

# 13. Water's Role in Climate

## *Ocean Effect*

### Driving Question

---

Do the oceans protect us from sudden changes in temperature?

### Materials and Equipment

---

***For each student or group:***

- |   |  |
|---|--|
| <input type="checkbox"/> Data collection system                         | <input type="checkbox"/> Teaspoon                                  |
| <input type="checkbox"/> Temperature sensors (2)                        | <input type="checkbox"/> Dry sand or white rocks, 1000 mL (4 cups) |
| <input type="checkbox"/> Small container for water, 50-mL               | <input type="checkbox"/> Table salt, 5 g (2 teaspoons)             |
| <input type="checkbox"/> Plastic food storage containers with lids (2), | <input type="checkbox"/> Water, 100 mL                             |
| <input type="checkbox"/> 750 to 1000 mL                                 | <input type="checkbox"/> 100-W lamp (optional)                     |

### Safety

---

Add this important safety precaution to your normal laboratory procedures:

- Do not look directly at the sun or 100-W lamp. Permanent damage to your eyes may result.

### Thinking about the Question

---

Water changes temperature very slowly. This resistance to sudden changes in temperature makes water an excellent place for organisms to live. Changes in water temperature occur very gradually and seasonal changes are small compared to those on land.

Discuss with your lab group members how oceans moderate the earth's climate.

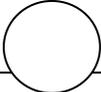
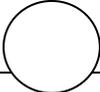
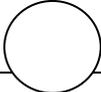
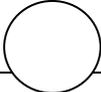
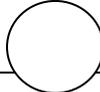
---

---

---

## Sequencing Challenge

The steps below are part of the Procedure for this lab activity. They are not in the right order. Determine the proper order and write numbers in the circles that put the steps in the correct sequence.

				
Fill each container half full with sand, so that each temperature probe is covered with sand.	Insert the temperature sensors into the plastic food containers.	Add a salt water solution to one of the containers of sand.	Cover each container with its clear lid and place in the sun to warm.	Make sure each lab group member is aware of safety rules and procedures for this lab.

## Investigating the Question

**Note:** When you see the symbol "◆" with a superscripted number following a step, refer to the numbered Tech Tips listed in the Tech Tips appendix that corresponds to your PASCO data collection system. There you will find detailed technical instructions for performing that step. Your teacher will provide you with a copy of the instructions for these operations.

### Part 1 – Making predictions

1.  Think about a sandy shoreline next to an ocean. How does the presence of the water affect the temperature of the shoreline?

---

---

2.  Predict what the difference in temperature would be without the ocean present. Explain your reasoning. Be prepared to share your prediction with the class.

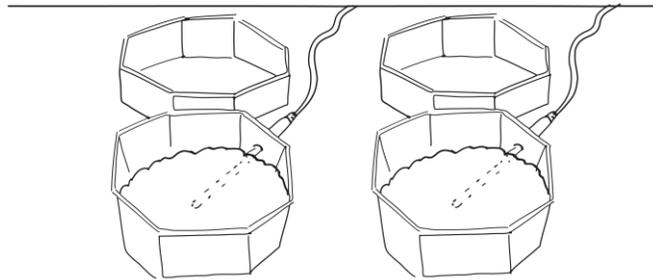
---

---

### Part 2 – Modeling land and coastline

3.  Obtain two plastic food storage containers with clear lids from your teacher. The containers should have a hole punched through their sides that will allow a temperature sensor to slip through the side of the container.

4.  Obtain a small container. Place 1 teaspoon of table salt and 50 ml of tap water into the glass cup. Stir the water in the glass cup until all of the salt is dissolved.
5.  Start a new experiment on the data collection system. ♦<sup>(1.2)</sup>
6.  Connect one temperature sensor to the data collection system. ♦<sup>(2.1)</sup>
7.  Monitor live data to measure the temperature of the air in the location where you will be conducting your experiment. ♦<sup>(6.1)</sup> Record the temperature in the space below:  
Air temperature = \_\_\_\_\_ degrees Celsius
8.  Connect a second temperature sensor to the data collection system. ♦<sup>(2.2)</sup>
9.  Change the sample rate to take one measurement per minute. ♦<sup>(5.1)</sup>
10.  Display Time, Temperature 1 (sand only), and Temperature 2 (sand and salt water) in a table. ♦<sup>(7.2.1)</sup>
11.  Place one temperature sensor through the side of each container so that the metal of the sensor is placed entirely inside the container. Fill each container approximately half full with sand so that each temperature sensor is completely covered with sand.

