

# What causes the tides in the ocean?

By NASA and NOAA, adapted by Newsela staff on 02.09.17

Word Count **686**

Level **830L**



Flying gulls on Morro Strand State Beach, California, at low tide. Morro Rock is seen in the background. Photo taken January 21, 2012, by Mike Baird. Originally posted to Flickr, licensed under Creative Commons. MIDDLE: Graphic showing the moon's gravitational pull. BOTTOM: The tidal range.

Tides come and go, as the sea rises and falls. This cycle of tides happens most days on coastlines around the world.

## Why Is That?

Tides are really all about gravity, and it is the moon's gravity that causes daily tides.

As Earth rotates, the moon's gravity pulls on different parts of our planet. Because the moon is much smaller than Earth, its gravity is less than Earth's gravity. However, since the moon is so close to us, it has enough gravity to move things around. The moon's gravity even pulls on the land, but not enough for anyone to really tell.

When the moon's gravity pulls on the oceans, though, someone's bound to notice. Since water is a liquid, it has a much easier time moving around than land. It bulges toward the moon. That bulge follows the moon as Earth turns beneath it.

That explains the first high tide each day, but what about the second high tide?

The ocean also bulges out on the side of Earth opposite the moon.

## Wait, What?

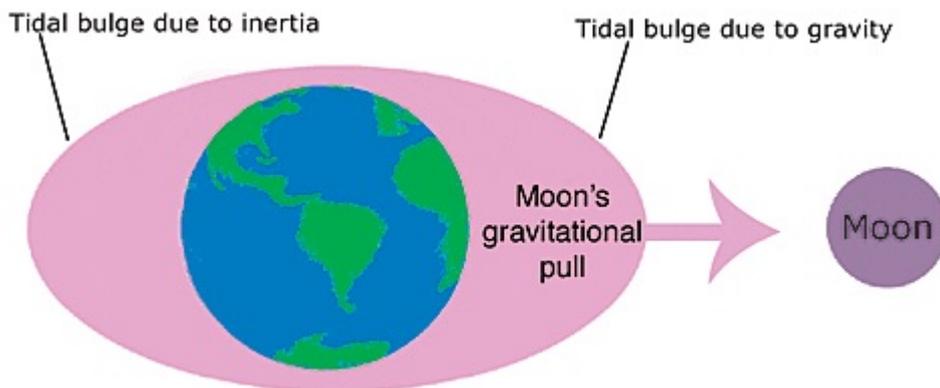
If the moon's gravity is pulling the oceans toward it, how can the ocean also bulge on the other side of the Earth?

Gravity is the main force causing tides, but inertia plays a part, too. Inertia is a resistance against change in direction. It acts to balance out the force of gravity. Inertia causes moving objects to continue moving in a straight line. It also causes still objects to continue staying still. Inertia wants to keep doing whatever it's doing, until another force acts on it.

While the water closest to the moon is getting pulled, the water farthest from the moon is staying right where it is. Both sides are experiencing gravity and inertia, but one force always overpowers the other.

On the side by the moon, gravity wins. On the side away from the moon, inertia wins. Both forces cause the water to bulge, creating a high tide.

This explains why there are two high tides and two low tides every day.



## Are Tides The Same Height Everywhere On The Planet?

The high and low tides are not the same height everywhere on the planet.

