Waves at Harbor Point

Read how wave behavior shapes a headland and bay.

MAQ.2.1 "Characterize wave features and wave properties, including wavelength, period, wave speed, breakers, and constructive waves and their effects on shoreline communities (e.g., headlands, embayments, shoreline erosion, and deposition)."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline each wave feature or property and circle the words that tell how it is measured or recognized. Number the places where wave behavior changes the shore or affects people.

A Changing Shore

1. At Harbor Point, a buoy sits beyond the breaking waves. One afternoon, neighboring wave crests are 40 meters apart. That distance is the wavelength. A crest passes the buoy every 8 seconds, so the period is 8 seconds. Wave speed is wavelength divided by period: 40 meters divided by 8 seconds equals 5 meters per second. These measurements describe the motion of the wave pattern, not a trip taken by one piece of water. As waves enter shallower water, their interaction with the bottom slows them and shortens their wavelength. Their crests may grow taller before they break.

2. Harbor Point is a rocky headland beside a curved, sandy embayment. Incoming waves slow first in the shallow water near the headland. Their crests bend, or refract, toward the point, concentrating wave energy there. Energy spreads out along the sheltered bay, where sand is more likely to settle. In calm weather, small, long-period waves often have a stronger swash up the beach than backwash down it. These constructive waves move sand landward and build the beach. In rough weather, steep waves can break forcefully; strong backwash may carry beach sand seaward.

3. A breaker forms when a wave becomes too steep in shallow water and its crest falls forward. Over a gently sloping bottom, a spilling breaker foams down its face; over a steeper bottom, a plunging breaker curls and crashes. Along Harbor Point, repeated impacts can wear away exposed rock, while shifting sand can widen or narrow the bay beach. A wider beach can absorb some wave energy before it reaches a nearby walking path. If storms strip away that sand, the path becomes more exposed. Residents measure beach width after storms rather than assuming one calm week will protect it.

2 ANSWER WITH EVIDENCE

Use the passage

1. How do the buoy measurements give a wave speed of 5 meters per second?

2. Why is wave energy concentrated at the headland but sand more likely to settle in the embayment?

3. How does the balance between swash and backwash help constructive waves build the beach?

4. How do spilling and plunging breakers differ, and why can a storm that removes bay sand put the walking path at greater risk?

3 YOUR TURN

Your own words

Imagine a new seaside town with a rocky headland, a sandy bay, and a road just behind the bay beach. In four or five sentences, predict what constructive waves and a storm's breakers could do to the shore and road, then propose one response based on your predictions.

ANSWER KEY

Waves at Harbor Point

HIGH SCHOOL · MAQ.2.1

PART 1 · READ AND MARK

Underline each wave feature or property and circle the words that tell how it is measured or recognized. Number the places where wave behavior changes the shore or affects people. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How do the buoy measurements give a wave speed of 5 meters per second?	**Divide the 40-meter wavelength by the 8-second period to get 5 meters per second.**
2	Why is wave energy concentrated at the headland but sand more likely to settle in the embayment?	**Waves slow and refract toward the headland, concentrating energy there. Energy spreads out in the sheltered bay, allowing sand to settle.**
3	How does the balance between swash and backwash help constructive waves build the beach?	**Their stronger swash moves sand up the beach, while weaker backwash carries less sand back down.**
4	How do spilling and plunging breakers differ, and why can a storm that removes bay sand put the walking path at greater risk?	**Spilling breakers foam down the wave face; plunging breakers curl and crash. With less beach sand to absorb wave energy, the path is more exposed.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

In calm weather, constructive waves could move sand up the bay beach and make it wider. The headland may receive more wave energy than the sheltered bay because waves bend toward it. During a storm, forceful breakers and strong backwash could remove sand from the beach. With less beach to absorb wave energy, the road could be more exposed. The town could monitor beach width and keep new structures farther back from the shore.

Accept equivalent explanations that connect wave behavior to erosion, deposition, or exposure. For Part 3, the proposed response should follow from the student's predictions.