

## Appendix B: Tide Demonstration Activity

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Notes: This activity is geared towards upper elementary students (4<sup>th</sup> and 5<sup>th</sup> grade), to show them how the tide varies over the course of a day at any given location on the earth. It utilizes information on the location of the moon with respect to the earth, gravity, and the earth's rotation to demonstrate that the water forms two bulges and that as the earth turns a specific location will experience 2 high tides and 2 low tides in 24 hours. The activity can be done outdoors and will take a full 50-minute period.

[Corresponds to Activities on pp. 14-15 – B; GPS Targets: S5E1, S6E1, S6E2, S6E3]

### Materials:

24 students (if additional students, can have 4 marking the edge of the water and 1 representing the moon. Any extra students can stand in the center of the earth and help keep track of the hours.)

4 soccer cones or other props to mark the locations of the water at low and high tide

4 pencils, one at each soccer cone

2 signs that say “high tide” and 2 that say “low tide”

24 poly vinyl spot markers

(<http://www.palossports.com/store/proddetail.cfm/ItemID/6075/CategoryID/40/SubCatID/2357/file.htm>) -- or pieces of paper or cardboard-- that can be used to designate locations, as is commonly done during a “cake walk”

Name tags, each with one of the 24 locations listed below and a place to fill in the times of high and low tide. These locations are organized from west to east and will be distributed **counterclockwise** around the circle (include the numbers on the cards to make it easier to keep things in order).

Additional name tags for students to be designated as “moon” “high tide” “low tide” and “earth”.

### Instructions:

- Pass out the name tags that designate a coastal location within each 15 degrees of longitude across the earth (see attached list).
- Distribute the spot markers in a circle from 1-24.
- Have students stand on the marker that corresponds to the number on their name tag.
- Have 4 additional students (or props if no more people are available) positioned evenly around the outside of the earth, about 1 step out from the circle. These students represent the boundary of the water in each portion of the globe. (you can think of the earth as surrounded by water)
- Designate another person (or a prop) as the moon. This person should be standing about 10 steps away from one of the 4 “water” people.
- Talk about the pull of gravity from the moon, and have the students recognize that the water person standing closest to the moon will feel the strongest pull. The water person on the opposite side (furthest from the moon) will have the weakest pull, and the two on either side will be in between.
- Also recognize that the earth itself will feel gravity. That will also be an “in between” amount of force.
- Have the water person closest to the moon take 6 steps towards it. Have the entire earth (all 24 kids) and the 2 side water people pick up their spot markers and take 3 steps towards the moon. The 4<sup>th</sup> water person just stands still. This should result in an oval of water surrounding the earth, with bulges closest and furthest from the moon.

- Have the students figure out that the two water people on the edges of the bulge are “high tide” and the two on the sides represent “low tide.” Give the high tide and low tide people name tags and pencils. Figure out which places on earth would be experiencing high tide and low tide at that point in time.
- Have the students around the circle put their spot markers down at their feet (like setting up a cake walk). Remind the students that the earth does not stay still, and prompt them to recognize that it rotates once per 24 hours.
- Say that it’s now midnight, and we are going to rotate. First, the people who are right now at either high tide or low tide need to have the tide people write the times down on their name tag (e.g. midnight = HT in Savannah, GA).
- Have the students take 1 step counterclockwise, onto the next person’s pie plate. It is now 1:00. Those students that are now experiencing High Tide or Low Tide should call it out, and also have the tide people write down the time on their name tag.
- Repeat 12 times! This should allow half of complete rotation. Ask students how many high tides and how many low tides they have experienced so far, and what they might predict will happen as they continue around.
- Continue calling out the hours (but more quickly) until everyone gets back to where they started.
- For advanced students, you can point out that at the end of the day the moon will have moved by about an hour—which means the bulge of water on the earth will have shifted slightly—which means the times of high tide and low tide for each particular point on the earth will move by about an hour a day.
- For VERY advanced students, you can also add the sun. However, this is quite complicated.

Assessment/follow up:

- Work with the students to construct a “word splash” on the board, with words and concepts that might be relevant to this exercise. They can then use these words in a drawing or paragraph explaining what they learned.
- Have the students draw a diagram showing the earth, the moon, and the water that surrounds it. Label which places are at low and high tide.
- Discuss the following:
  - How often should there be high tide in a day?
  - How long is it between two low tides?
  - How does the moon’s gravity affect the water on the earth? Which parts are pulled the most? The least?
- One could also have students find their locations on a map, or ask them to figure out the longitude of their location.

