Waves in Motion

Use observed motion to analyze waves in nature.

PHS.6.2 "Analyze examples and evidence of transverse and longitudinal waves found in nature (e.g., earthquakes, ocean waves, and sound waves)."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline evidence showing how material moves as each wave travels. Circle the wave types you can identify from that evidence.

Signals at the Coast

1. At a coastal research station, sensors record an earthquake, a floating buoy, and a passing ship's horn. To compare their wave records, track two directions: the direction energy travels and the direction the material moves. If material moves at right angles to the energy's path, the wave is transverse. If material moves back and forth along that path, the wave is longitudinal. A wave can carry energy across a region without carrying the same bit of material across it. This distinction matters when a surface rises, a hillside shifts, or air briefly squeezes together.

2. When an earthquake begins, two kinds of seismic waves leave the fault. A P wave repeatedly squeezes and stretches rock in the same direction that the disturbance travels. An S wave shifts rock across the direction of travel instead. Seismometers often record the faster P wave before the S wave. An S wave cannot pass through Earth's liquid outer core, but a P wave can cross it. Scientists use these patterns as evidence about both motion in the rock and materials deep inside Earth. This evidence comes from motion measured at stations far from the fault.

3. Offshore, a ship's wake moves across the surface toward a buoy. As a crest passes, the buoy rises and falls, but it does not ride along with that crest to shore. That up-and-down motion gives evidence of a transverse component. Yet water in surface waves also moves forward and backward, tracing nearly circular paths in deep water, so the whole surface wave is not purely transverse. Nearby, the ship's horn pushes air into alternating compressed and spread-out regions. Those regions move outward, while each small parcel of air vibrates back and forth along their path.

2 ANSWER WITH EVIDENCE

Use the passage

1. Classify the earthquake's P and S waves. What motion in the passage supports each classification?

2. An earthquake sensor detects a wave after it has crossed Earth's liquid outer core. Which wave could it be, P or S? Use evidence from the passage.

3. Why would the buoy's rising and falling be incomplete evidence for calling the whole surface wave transverse?

4. How is the sound from the ship's horn like an earthquake P wave? Compare the motion that supports your answer.

3 YOUR TURN

Your own words

Imagine a long spring stretched across a floor. In three or four sentences, describe how you would make one transverse pulse and one longitudinal pulse. For each pulse, explain how a section of the spring would move compared with the direction the pulse travels.

ANSWER KEY

Waves in Motion

PART 1 · READ AND MARK

Underline evidence showing how material moves as each wave travels. Circle the wave types you can identify from that evidence. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Classify the earthquake's P and S waves. What motion in the passage supports each classification?	**P waves are longitudinal because they squeeze and stretch rock along their direction of travel. S waves are transverse because they shift rock across their direction of travel.**
2	An earthquake sensor detects a wave after it has crossed Earth's liquid outer core. Which wave could it be, P or S? Use evidence from the passage.	**It could be a P wave because P waves can cross the liquid outer core, while S waves cannot.**
3	Why would the buoy's rising and falling be incomplete evidence for calling the whole surface wave transverse?	**The rising and falling shows a transverse component, but the water also moves forward and backward. In deep water, its motion is nearly circular.**
4	How is the sound from the ship's horn like an earthquake P wave? Compare the motion that supports your answer.	**Both are longitudinal. Air vibrates back and forth along the horn sound's path, while rock is squeezed and stretched along the P wave's path.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

I would flick one end of the spring sideways to send a transverse pulse along its length. A section of the spring would move sideways, across the pulse's path. Next, I would push one end toward the other end and pull it back to send a longitudinal pulse. A section of the spring would move back and forth along the pulse's path.

Accept equivalent descriptions of motion across or along a wave's direction of travel. For the surface wave question, look for recognition that the buoy's vertical motion does not describe all of the water's motion.