Shoreline Heat Test

Investigate how land and water temperatures shape winds.

ESS.7.b "Plan and carry out an investigation to determine the differential heating of land and water and explain how these differences create changes in local and global weather."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline two conditions the students keep the same, circle the sand and water temperatures before heating and after 20 minutes of heating, and number the two events that create the daytime lake breeze.

Why Does the Breeze Turn?

1. At a lakeside school, students ask why a breeze often moves inland on sunny afternoons. They place equal masses of dry sand and water in identical trays, both starting at 20 °C. A lamp is the same distance from each tray, and thermometers sit at the same depth. Students record temperatures before heating and after 10 and 20 minutes.

2. After 20 minutes, students switch off the lamp and take another reading 10 minutes later. Water generally warms more slowly because more energy is needed to raise its temperature, and heat can mix downward or drive evaporation. Their trays model surface heating at a shore, but not the lake's depth or moving air.

TRAY TEMPERATURES

Reading time	Sand (°C)	Water (°C)
Before lamp on	20	20
After 10 min on	28	22
After 20 min on	35	24
10 min after off	28	23

3. On a sunny afternoon, warmer land heats nearby air, which rises. Cooler air over the lake moves inland to replace it, forming a lake breeze. At night, land often cools faster than water, so surface wind can reverse. On a larger scale, summer heating of continents relative to oceans can help draw moist air inland and contribute to monsoon rains.

2 ANSWER WITH EVIDENCE

Use the passage

1. Name two conditions kept the same in the tray test. Why does keeping them the same help answer the students' question?

2. How much did each material warm during the 20 minutes with the lamp on? What do these changes show?

3. How much did each material cool in the 10 minutes after the lamp was switched off? How does this result help explain a possible nighttime wind change?

4. Use the passage to explain how different heating of land and water can affect both a daytime lake breeze and summer monsoon rain.

3 YOUR TURN

Your own words

Plan a new test to find out whether wet shoreline sand heats differently from dry sand and water. In 4 to 6 sentences, name what you will change, at least two conditions you will keep the same, when you will measure temperatures, your predicted result, and how that result could affect a daytime lake breeze.

ANSWER KEY

Shoreline Heat Test

HIGH SCHOOL · ESS.7.b

PART 1 · READ AND MARK

Underline two conditions the students keep the same, circle the sand and water temperatures before heating and after 20 minutes of heating, and number the two events that create the daytime lake breeze. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Name two conditions kept the same in the tray test. Why does keeping them the same help answer the students' question?	**For example, both trays contain equal masses and start at 20 °C. Keeping these conditions the same helps isolate the effect of sand versus water on temperature change.**
2	How much did each material warm during the 20 minutes with the lamp on? What do these changes show?	**Sand warmed 15 °C, while water warmed 4 °C. Sand warmed more under the same lamp.**
3	How much did each material cool in the 10 minutes after the lamp was switched off? How does this result help explain a possible nighttime wind change?	**Sand cooled 7 °C, while water cooled 1 °C. Faster cooling on land helps explain why land may become cooler than water at night, allowing surface wind to reverse.**
4	Use the passage to explain how different heating of land and water can affect both a daytime lake breeze and summer monsoon rain.	**Warmer land causes air to rise, drawing cooler lake air inland as a lake breeze. On a larger scale, summer heating of continents can help draw moist ocean air inland and contribute to monsoon rain.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

I will compare dry sand, wet sand, and water in identical trays under a lamp. I will keep the mass of material, starting temperature, and lamp distance the same. I will measure each temperature every five minutes for 20 minutes, with thermometers at the same depth. I predict wet sand will warm less than dry sand. If wet shoreline sand stays cooler, the temperature difference between land and lake may be smaller, which could weaken the daytime lake breeze.

Accept other valid controls and measurement schedules. A prediction may differ from the sample if its proposed effect on the lake breeze follows logically from the predicted temperature difference.