NAME: DATE: class:

Lab Activity: Heating and Cooling from the Earth Ocean vs. Soil

Background:

When you walk barefooted on the beach in the summer, you may have observed that the dry sand feels hot while the moist sand near the water feels much cooler. You may also have noticed that in the evening it is warmer near the shore than it is farther inland. In this lab activity, you will compare the heating and cooling rates of actual earth materials.

Problem:

How do soil and water compare in their ability to absorb radiant energy?

***Objectives*: you should be able to:**

1. Compare the rates of temperature change of land and water surfaces when heated and cooled.
2. Describe the effects that land and water masses have on the temperature of the air above them.

Materials:

1 SPLIT earth globe
2 thermometers.
Heat source,
Clock or timer
2 cups of dry soil in one of the earth globe
Water in one of the earth globe
Ring stand
Ring clamp
Thermometer holder

PREDICTION:

Which will heat faster? SOIL WATER NEITHER

Which will cool faster? SOIL WATER NEITHER

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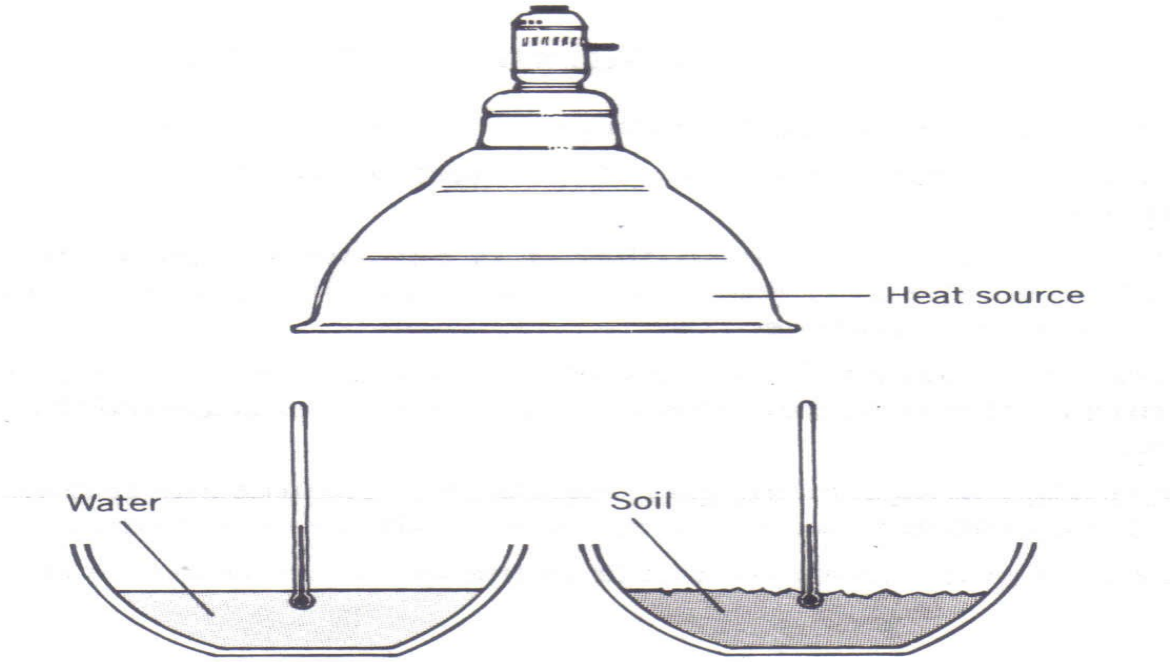
PROCEDURE

STEP 1: As shown in the illustrations (previous page), set up the lab activity by placing approximately equal volumes of dark soil and water in separate containers.

STEP 2: Place a thermometer in each container so that the thermometer bulbs are just beneath the surface of the material. (See diagram below)

STEP 3: Arrange a source of heat so that it is equal distant from the two containers, as shown in the illustration on the previous page, but **do not turn it on** until told to.