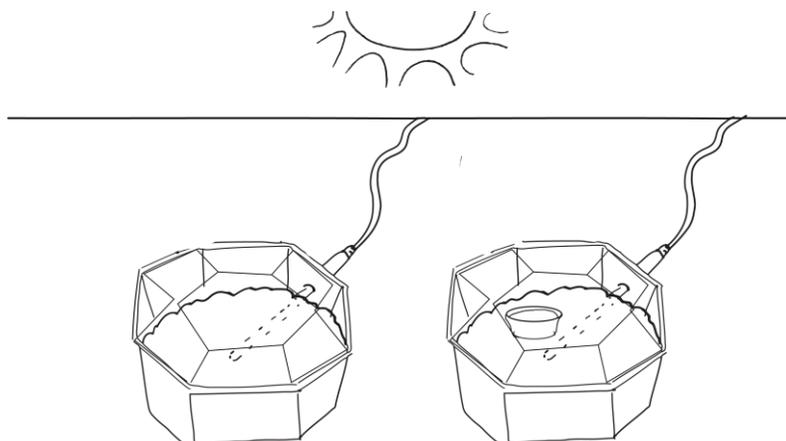


12.  Place the small cup of salt water in one of the containers, pressing it down into the sand if necessary so it will fit when the lid of the container is closed.
13.  Attach the lids to each container.

### 13. Water's Role in Climate

#### Part 3 – Measuring temperature changes

14.  Place both containers side by side outside in warm overhead sunshine. If sunlight is not available, use a 100 W lamp approximately 1/2 meter above the containers.



15.  Start data recording on both temperature sensors. <sup>(6.2)</sup> Continue collection for 10 minutes for both containers. You will enter your temperature data in a table below; you may write this data as it is being recorded, or you may wait until the end of data collection.
16.  After 10 minutes, stop data recording. <sup>(6.2)</sup>
17.  Complete Table 1 below, if you have not done so already.

Table 1: Temperatures 1 and 2

Time (minutes)	Temperature 1 (°C) (Sand only)	Temperature 2 (°C) (Sand and salt water)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

---

## Answering the Question

---

### Analysis

1. How did the temperatures of the sand in each container compare with the temperature outside the containers?

---

2. How does the temperature of the sand in the sand-only container compare to the temperature of the sand inside the other container that has water and sand? Did the container with only sand heat up faster?

---

3. How did the presence of salt water in one container affect the temperature? Be prepared to share your answer with the class.

---

4. Did the water in the container prevent major temperature fluctuations in the sand? Explain your thinking.

---

---

### True or False

Enter a "T" if the statement is true or an "F" if it is false.

\_\_\_\_\_ 1. Water, which covers the majority of the earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the "water cycle."

\_\_\_\_\_ 2. Approximately 70% of the earth's surface is covered with water.

\_\_\_\_\_ 3. Water has the property of being able to resist sudden changes in its temperature.

\_\_\_\_\_ 4. Oceans have no effect on temperature.

\_\_\_\_\_ 5. Breezes blow near the shore of oceans because of differences in temperature over the land and over the water.

\_\_\_\_\_ 6. During the night, the beaches cool more slowly than the ocean waters.

\_\_\_\_\_ 7. Seasonal changes in the ocean are smaller than seasonal changes on land.

### 13. Water's Role in Climate

---

#### Key Term Challenge

Fill in the blanks from the randomly ordered words below. You may change the form of a word, for example by making a singular word plural. You may not use every word, and you may use a word more than once:

gains	energy	sun	shore
loses	sand	temperatures	water
oceans	70%	glacier	polar ice caps

1. Water \_\_\_\_\_ energy by absorbing it from the \_\_\_\_\_ during the day.
2. Sand \_\_\_\_\_ energy more quickly than water does.
3. Earth's \_\_\_\_\_ help our planet maintain stable \_\_\_\_\_ that remain within limits.
4. Almost all of the \_\_\_\_\_ on Earth comes from the \_\_\_\_\_.
5. Much of our fresh \_\_\_\_\_ is stored in the solid form in the \_\_\_\_\_.