. Type the URL, or Web address, for the U.S. Naval Observatory "Phases of the Moon" website into the navigation bar: <http://aa.usno.navy.mil/data/docs/MoonPhase.html>
3. You will see data for phases of the moon from years 1700–2035. Scroll down to choose the data for the year you want to study (2011). You need to print this part of the page for a reference:

### 2011 Phases of the Moon

Universal Time

New Moon			First Quarter			Full Moon			Last Quarter		
d	h	m	d	h	m	d	h	m	d	h	m
Jan	4	9 03	Jan	12	11 31	Jan	19	21 21	Jan	26	12 57
Feb	3	2 31	Feb	11	7 18	Feb	18	8 36	Feb	24	23 26
Mar	4	20 46	Mar	12	23 45	Mar	19	18 10	Mar	26	12 07
Apr	3	14 32	Apr	11	12 05	Apr	18	2 44	Apr	25	2 47
May	3	6 51	May	10	20 33	May	17	11 09	May	24	18 52
Jun	1	21 03	Jun	9	2 11	Jun	15	20 14	Jun	23	11 48
Jul	1	8 54	Jul	8	6 29	Jul	15	6 40	Jul	23	5 02
Jul	30	18 40	Aug	6	11 08	Aug	13	18 57	Aug	21	21 54
Aug	29	3 04	Sep	4	17 39	Sep	12	9 27	Sep	20	13 39
Sep	27	11 09	Oct	4	3 15	Oct	12	2 06	Oct	20	3 30
Oct	26	19 56	Nov	2	16 38	Nov	10	20 16	Nov	18	15 09
Nov	25	6 10	Dec	2	9 52	Dec	10	14 36	Dec	18	0 48
Dec	24	18 06									

4. Using a highlighter, mark the dates for the full moon in pink and the new moon in yellow. This is the data you will use for your experiment, the other data you will need to ignore.
5. Next, type the URL, or Web address, for the NOAA "Water Level and Tidal Current Predictions" website into the navigation bar: [http://www.co-ops.nos.noaa.gov/tide\\_predictions.shtml](http://www.co-ops.nos.noaa.gov/tide_predictions.shtml)
6. Select the State you are interested in.
7. You will then need to choose the region within the state, and then a particular naval station.
8. Select the "Begin Date" to the 1st of Jan of year you are interested in.
9. Set the "Time Range" to Weekly; "Time Zone" to LST/LDT; and the "Data Units" to Feet.
10. This will give you a graph of the predicted height of the tide at your chosen location for that week.



11. To the right of the graph you will find a chart with the exact high/low tide predictions, download the TXT version and print for your reference.
12. Repeat this process for each week of the month.
13. Copy and past these graphs onto a blank piece of paper
14. Using a highlighter, mark each date that matches with a full moon in pink and the new moon in yellow. This will help differentiate between the two phases and make them easier to see. For one month, there will be 1 new moons and 1 full moons, so you should have highlighted 2 days total from your data.
15. Now choose one color to represent the full moon, and another color to represent the new moon. Using the correct color, place a dot on the graph of the high and low tides of the day. You should have two dots for the high tide, and two dots for the low tide for each day.
16. When you are finished you can look at and analyze your results. Is there a difference between the high and low tides during a full moon compared to a new moon?

## Project Lesson Assessment

When this project is completed the students should be able to answer these questions:

1. When are tides high?
2. When are tides low?
3. Is there a relationship between the phase of the moon and position of the tide?
4. Are tides high or low during a full moon?
5. Are tides high or low during a new moon?

### Assessment Data:

	# at 30%	# at 30 to 70%	# at 70%+
When are tides high?			
When are tides low?			
Is there a relationship between the phase of the moon and position of the tide?			
Are tides high or low during a full moon?			
Are tides high or low during a new moon?			

## Teacher Assessment Results Summary:

Does this lesson need to be re-taught?      \_\_\_\_YES      \_\_\_\_NO

What portion of the lesson was most effective and why?

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What portion of the lesson was least effective?

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What would most improve the learning of that portion of the lesson?

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What I will do to re-teach this portion:

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When I teach this full lesson next time, I will:

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