STEP 4: In the Data Table on the Report Sheet, record the temperature in each container.

STEP 5: TURN on the HEAT lamp and heat BOTH containers for 15minutes, recording the temperature in each container every minute in the Data Table on the Report Sheet.

STEP 6: Once TEN minutes are up, turn off the lamp, remove it immediately

STEP 7: In the Data Table on the Report Sheet, CONTINUE to record the temperatures of each container every minute for another 15 minutes.

STEP 8: CLEAN up the lab setting.

STEP 9: Graph the data for both containers on the grid provided on the Report Sheet. Plot a separate line graph for each container. Identify the data by correctly labeling each curve. Make sure to include the following on the graph:

i. Title
ii. Author of graph
iii. Date
iv. Key

STEP 10: Answer each of the Summing Up questions at the end of this investigation. Turn in the Summing Up page only.

NAME: DATE: class:

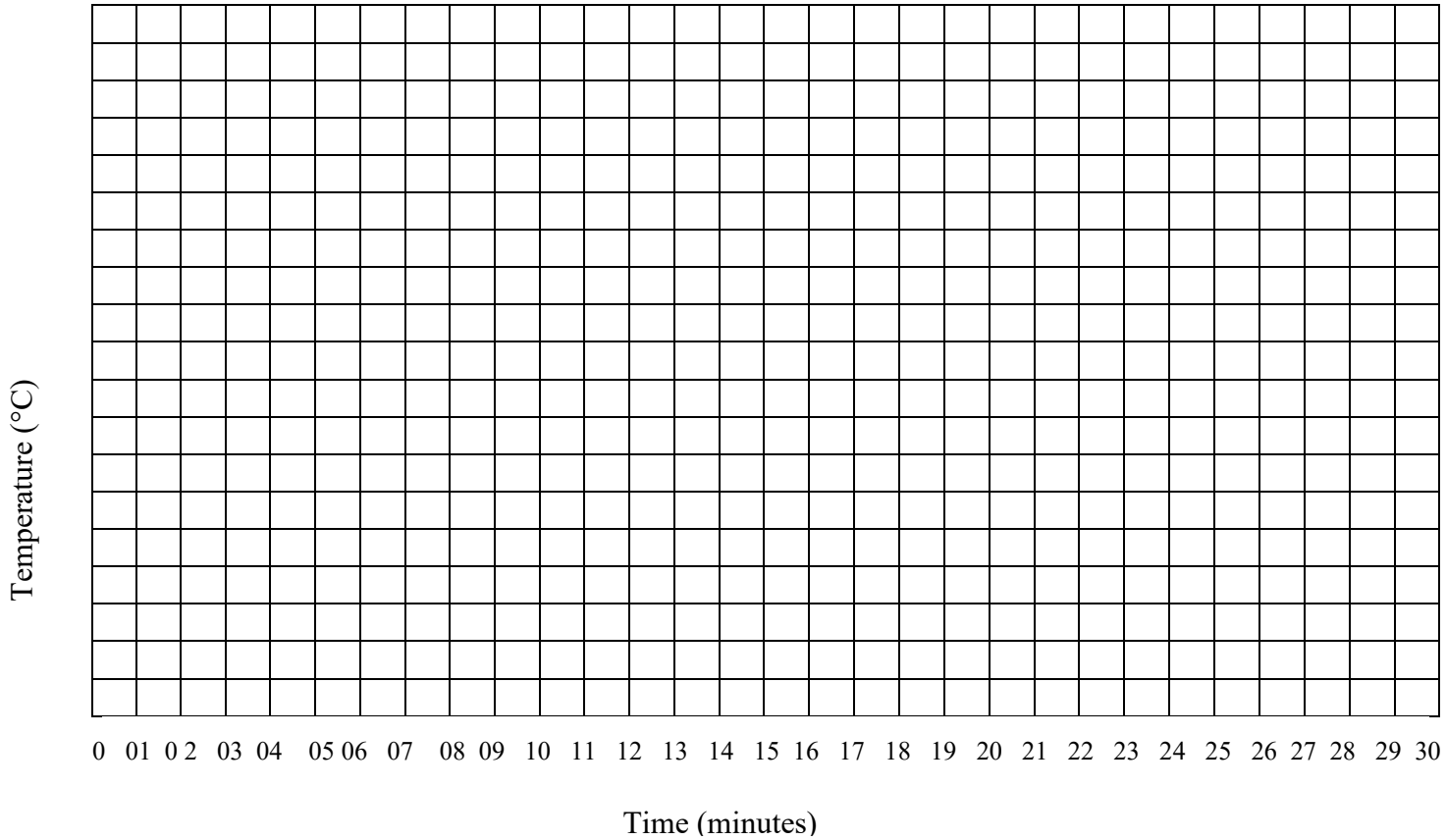
Lab Activity: Ocean vs. Soil

REPORT SHEET

DATA TABLES

TIME (min)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Temperature (°C) SOIL																	
Temperature (°C) WATER																	

TIME (min)	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30				
Temperature (°C) SOIL																			
Temperature (°C) WATER																			



NAME: DATE: class:

Summing up SOIL vs OCEAN Conclusion

1. **Why was it important to remove the lamp after it was turned off?**
   a. **Heat lamp will continue to radiate heat**
   b. **Heat lamp will NOT radiate heat but draw the heat to it**
   c. **Heat lamp will cause a problem with reading the temperature**

SELECT the best representation for each object

2. **Heat Lamp**
3. **Bowl of water**
4. **Bowl of soil**

a. **The Sun**
b. **The ocean**
c. **The land**
d. **The sky**

5. **Which material SOIL or WATER received more energy from the lamp?**
   a. **SOIL** b. **WATER** c. **NEITHER**
6. **Which material heated more rapidly?**
   a. **SOIL** b. **WATER** c. **NEITHER**
7. **Which material cooled more rapidly?**
   a. **SOIL** b. **WATER** c. **NEITHER**

