

## More to Learn

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# *How Are Tides Caused by Gravity of the Sun and the Moon?*

Earth and the other planets are kept in orbit around the Sun by the Sun's gravity. Any two objects pull on each other because of the force of gravity. The more massive an object is, the greater the force of gravity pulls on another object. The Sun is much more massive than Earth, so Earth is prevented from moving off into space and is instead pulled into orbit around the Sun. In the same way, the Moon is pulled into orbit around Earth because Earth is much more massive than the Moon.

However, the Moon's gravity does have an effect on Earth. If you live near the ocean, or if you have visited the seashore, you know that the line where the water reaches the shore changes dramatically throughout the day. **Tides** are the rise and fall of water in the oceans. There can be two high tides and two low tides in a 24-hour period, with the highest and lowest levels occurring about every 6 hours.

Tides are caused by the gravitational attraction between Earth and the Moon. The Moon's gravity distorts the sea level so that the sea is slightly higher on the side of Earth closer to the Moon and also on the side farther from the Moon. As Earth spins on its axis, the part of Earth that faces the Moon changes. When a location is oriented so that it faces toward the Moon, or opposite the Moon, the bulge of water is at its highest point, and there is a **high tide**. Between the two bulges are low areas, because water has been pulled away to form the bulge.

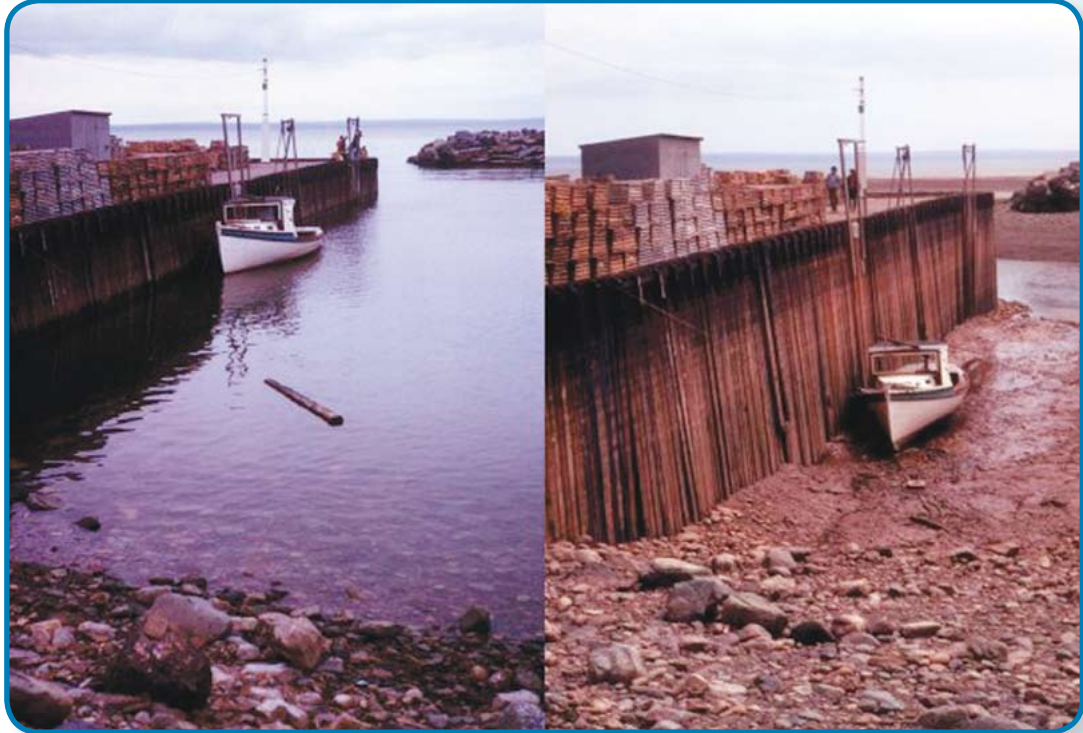
A location in one of these low areas has a **low tide**.

At any given location on Earth, there can be two high tides and two low tides in a 24-hour period. However, because the Moon takes 24 hours and 50 minutes to return to the same position above a given location, high tides and low tides occur about 50 minutes later each day. For example, if high tide at a location is at 10:00 AM one day, it will be at 10:50 AM the next day.

**tide:** the rise and fall of the surface level of a body of water due to the Moon's and the Sun's gravitational pull.

**high tide:** the time, for a certain location, when the tide is at its highest point.

**low tide:** the time, for a certain location, when the tide is at its lowest point.



*High tide on left, low tide on right. Each occurs twice in a 24-hour period.*

The Sun also has an influence on tides. Even though the Sun is farther away, it has much more mass than the Moon. If the Sun and the Moon are pulling in the same direction on Earth, when the three bodies are in a line, then the tides are stronger. If the Sun is pulling on Earth at a right angle from the Moon, then the tides are weaker.

