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# Heating and Cooling of Land and Water Measured with TI Calculator

Erin Gwara  
*The College at Brockport*

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# Generic Lesson Plan Template

You should submit this form in addition to any computer generated files/documents/models to your group folder on Angel. Please create a .zip file and upload the group of files as a single archive.

Name: Erin Gwara
Grade level(s)/Subject taught: Earth Science
Objectives: Students will use temperature probes to investigate the heating and cooling of land and water and relate it to specific heat.

Please provide a rich **one-page, single-spaced**, description or a *vision* of your best thinking on a way or ways you might teach the planned lesson. (approximately ½ page for the teacher role, ½ page for the student role). Also, construct a tentative rubric that you might use with your students (see example)

Items to include in your lesson plan: (Choose your discipline/concepts from your own area).

1b. *Write the Science Concept* or “key idea” that modeling will be used to teach: (e.g. Organisms maintain a dynamic equilibrium that sustains life).

Key Idea—Many of the phenomena that we observe on Earth involve interactions among components of air, water, and land.
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Materials:

TI 84  
Temperature Probes  
Dish of Sand  
Dish of Water  
Stand  
Lamp with 100 Watt Bulb  
Student Worksheet

“...a rich **one-page, single-spaced**, description or a *vision* of your best thinking...”

Prompts:

1. How will you assess the prior knowledge of the student?
2. How will you begin the lesson?
3. What are the teacher and students doing every 5-10 minutes? (Teacher Actions and Student Actions)
4. How will you assess the learning for the lesson?

**Using the TI 84 and the temperature probes, I plan on having my students research heating and cooling of land and water.**

Students will already have prior knowledge of the TI 84 calculator. The students will be in groups of 4, where two students are responsible for gathering data from the container of sand, and two students are responsible for gathering data from the container of water. Students will share their information with one another to get a complete set of data. Student handouts will already be placed on their desks as they walk in.

A bellwork question will be posted on the overhead—“Using your Earth Science Reference Tables, find the specific heat of water and the specific heat of granite (the Earth’s crust). Write these down. Looking at the units behind the numbers, make a prediction—which substance will heat faster and cool down faster?” Students will write their answers on their bellwork sheet and hand it in within 5 minutes. After the sheets have been collected, I will give them a brief introduction to specific heat, explaining what specific heat is by looking at the units. I will ask students to report out their predictions they made with the bellwork, and have them explain why they made those predictions. Not a lot of direct instruction will be given, as I want the students to explore the experiment and come up with their own conclusions.

Students will have all the necessary equipment at their lab areas. At each group there will be: a TI 84, two temperature probes, a bowl of water, a bowl of sand (the same amount as the water), a stand, and a 100 Watt light attached to the stand. The light will be positioned over the water and the sand. The students will hook up their calculators to the temperature sensors/probes. The temperature of the water and the sand must be read for a total of 20 minutes—10 minutes of heating (with the light on) and 10 minutes of cooling (with the light off). Students will set their sampling times to an interval of 1 minute (which would be entered as 60 seconds) and a sample number of 20.

Students will follow their sheet, which describes how to perform the experiment. I will circulate and check for understanding, making sure the sample number and interval time is correct, and that the temperature probes and calculators are working correctly.

Once the students have collected their data, they will graph it on the calculator. Time will be on the x axis and temperature will be on the y axis. Students will share their graph with each group member, as they will need to analyze the graph.

All information will be written in the student’s journal. Formal assessment of student knowledge will be done by collecting and reading the students’ responses in the journals. Additionally, informal assessment will be done as I circulate around the room and ask questions of the students.

Students will return their lab station to the way they found it at the beginning of class.

	3	2	1
Calculations	All four rate of change calculations done accurately with correct units.	Three out of four rate of change calculations done accurately, may be missing units.	Two or less rate of change calculations done accurately, missing units.
Completeness	Complete lab report—has procedures, observations, data, graph.	Missing one section from lab report.	Missing two or more sections from lab report.
Summary Questions	Complete and correctly answered summary questions.	Partially complete summary questions, missing one to three answers.	Incomplete summary questions, missing four or more answers.

## Heating and Cooling of Land and Water—Journal Entry #21

- Purpose:** Compare the heating and cooling rates of land and water
- Materials:** Two plastic hemispheres, soil, water, temperature probes, TI 84 Calculator
- Plan:** Read and record temperatures of soil and water as they are heated by a light source for a total of 20 minutes (10 with the light on, 10 with the light off) using a TI 84 calculator and the program.
- Graph your findings.
- Calculate the heating and cooling rates for each material.
- Complete the summary work.
- To Do:**
- Before you begin your observations, set up your journal.
  - Record the date and the title of the activity.
  - Write the purpose and the procedures (just a summary of what will be done)
  - Set up the observation section (diagram the equipment, make a data table in which you will record the temps for each of the 20 minutes, as is shown on the calculator, set up an area to paste your graph from the calculator, record the rate of change formula and leave space to calculate the heating and cooling rates of change for both land and water), and set up a place to compare and contrast the rates.
  - Leave a place for the conclusion.
  - Once your journal has been set up, begin the investigation.

### Summary:

- Make a list of the “controls” for this investigation.
- Make a list of the “variables” for this investigation.
- Look up and record the specific heat of water.
- Look up and record the specific heat of granite (continental crust).
- Use the specific heat information to explain the difference in temperature change in the two materials.
- The atmosphere is heated by the Earth’s surface. Which would heat faster: the air over the water? Or the air over the land? Defend your response.
- Explain why shoreline temperatures are warmer in the winter and cooler in the summer.
- A summer weather forecast for Rochester, NY says the temp would be 88°F downtown and only 76°F at Sea Breeze. Make a prediction of the temperatures in a winter forecast for each location. Defend your response.