



**Worksheet: Phases of the Moon and Tides**

If you have ever spent a long day at the beach you may have noticed a change in how far the waves would wash up on the sand, over the length of the long day. This phenomenon is due to tidal forces. At certain times of the day, the tide is at a low point and at other times, it is higher and the waves wash further up on the beach. As some of you may know the tides are primarily due to the gravitational force of the moon. Another thing you should know is that it takes 29.5 days for the moon to complete one revolution around the Earth. Let's take a look at some more data to see if we can learn more about the moon and tides.


Whenever you see a , a partner should do something with the spreadsheet file

Open the Excel file called *MoonTides.xls*. At the bottom of the document are two tabs for two slightly different spreadsheets, one labeled *24 Hour* and the other labeled *12 Hour*. Your teacher will tell you which one to click on to open and use. The *24 Hour* sheet might be easier to understand because it does not switch from AM to PM. Both contain moon, sun and tide data for August 2009.

**Sunrise and Moonrise**

 Look at one row for one day.

1. How many moonrises are there per day? \_\_\_\_\_
2. How many sunrises per day? \_\_\_\_\_
3. Why do you think the sunrises and moonrises are the same number?  
\_\_\_\_\_

Whenever you see a , partners should write out answers **together**. If you don't know the answer, ask another group for help before moving on.

 Now look at the Moonrise and sunrise columns.

4. How does the time for moonrise change day by day (approx.)?  
\_\_\_\_\_
5. How does the time for sunrise change day by day (approx.)?  
\_\_\_\_\_
6. Why do you think the sunrise time changes day by day? \_\_\_\_\_
7. Why do you think the sunrise time changes so little day by day? \_\_\_\_\_
8. Why do you think the moonrise time changes day by day? \_\_\_\_\_
9. Why do you think the moonrise time changes more than the sun, day by day?  
\_\_\_\_\_

Hint: Click in the phases animations link at the bottom of the spreadsheet data area and run the third simulation down on the page. ([http://brahms.phy.vanderbilt.edu/a103/labs/web\\_moonphases.shtml](http://brahms.phy.vanderbilt.edu/a103/labs/web_moonphases.shtml))

**Tides**

 Look one high or low tide column (it doesn't matter which one).

10. How does the time for tide change day by day (approximately)?  
\_\_\_\_\_
11. What other time change amount is this similar to? \_\_\_\_\_

 Now look at one row for one day.

12. How many low tides are there per day? \_\_\_\_\_
13. How many high tides? \_\_\_\_\_
14. How far apart are the high tides? \_\_\_\_\_

15. The low tides? \_\_\_\_\_

16. If the gravitational force of the moon pulls and causes the water to rise for one high tide, when that location's side of the earth is closest to the moon, can you guess why there is also another high tide about 12 hours later at this same location on Earth?

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### Phases of the moon (interactive)

#### Lab observations

Working in teams of three:

- One partner will be the Earth and observing (and maybe drawing) phases of the moon she/he observes.
- Another partner will revolve (slowly) around the Earth person, holding up the moon (a ball).
- The last partner will stand stationary about 15 feet away from the other two and shine a flashlight beam on the moon as it revolves around its Earth.
- If you have time switch roles.

#### Website observations (alternative)

Take a look at the phases animations link at the bottom of the spreadsheet data area and run the third simulation down on the page. ([http://brahms.phy.vanderbilt.edu/a103/labs/web\\_moonphases.shtml](http://brahms.phy.vanderbilt.edu/a103/labs/web_moonphases.shtml))

And then look at this page for a calendar of phases for August 2009:

<http://stardate.org/nightsky/moon/index.php?month=8&year=2009&css=moon.css&Submit=Go>

17. How many full moons are there in one lunar month (29.5 Earth days)? \_\_\_\_\_

18. How many new moons? \_\_\_\_\_

19. How many quarter moons? \_\_\_\_\_

#### Phases and Spring and Neap Tides

The full moon, new moon and quarter phases for August 2009 are also indicated in the Phases column of the spreadsheet. Take a look at the tide height readings in one high tide column. It changes day by day.

20. Can you see any relationships between the highest high tide days and other data in another column the spreadsheet (hint: its not an exact match, but close)?

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21. What about the lowest high tides? \_\_\_\_\_

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Relationships between data are called correlations. You may have found some correlations between phase data and highest high tides and lowest high tides. Take a look at the phases animations link at the bottom of the spreadsheet data area and run the third simulation down on the page.

([http://brahms.phy.vanderbilt.edu/a103/labs/web\\_moonphases.shtml](http://brahms.phy.vanderbilt.edu/a103/labs/web_moonphases.shtml))

Make some observations and try to answer the following questions.

22. Why do you think the highest high tides are around the full and new moon times (hint: there are **3** large objects with gravitational pull at work)? \_\_\_\_\_

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23. Why do you think the lowest high tides are around the two quarter moon times (hint: there are **3** large objects with gravitational pull at work)? \_\_\_\_\_

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Scientists often look at data to explain some observations...or make some observations to try to explain some data. When you looked at the online animations you were observing, to help you explain some data correlations you notice.... but you were also collecting data.



24. What data did you note about the position of the earth, moon and sun at full and new moon time?

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25. What data did you note about the position of the earth, moon and sun at the quarter moon times?

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We asked you questions to note what you observed. Much of what we know about the solar system, the Milky Way galaxy and the universe, has been discovered by collecting observed data. The observational data then led to a new understanding.

Extension exercise: Your teacher may ask you to research one famous astronomer and describe one observation they made and what new knowledge it led to.



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