



Tide Table Lab

Mission: The harbor master needs a tide table so boats don't get stuck. Use the Earth-Moon model to find out why the ocean rises and falls twice a day, and when the biggest tides happen.

Big question: How does the Moon's gravity cause tides?

★ Warm-up: Notice & wonder

Imagine a day at the beach.

Your sandcastle was dry at 9 AM but underwater at 3 PM. What happened? ✓ **The tide came in.**

Does a lake in Indiana have noticeable tides? ✓ **No: tides are only big in oceans.**

Key vocabulary

Tide	The regular rise and fall of sea level.
High tide / low tide	The highest / lowest water level.
Spring tide	Extra-big tides when the Sun, Earth, and Moon line up.
Neap tide	Smaller tides when the Sun and Moon are at a right angle.

1 Box 1

Spin for a day

In the simulator: Spin Earth one full day (Sun's pull off).

How many high tides did the beach town get in one day?

Answer: _____ high tides ✓ **2**

2 Box 2

Why twice?

Why are there TWO high tides each day?

☐ Earth rotates through both bulges ☐ The Moon goes around Earth twice a day ☐ The ocean sloshes

✓ **Earth rotates through both bulges**

3 Box 3

Add the Sun

In the simulator: Turn on the Sun's pull, line up the Moon with the Sun (straight line), and spin a day.

What was the highest water level?

Answer: _____ m ✓ **varies: check the student's simulator readout**

Right angle

In the simulator: Now put the Moon at a right angle to the Sun (top or bottom) and spin a day.

Compared to when they lined up, the tides were...

☐ smaller (neap tides) ☐ bigger (spring tides) ☐ the same

✓ **smaller (neap tides)**

4 Box 4

Match the phase

Which tides go with which Moon phases?

Sort: New moon · Full moon · First quarter · Third quarter

Spring tides (biggest)	Neap tides (smallest)
New moon Full moon	First quarter Third quarter

5 Box 5

Legend: tide timing Legend only

High tide was at 6:00 AM. About when is the next high tide? (Type the PM hour.)

Answer: _____ PM ✓ 6

6 Box 6

Harbor report (CER)

How does the Moon cause tides?

Claim

Look for: Names gravity; at least 6 words

Evidence

Look for: Uses the high tide count; Uses the Sun comparison; a number from the simulator; at least 12 words

Reasoning

Look for: Explains the bulges; at least 10 words

Exit ticket: answer the big question in your own words

How does the Moon's gravity cause tides?

Look for: The Moon's gravity pulls on Earth's oceans, making two bulges of water: one facing the Moon and one on the opposite side. As Earth rotates through both bulges, a beach gets two high tides and two low tides each day. When the Sun and Moon line up, tides are extra big (spring tides).

Completion codes

Students see a code like **ABC-I3** when they finish. The first part must match below. The letter is the level (E = Explorer, I = Investigator, L = Legend), and the number at the end is how many stars they earned.

Level	Code starts with
 Explorer	CVQ-E
 Investigator	4VU-I

**Watch for these misconceptions**

- "There is no gravity in space." Gravity reaches across space; astronauts float because they are falling around Earth.
- "Moon phases are caused by Earth's shadow." Only lunar eclipses involve Earth's shadow.
- "Summer happens when Earth is closest to the Sun." Earth is closest in January. Tilt causes seasons.