Ocean Currents Connect

Trace how wind, rotation, and density move ocean water

MAQ.2.3 "Summarize principles related to currents (e.g., global wind patterns, Coriolis effect, Ekman spiral, surface, thermohaline, upwelling, downwelling, El Niño, La Niña, hurricanes, Barrier Island movement)."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline one cause-and-effect chain in each paragraph. Circle the names of the currents or processes in those chains so you can use them to explain how ocean water moves.

Why Ocean Water Moves

1. On a research ship in the eastern Pacific near the equator, scientists lower a thermometer into cool water. Most years, trade winds blow from east to west across the tropical Pacific, pushing warm surface water toward Indonesia. Earth's rotation bends moving water to the right north of the equator and to the left south of it, a pattern called the Coriolis effect. Because surface water on either side of the equator spreads away from it, cold, nutrient-rich water rises to replace it. This upwelling feeds plankton near the surface. Wind and Earth's rotation thus link distant weather patterns to marine life.

2. The pattern does not stay fixed. During El Niño, the trade winds weaken, so less warm water is pushed west. Warm surface water spreads eastward, and upwelling weakens in the eastern tropical Pacific. With fewer nutrients reaching sunlit water, plankton and the animals that eat them may decline in some areas. During La Niña, stronger trade winds push more warm water westward and generally strengthen cold upwelling in the east. These shifts also change where rain falls around the Pacific, because warm ocean surfaces add heat and moisture to the air above them.

3. When winds blow along a coast, surface water can move offshore or toward shore. Offshore movement lets deeper water rise; onshore movement piles water near the coast and promotes downwelling. This sideways transport comes from the Ekman spiral: friction passes wind energy through layers of water, while Earth's rotation turns each layer. In the Northern Hemisphere, the overall transport is to the right of the wind. A slower circulation begins where cooling and salt make seawater dense enough to sink. Called thermohaline circulation, it carries deep water between ocean basins rather than moving surface water mainly by wind.

2 ANSWER WITH EVIDENCE

Use the passage

1. Summarize how trade winds and the Coriolis effect work together to produce upwelling near the equator.

2. Compare how El Niño and La Niña change trade winds and upwelling in the eastern tropical Pacific.

3. Explain how the Ekman spiral can lead to either upwelling or downwelling along a coast.

4. How do the main causes and locations of wind-driven surface movement differ from those of thermohaline circulation?

3 YOUR TURN

Your own words

Imagine a straight Northern Hemisphere coast with ocean to the west and land to the east. The wind changes from blowing northward to blowing southward along the coast. In three or four sentences, predict how this change affects surface transport, vertical water movement, and nutrients near the surface.

Ocean Currents Connect

PART 1 · READ AND MARK

Underline one cause-and-effect chain in each paragraph. Circle the names of the currents or processes in those chains so you can use them to explain how ocean water moves. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Summarize how trade winds and the Coriolis effect work together to produce upwelling near the equator.	**Trade winds push warm surface water west. The Coriolis effect moves surface water away from the equator on both sides, allowing cold, nutrient-rich water to rise.**
2	Compare how El Niño and La Niña change trade winds and upwelling in the eastern tropical Pacific.	**During El Niño, weaker trade winds reduce upwelling. During La Niña, stronger trade winds generally increase upwelling.**
3	Explain how the Ekman spiral can lead to either upwelling or downwelling along a coast.	**Wind transfers energy through layers of water, and Earth's rotation turns each layer. The resulting transport can move surface water offshore, allowing upwelling, or toward shore, promoting downwelling.**
4	How do the main causes and locations of wind-driven surface movement differ from those of thermohaline circulation?	**Wind and Earth's rotation move surface water. Thermohaline circulation begins when cooling and salt make water dense enough to sink, then carries deep water between ocean basins.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

When the wind blows northward, surface water moves to its right, toward shore, which promotes downwelling. After the wind shifts southward, surface water moves to its right, away from shore. Deeper water then rises to replace it. This upwelling brings more nutrients near the surface.

Accept equivalent cause-and-effect summaries. For the open task, the key directional check is that right of a southward wind is west, away from this coast.