Pulled Into Motion

Explain orbits and tides using gravity and motion.

E.6.8.5 "Construct explanations for how gravity affects the motion of objects in the solar system and tides on Earth."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline two places where gravity changes an object's path. Circle two places where gravity helps change ocean water levels.

A Pull You Can See

1. Imagine watching Earth from a spacecraft. Earth moves forward through space, while the Sun's gravity pulls it inward. Together, that motion and pull keep Earth traveling around the Sun instead of flying away in a straight line or falling straight into the Sun. Earth also pulls on the Moon with gravity. The Moon moves forward, but Earth's pull keeps bending its path around Earth. Gravity does not switch off when an object is moving. It can change the direction of that object's motion.

2. Now imagine standing on a beach as the ocean rises up a pier. The Moon's gravity pulls on both Earth and its oceans. Because the Moon is closer to the ocean on Earth's near side, its pull is stronger there than at Earth's center. The ocean forms a bulge toward the Moon. On Earth's far side, the Moon's pull is weaker than at Earth's center, so another ocean bulge forms there. As Earth turns through these bulges, many coasts have two high tides and two low tides in about a day.

3. The Sun also pulls on Earth's oceans. Its tidal effect is smaller than the Moon's because the Sun is much farther away. When the Sun, Moon, and Earth line up, their tidal effects add together. This makes the difference between high and low tide larger. When the Sun and Moon lie in directions at right angles from Earth, their tidal effects partly cancel. The difference between high and low tide becomes smaller. Earth keeps turning, so a beach can experience these changes in water level as a repeating pattern.

2 ANSWER WITH EVIDENCE

Use the passage

1. Why does Earth travel around the Sun instead of moving away in a straight line?

2. How do the Moon's motion and Earth's gravity work together to keep the Moon traveling around Earth?

3. How does the Moon's gravity help cause high tides on both the near and far sides of Earth?

4. Why is the difference between high and low tide larger when the Sun, Moon, and Earth line up than when the Sun and Moon are at right angles from Earth?

3 YOUR TURN

Your own words

An ocean planet named Nara moves forward around a star and has a moon. Explain what would happen to Nara's path if the star's gravity suddenly vanished, and how a coast's water level could still change as Nara turns.

ANSWER KEY

Pulled Into Motion

GRADE 6 · E.6.8.5

PART 1 · READ AND MARK

Underline two places where gravity changes an object's path. Circle two places where gravity helps change ocean water levels. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Why does Earth travel around the Sun instead of moving away in a straight line?	**Earth moves forward, but the Sun's gravity pulls it inward and keeps bending its path around the Sun.**
2	How do the Moon's motion and Earth's gravity work together to keep the Moon traveling around Earth?	**The Moon moves forward while Earth's gravity pulls it inward, bending its path around Earth.**
3	How does the Moon's gravity help cause high tides on both the near and far sides of Earth?	**The Moon pulls more strongly on the near ocean than on Earth's center, forming a bulge. It pulls less strongly on the far ocean than on Earth's center, so a second bulge forms there.**
4	Why is the difference between high and low tide larger when the Sun, Moon, and Earth line up than when the Sun and Moon are at right angles from Earth?	**Their tidal effects add together when they line up, but partly cancel when they are at right angles.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Without the star's gravity pulling it inward, Nara would keep moving in a nearly straight path instead of orbiting the star. Its moon would still pull more strongly on the near ocean than on Nara's center and less strongly on the far ocean. As Nara turns through the two ocean bulges, the coast could have repeating high and low tides.

Accept explanations that connect forward motion and an inward gravitational pull to a curved orbit. For tides, look for an explanation that the moon's unequal pull forms ocean bulges and that turning carries a coast through changing water levels.