Family edition

Moon and Tides Lab: Why Are There Two High Tides a Day?

Ages 11-14 · about 45 minutes, in one sitting

Your child finds out why the sea rises and falls twice a day, in Moon and Tides Lab. The point is that the Moon stretches the ocean into two bulges, and the turning Earth carries each beach through both.

What you need

- A computer or Chromebook with a current browser.
- The lesson link: mytekdev.com/try/moontideslab?lesson=why-are-there-two-high-tides-a-day&ref=fam-moontideslab-3. No account, no email and nothing to install.

Before you start: try it once yourself

Open mytekdev.com/try/moontideslab?lesson=why-are-there-two-high-tides-a-day&ref=fam-moontideslab-3. The Tides chapter: an ocean planet with no land, the Moon to one side, a small person on a beach, and a tide board.

1. **Predict.** Pick one, two or four high tides a day.
2. **A day.** Press `Play` (an hour a second) and watch 24 hours. The person passes both bulges: two highs and two lows.
3. **The Sun.** Turn on `The Sun's pull` and `A month on the graph`. The biggest highs come near new and full Moon.
4. **A real coast.** Pick Boston from Real coast: about 3 meters from low to high. Eastport, Maine is over 5; Pensacola, Florida less than half a meter, once a day.

> The ocean-planet tide is about half a meter at most. Real coasts come from NOAA's measured numbers, not from the bulges, because the shape of each ocean decides the size and timing.

The ideas, in plain words

The Moon pulls the near side of the Earth a little more than the middle, and the middle a little more than the far side. Take away the pull on the middle and what is left stretches the ocean outward on both sides: two bulges. The Earth turns under them, so most beaches get two high tides, about 12 hours 25 minutes apart.

The Sun does the same with a stretch a little less than half the Moon's. In a line, at new and full Moon, they add: spring tides. At right angles, at the half Moons, they partly cancel: neap tides.

Real oceans do not have two smooth bulges. Tide waves move round each ocean basin, and the shape of the coast can make the tide huge, as in Maine, or once a day, as in the Gulf of Mexico.

Do it together

1. Open mytekdev.com/try/moontideslab?lesson=why-are-there-two-high-tides-a-day&ref=fam-moontideslab-3 together. Ask: how many high tides does a beach get in one day? Pick your answer in the guide.

   > **You'll know it worked when:** Any answer is fine: it is asked again later.

2. Press `Play` and watch a whole day.

   > **You'll know it worked when:** The beach passes through both bulges: two high tides.

3. Turn on `The Sun's pull` and `A month on the graph`.

   > **You'll know it worked when:** The highest tides come near new and full Moon.

4. Pick Pensacola, Florida as the Real coast, then Eastport, Maine.

   > **If you get stuck:** The Real coast list is under the picture.
   >
   > **You'll know it worked when:** Your child can say that real coasts follow the Moon but the shape of the ocean changes the size and the timing.

Talk about it

Ask these while you work together. A child who has understood it can answer them without help:

- Where is the far bulge, and why is it there?
- Why is the second high tide about 12 hours after the first?
- When in the month are the biggest tides?
- Why does Pensacola have one high tide a day?
- Does the wind make the tides? How do you know?

> The first question is the real test: a child who can explain the far bulge has more than the one-bulge picture.

For younger and older kids

Younger: For a younger child, look up the tide times for a beach you know and count the high tides in a day.

Older: For a teenager, solve the three Tides puzzles and explain why high tide is about 50 minutes later each day.

Keep going

- Solve The tide clock and Spring or neap? in Puzzles.
- Compare San Francisco's two unequal high tides with Boston's two equal ones.
- Find out why high tide comes about 50 minutes later each day.

Bring it into other subjects

- Math: graph a day of real tide heights from NOAA for a beach near you and find the range.
- Geography: find the Bay of Fundy on a map and read why it has the biggest tides in the world.
- Life science: what lives in the zone between high and low tide, and how does it survive both?
- English: write a tide warning for beach visitors in plain words.

For your records

Ready to copy into an hour log, a portfolio or a transcript.

LESSON	Moon and Tides Lab: Why Are There Two High Tides a Day?
SUBJECTS	Earth and space science
TIME	45 minutes
WHAT WE DID	Used a model of the Earth, Sun and Moon to explain two high tides a day and spring and neap tides, and compared the model with real NOAA tide data.
SKILLS PRACTICED	Tides; Using a model; Reading real data

Activity sheet (optional)

Name: _____ Date: _____

Open the app: scan the QR code, or go to mytekdev.com/try/moontideslab?lesson=why-are-there-two-high-tides-a-day

Essential question: Why does a beach get two high tides a day when there is only one Moon?

Warm-up: How many high tides does a beach get in one day? Why? _____

1. **Vocabulary.** Tide, bulge, spring tide, neap tide, tidal range: write each in your own words.

2. **The tide table.** For Boston, Eastport and Pensacola: high tides a day ____ and the biggest range ____ m. Which is the odd one out?

3. **Spring and neap.** The biggest tides came at _____ Moon. The smallest at _____ Moon.

1. Why does a beach get two high tides a day? Draw the Earth, the Moon and the bulges.

2. Why can a real coast be different from the model?

Quick check

Name: _____

1. Most beaches get (A) one high tide a day (B) two high tides a day (C) four high tides a day

2. The biggest tides of the month come at (A) the half Moons (B) new and full Moon (C) any time

3. Where is the second bulge, and why is it there?

Answers

QUESTION	ANSWER	WHY
1	B	The turning Earth carries a beach through both bulges.
2	B	The Sun and Moon are in a line, so their stretches add: spring tides.
3	On the far side from the Moon	The Moon pulls the far side less than the Earth's middle, so the ocean there is left behind. A full answer names the stretch.

If your state or umbrella school asks, this lesson covers Texas TEKS 112.26(b)(9)(B).

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The app this lesson uses is free and runs in the browser, with nothing to install and no account needed. It is at mytekdev.com.

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