8. ***The specific heat of a substance is the quantitative measure of its heat capacity. It is defined as the ratio of the heat capacity of a substance to the heat capacity of water. Materials having high specific heat show relatively little temperature change when heated*. Which material, water or soil, appears to have a higher specific heat?**
   a. **SOIL** b. **WATER**

9. **How would the differences in the heating and cooling rates of land and water surfaces affect atmospheric conditions above them?**
   a. **The air mass above the land or water DOESN'T takes on the characteristic of that area**
   b. **The air mass above the land or water DOES takes on the characteristic of that area**
   c. **The air mass above the land or water has no effect on it**

10. **How would temperature variations in soil and water surfaces affect air pressures in the atmosphere above them?**
    a. **The temperature above the land/water DOESN'T takes on the air pressure**
    b. **The temperature above the land/water DOES takes on the air pressure**
    c. **The air pressure above the land/water has no effect**

11. **How would pressure variations affect the way the wind blows from a land breeze?**
    a. **Pressure would change from high to low or from land to sea**
    b. **Pressure would change from low to high or from sea to land**
    c. **Pressure would NOT change**

12. **How would pressure variations affect the way the wind blows from a sea breeze?**
    a. **Pressure would change from high to low or from land to sea**
    b. **Pressure would change from low to high or from sea to land**
    c. **Pressure would NOT change**

13. **On land, how would temperature vary from day to night?**
    a. **Temperature would increase** b. **Temperature would decrease** c. **Temperature would remain the same**

14. **On land, how would temperature vary from night to day?**
    a. **Temperature would increase** b. **Temperature would decrease** c. **Temperature would remain the same**

15. **Was the Graph done correctly? The Student:**
    a. **Plotted the lines but did not include:** Title, Author of graph, Date, Key
    b. **Plotted the lines but did not include:** Author of graph
    c. **Plotted the lines but did not include:** Key
    d. **Plotted the lines but did not include:** Date
    e. **Plotted the lines & include:** Title, Author of graph, Date, Key