## **1. Samoa**

Low Tide: \_\_\_\_\_, \_\_\_\_\_

High Tide: \_\_\_\_\_, \_\_\_\_\_

## **2. Honolulu, Hawaii**

Low Tide: \_\_\_\_\_, \_\_\_\_\_

High Tide: \_\_\_\_\_, \_\_\_\_\_

## **3. Fairbanks, Alaska**

Low Tide: \_\_\_\_\_, \_\_\_\_\_

High Tide: \_\_\_\_\_, \_\_\_\_\_

## **4. Vancouver, British Columbia**

Low Tide: \_\_\_\_\_, \_\_\_\_\_

High Tide: \_\_\_\_\_, \_\_\_\_\_

## **5. Los Angeles, California**

Low Tide: \_\_\_\_\_, \_\_\_\_\_

High Tide: \_\_\_\_\_, \_\_\_\_\_

## **6. Houston, Texas**

Low Tide: \_\_\_\_\_, \_\_\_\_\_

High Tide: \_\_\_\_\_, \_\_\_\_\_

## **7. Savannah, Georgia**

Low Tide: \_\_\_\_\_, \_\_\_\_\_

High Tide: \_\_\_\_\_, \_\_\_\_\_

## **8. Boston, Massachusetts**

Low Tide: \_\_\_\_\_, \_\_\_\_\_

High Tide: \_\_\_\_\_, \_\_\_\_\_

## **9. Buenos Airies, Argentina**

Low Tide: \_\_\_\_\_, \_\_\_\_\_

High Tide: \_\_\_\_\_, \_\_\_\_\_

## **11. Reykjavik, Iceland**

Low Tide: \_\_\_\_\_, \_\_\_\_\_

High Tide: \_\_\_\_\_, \_\_\_\_\_

## **13. Naples, Italy**

Low Tide: \_\_\_\_\_, \_\_\_\_\_

High Tide: \_\_\_\_\_, \_\_\_\_\_

## **15. Zanzibar, Tanzania**

Low Tide: \_\_\_\_\_, \_\_\_\_\_

High Tide: \_\_\_\_\_, \_\_\_\_\_

## **10. Rio de Janeiro, Brazil**

Low Tide: \_\_\_\_\_, \_\_\_\_\_

High Tide: \_\_\_\_\_, \_\_\_\_\_

## **12. Dublin, Ireland**

Low Tide: \_\_\_\_\_, \_\_\_\_\_

High Tide: \_\_\_\_\_, \_\_\_\_\_

## **14. Istanbul, Turkey**

Low Tide: \_\_\_\_\_, \_\_\_\_\_

High Tide: \_\_\_\_\_, \_\_\_\_\_

## **16. Saudi Arabia**

Low Tide: \_\_\_\_\_, \_\_\_\_\_

High Tide: \_\_\_\_\_, \_\_\_\_\_

## **17. Bombay, India**

Low Tide: \_\_\_\_\_, \_\_\_\_\_

High Tide: \_\_\_\_\_, \_\_\_\_\_

## **19. Bangkok, Thailand**

Low Tide: \_\_\_\_\_, \_\_\_\_\_

High Tide: \_\_\_\_\_, \_\_\_\_\_

## **21. Shanghai, China**

Low Tide: \_\_\_\_\_, \_\_\_\_\_

High Tide: \_\_\_\_\_, \_\_\_\_\_

## **23. Sidney, Australia**

Low Tide: \_\_\_\_\_, \_\_\_\_\_

High Tide: \_\_\_\_\_, \_\_\_\_\_

## **18. Calcutta, India**

Low Tide: \_\_\_\_\_, \_\_\_\_\_

High Tide: \_\_\_\_\_, \_\_\_\_\_

## **20. Hong Kong**

Low Tide: \_\_\_\_\_, \_\_\_\_\_

High Tide: \_\_\_\_\_, \_\_\_\_\_

## **22. Tokyo, Japan**

Low Tide: \_\_\_\_\_, \_\_\_\_\_

High Tide: \_\_\_\_\_, \_\_\_\_\_

## **24. Auckland, New Zealand**

Low Tide: \_\_\_\_\_, \_\_\_\_\_

High Tide: \_\_\_\_\_, \_\_\_\_\_

Moon

Sun

Moon

Sun

Earth

Earth

Earth

Earth

High Tide

Low Tide

Moon

Sun

Earth

Earth

Earth

Earth