

Tide Force Patterns

Read how moving Earth, Moon, and Sun create changing ocean tides.

6.9.B “describe and predict how the positions of the Earth, Sun, and Moon cause daily, spring, and neap cycles of ocean tides due to gravitational forces.”

NAME _____

DATE _____

1 READ AND MARK _____ Read it twice

YOUR JOB Underline each sentence that explains how the positions or motions of Earth, the Sun, and the Moon affect tides. Circle the words *spring tides* and *neap tides* and number the Moon phases connected to each one.

Why the Water Moves

- ① At a beach, water level rises and falls in a repeating pattern called a tide. The Moon's gravity pulls more strongly on the side of Earth facing the Moon than on Earth's center. This difference helps form two broad water bulges, one on the Moon-facing side and one on the far side. As Earth rotates, a coast moves through these bulges and the lower-water areas between them. Many coasts experience two high tides and two low tides in about one lunar day, roughly 24 hours and 50 minutes.
- ② The Sun also exerts gravity on Earth's oceans, although the Moon has a larger effect because it is much closer. When the Sun, Earth, and Moon line up during a new moon or full moon, their gravitational pulls work along the same line. This arrangement produces spring tides. Spring tides have the greatest difference between high and low water, called the tidal range. They do not happen only in spring. The word spring refers to water levels that seem to spring farther up and down.
- ③ When the Moon is at first quarter or third quarter, the Sun-Earth line and the Earth-Moon line form a right angle. The Sun's and Moon's tidal effects partly offset each other. This creates neap tides, which have the smallest tidal range. High tides are not as high, and low tides are not as low. Tides still occur during neap tides because the Moon continues to pull on Earth's oceans. Knowing the Moon phase and positions of the three bodies helps scientists predict whether a tide cycle will have a large or small range.

2 ANSWER WITH EVIDENCE _____ Use the passage

1 How does Earth's rotation help cause the daily pattern of high and low tides at many coasts?

2 During which Moon phases do spring tides occur? Describe the positions of the Sun, Earth, and Moon at that time.

3 The Moon is at third quarter. Predict the tidal range and explain why.

4 Why do tides still occur during neap tides?

3 YOUR TURN _____ Your own words

Create two labeled panels. In Panel 1, sketch a spring-tide arrangement, and in Panel 2, sketch a neap-tide arrangement. Show the Sun, Earth, and Moon, add gravity arrows, and write one sentence in each panel predicting the tidal range.

PART 1 • READ AND MARK

Underline each sentence that explains how the positions or motions of Earth, the Sun, and the Moon affect tides. Circle the words *spring tides* and *neap tides* and number the Moon phases connected to each one. Accept any marking that follows this job and points at the right text.

PART 2 • ANSWERS

#	QUESTION	ANSWER
1	How does Earth's rotation help cause the daily pattern of high and low tides at many coasts?	As Earth rotates, a coast moves through the two water bulges and the lower-water areas between them. Many coasts have two high tides and two low tides in about one lunar day.
2	During which Moon phases do spring tides occur? Describe the positions of the Sun, Earth, and Moon at that time.	Spring tides occur during a new moon or full moon, when the Sun, Earth, and Moon line up and their pulls work along the same line.
3	The Moon is at third quarter. Predict the tidal range and explain why.	The tidal range will be small, a neap tide. At third quarter, the Sun-Earth line and Earth-Moon line form a right angle, so their tidal effects partly offset each other.
4	Why do tides still occur during neap tides?	Tides still occur because the Moon continues to pull on Earth's oceans.

PART 3 • YOUR TURN (SAMPLE ANSWER)

Panel 1: The Sun, Earth, and a full Moon are in a straight line, with gravity arrows along the line. This produces a spring tide with the greatest tidal range. Panel 2: The Sun-Earth line and Earth-Moon line meet at a right angle at first quarter. This produces a neap tide with the smallest tidal range.

Accept either new moon or full moon for the spring-tide panel, and either first quarter or third quarter for the neap-tide panel. Students should show alignment for spring tides and a right-angle arrangement for neap tides, with matching large or small tidal-range predictions.