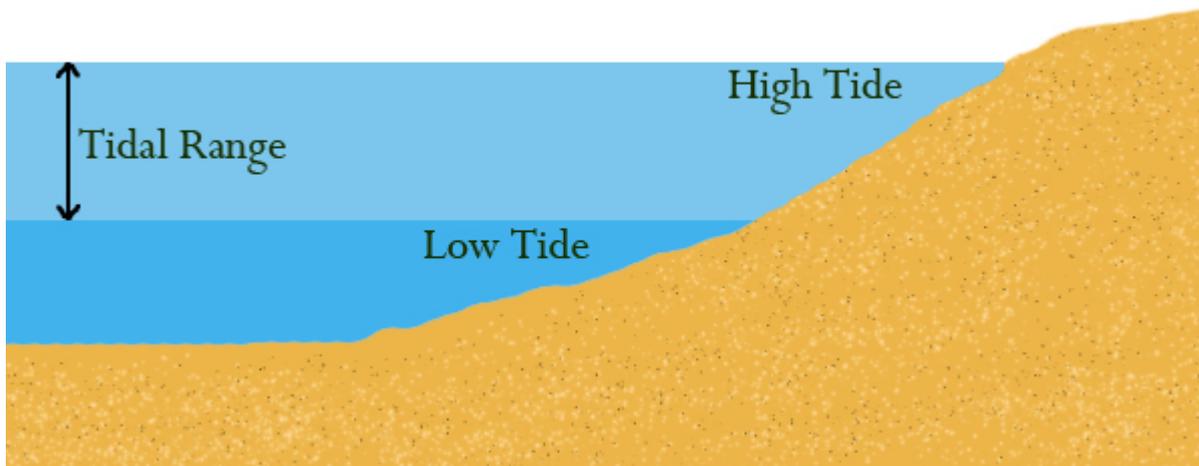
If Earth were perfectly round and completely covered in water, then all tides would be the same. But Earth is not perfectly round. Also, the big continents on Earth get in the way of water bulging toward the moon. That's why in some places, the difference between high and low tide isn't very big. In other places, the difference is huge.

## High And Low Tides

Tides begin in the oceans as waves. Then they move toward the coastlines, where they appear as the regular rise and fall of the sea. When the highest part of the wave reaches a particular place, high tide occurs. Low tide corresponds to the lowest part of the wave.

Most coastal areas have two high tides and two low tides every day. But, they are affected by the lunar day, not the solar day. Everyone knows the solar day. It's the 24 hours it takes for the Earth to turn around its axis. A lunar day is the time it takes for the moon to circle around the Earth and come back to the same place in the sky. This takes 24 hours and 50 minutes. It is slightly longer than a solar day.

The Earth turns through two tidal "bulges" every lunar day. This means coastal areas have two high tides and two low tides every 24 hours and 50 minutes. High tides happen 12 hours and 25 minutes apart. The water goes from high tide to low tide in half that time.



### Does Anything Else Affect Tides?

The sun plays a part in tides as well. When the sun's gravity lines up with the moon's gravity, the tides are more extreme.

Wind and weather can affect tides, too. For instance, strong offshore winds can move water away from coastlines. This makes low tides even lower. Likewise, onshore winds can push water onto the shore. This makes low tides less visible.

**Quiz**

- 1 What is MOST LIKELY the reason why the author included the information about inertia?
- (A) to explain why the tide is weaker on the opposite side of Earth
  - (B) to explain why there is a second high tide every lunar day
  - (C) to explain why the moon's gravity is less strong than Earth's gravity
  - (D) to explain why the difference between high and low tide is small
- 2 According to the article, what is the relationship between Earth and the moon?
- (A) The moon's gravity pulls on Earth's oceans and causes daily tides.
  - (B) The moon makes the tides on Earth even more extreme than usual.
  - (C) The moon's gravity causes Earth's continents to change their shapes.
  - (D) The moon's lunar day is slightly shorter than Earth's solar day.
- 3 Read the section "Wait, What?" and examine the image.
- Why is the moon included in this image?
- (A) because the moon's gravity is stronger than Earth's gravity
  - (B) because the moon causes inertia to happen on Earth
  - (C) because the moon's gravity affects the water on Earth that is closest to it
  - (D) because the Earth's tidal bulge affects the moon's orbit
- 4 Read the caption under the photo at the top of the article. Based on the article, what do we know about the tide in the photo?
- (A) Winds probably made the tide less visible.
  - (B) There is a big difference between the high and low tide.
  - (C) It corresponds to the highest part of the wave.
  - (D) It corresponds to the lowest part of the wave.

## Answer Key

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