

Tides & Lunar Cycles

Overview: In this activity, students will learn how the moon affects ocean tides and also will create and interpret graphs of regional tide data.

Episode Connection: Tides

At the conclusion of the lesson, students will be able to:

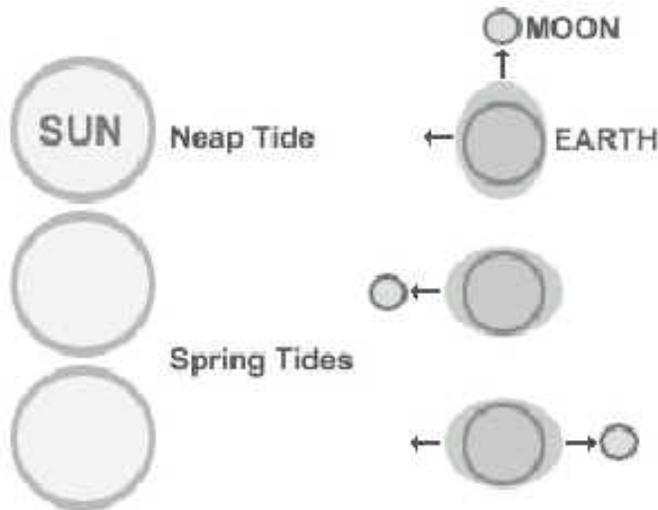
- explain how the moon and the sun influence the height and frequency of the ocean's tides
- explain the difference between neap tides and spring tides
- utilize the Internet to gather current tidal information
- create a graph using regional tide data from the Internet

Time: 3 class periods

Background

The Earth's ocean tides are a result of variations in gravitational attractions between the Earth, the moon, and the sun. The moon is the primary factor controlling the rhythm and height of the tides. The moon produces two tidal bulges on the Earth. Due to strong gravitational attraction, the sea is drawn towards the moon at the location on the Earth closest to the moon. Another tidal bulge occurs simultaneously on the opposite side of the Earth, pulling away from the moon. The Earth's rotation and the revolution of the moon thus play a large part in the timing of tidal events. The Earth completes one rotation every 24 hours, while the moon takes 27 days to revolve around the Earth. As a result, each tidal period is 24 hours and 50 minutes long.

Position of the Sun, Moon and Earth. Shaded areas on the Earth represent tidal bulges.



During each tidal period, most of the Earth's surface experiences two tidal crests (high tides) and two tidal troughs (low tides). However, due to the unevenness of the sea floor, along with the fact that the moon orbits at an angle around the Earth rather than directly around the equator, some areas of the Earth experience only one high and one low tide (called *diurnal tides*) each day.

The sun also influences the Earth's tides. When the moon, the Earth, and the sun are in line, the pull of the sun and the moon act together to create higher high tides and lower low tides, called *spring tides*. These tides occur every 14–15 days, during full and new moons. When the moon, the Earth, and the sun are at– right angles to each other, *neap tides* are formed. Neap tides occur during the first and last quarter of the moon, and consist of lower than normal high tides and higher than normal low tides.

Materials

- *As the Tide Turns* Worksheet
- 2 safety pins
- Two 16-inch pieces of string
- Labels or name tags for the Earth, moon, sun, and gravity, if you choose to do so
- Access to the Internet for current tide information
- Overhead projector, transparency of graph paper, graph paper, colored pencils

Procedure

Class Period 1

1. Pass out copies of the *As the Tide Turns* worksheet then provide students with a general overview of tides and lunar cycles, with the *Science Minutes* episode and the information in the Background section.
2. Demonstrate how the moon affects the tides by using students as models. Select one student to stand in the front of the room to symbolize the Earth. (You may want to make a large necklace or name tag to label your models. It might even enhance student understanding if you tape continents onto the "Earth's" body.) Select another student to stand up next to the "Earth" to represent the moon. Select a third student to represent the sun and two additional students to represent the force of gravity.
3. Tie a piece of string to two separate safety pins and pin them to the front and back of the "Earth's" shirt. The shirt will represent the Earth's oceans. The "gravity" students will use the strings pinned on the shirt to demonstrate the force of gravity.
4. To demonstrate a neap tide, have the "sun" and the "moon" stand in a perpendicular formation to the "Earth" and have the "Earth" face the "moon." Then, have the "gravity" students tug gently on the strings in the direction of the "moon" and directly opposite the "moon" to demonstrate how gravity creates tidal bulges. As the models demonstrate, ask the rest of the class to identify where high and low tides would consequently occur on the "Earth."
5. You can use the same models or allow other students to get up to demonstrate spring tides. This time, have the "moon" stand between the "sun" and the "Earth." Have "gravity" tug gently on the strings in the directions towards and away from the moon. Again ask students to identify where the high and low tides would be on the Earth.
6. After observing the model, have students try to draw and label the diagram on their worksheet to show tidal bulges as well as neap and spring tides.
7. Show the companion *Science Minutes* episode to review the concept.
8. Have students complete the rest of Page 1 of the worksheet, then discuss their responses.

Class Period 2

1. In a computer lab or with a projector in your classroom, log onto the NOAA website (<http://tidesonline.nos.noaa.gov/>) and navigate to find the section titled *Tides Online*. Select a region to access relevant tide data, then view graphs and tables displaying tidal information for various time periods. Note that some graphs include predictions for future high and low tides.

2. Read through a month's worth of data with your students, determining together the high and the low tides, along with spring and neap tides.
3. Using a Smartboard, projection, or an overhead projector with a transparency of graph paper, demonstrate how to set up graph paper to create a graph showing tidal data. Label the Y axis (tide height in feet) and the X axis (6 hour time periods).
4. Demonstrate on the projector how to plot the tide level points for your chosen region, using tide data from the NOAA website.

Class Period 3

1. Pass out graph paper and Page 2 of *As the Tide Turns* worksheet to each student. This worksheet includes a sample tide chart from Tampa Bay, FL.
2. Have students plot the Tampa Bay sample data onto the graph paper.
3. To assess student understanding, have students label the tidal crests and troughs (highest and lowest tidal points). In addition, ask them to make tidal predictions, complete the chart with their predictions, and then graph the additional information.
4. Finally, have students complete the remainder of their worksheets, then discuss their responses.

Go Further

- To integrate technology, have students make their charts and graphs using a computer spreadsheet or graphing program.
- To increase students' knowledge and comfort with tidal charts, visit some of the other tide data collection websites. A number of sites allow students to select the exact data they want presented and then modify the way in which the data is displayed on the screen.

Source: <http://www.sitesalive.com/oil/tg/private/oiltgtides.html>

Standards Addressed

National

Next Gen Sunshine State

Grade 5

Grade 6

Grade 7

Grade 8

Notes

The graphing involved in this activity provides a meaningful way for you to integrate math into your science curriculum. Additionally, this activity allows you to integrate technology into the curriculum to meet educational standards for technology education. The graphing may be challenging for younger students, so please consider some age-appropriate modifications.