How are tides affected by phases of the moon?

Earth’s oceans are constantly in motion. The periodic rise and fall of the surface levels of the oceans are known as tides. A tide is a giant wave caused by gravitational attractions among the sun, moon, and Earth. High tide occurs when the crest of the wave approaches the shore and the sea level rises. Low tide occurs when the trough of the wave approaches the shore and the sea level drops. A cycle of two high and two low tides takes slightly more than a day.

The moon’s gravity exerts a strong pull on Earth. The water in the oceans responds to this pull. The pull of the moon’s gravity is slightly stronger on the surface of Earth that is closest to the moon. Water is pulled up toward the moon as Earth and the moon revolve round a barycentre, a common center of mass between Earth and the moon. A bulge of water forms directly under the moon as the water closest to the moon is pulled toward the moon.

The rotation of the moon and Earth around the barycentre also causes a bulge of water on the side of Earth opposite the moon. On the far side of Earth, the pull of the moon’s gravity is weaker. Earth’s spinning produces a force much like the force that causes a spinning ice skater’s hair to fly outward. This makes Earth wobble slightly as it revolves around the barycentre. The wobbling action propels the oceans outward, causing a bulge on the side of Earth opposite the moon.

As Earth rotates, the tidal bulges remain aligned with the moon. Every location on Earth passes under both tidal bulges and thus experiences two high and two low tides each day.

The sun also affects tides. When the moon and sun are aligned, their combined gravitational forces result in high tides that are higher and low tides that are lower than normal. These tides are called spring tides. When the sun and noon are not aligned, their gravitational forces counteract each other, causing high tides that are lower and low tides that are higher than normal. These are called neap tides.

In this Virtual Lab you will measure the height of high tides and low tides during four phases of the moon. You will determine how the different phases of the moon affect tides.

Objectives:

* Measure the height of the two highest and two lowest tides during four phases of the moon.
* Record the highest high tide and lowest low tide for each phase of the moon and interpret a graph of this information.
* Compare the influence of each phase of the moon on tidal range.

Procedure: Prepare a Separate Data Table for each of two locations… See Data Table below

1. Select a phase of the moon by clicking one of the four circles around Earth. (NOTE: Earth is shown from a view directly above the North Pole)
2. Examine the calendar to find out when the selected phase of the moon occurs. The phases of the moon are abbreviated as follows: NM = New moon; FQ = First quarter; FM = Full moon; LQ = Last quarter.
3. Observe the water level at 12:00 A.M. Click the hourglass to begin the day’s tide cycle. Observe the rise or fall of the water level for six hours of the tide cycle.
4. Read the measurement after the water level has reached the first low or high tide of the day. Record it by clicking the up and down arrows to scroll through the measurements. Record in your data table.
5. Click the hourglass again and collect data for h next six hours of the tide cycle. Repeat this step until you have collected data for all the high and low tides.
6. Click the Check button. If a measurement is recorded incorrectly, it will be highlighted yellow. Click the panel with the highlighted measurement and examine the water level. Click the up and down arrows to select another measurement.
7. After you have correctly measured the four tides, compare the two low tides and the two high tides. In the Table on the Virtual Lab, record the highest and the lowest tide of the day for the selected phase of the moon. Click the Graph button to see a graphical representation of the data. Also, record the lowest and highest on your data table. Make a “rough” sketch of the shape of the line graph.
8. Repeat each step of the Virtual Lab and collect data for each of the four phases of the moon.
9. Click the New Location button – to get a new location. (You will need a separate data table for information from this location)
10. Complete the Journal Questions.

Data Collection: Prepare two Data Tables for this Lab – Each Location will have the same headings as shown below….-be sure to include enough rows for all information for all four phases.

Location:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Low Tides |  |  | High Tides |  |  |
| Moon Phase | Date | Time | Height | Date | Time | Height |
| NM |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  | Lowest: |  |  | Highest: |  |  |
| FQ |  |  |  |  |  |  |

Journal Questions: How are tides affected by phase of the moon?

1. What is the name of the location where you are taking tide measurements?
   1. What was the highest tide at that location?
   2. During which phase of the moon did it occur?
2. During which two phases of the moon do neap tides occur?
   1. Explain your answer using the data from your graph and the positions of Earth, the moon, and the sun.
3. During which two phases of the moon do spring tides occur?
   1. Explain your answer using the data from your graph and the positions of Earth, the moon, and the sun.
4. During which of those two phases does the greater spring tide occur?
   1. Why do you think the range between high tide and low tide is greater in this phase?
5. About how many hours occur between high tides?
   1. Explain.