NAME: Due DATE: class:

Lab Activity: Heat Radiation from the Earth's Soil Clouds vs. No Clouds

Background:

You may have noticed that, after sunset, the ground temperature does not drop as quickly on cloudy nights as it does on clear nights. In fact, during the winter, the coldest nights seem to occur when the sky is quite clear. In this investigation, you will use a model to study this pattern of temperature change.

Problem:

How do variations in the atmosphere affect the cooling rate of warmed earth material?

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

1. Describe the effect of an atmosphere-like covering on the rate at which earth material cools.
2. Identify factors in the atmosphere that may account for differences in the cooling rate of soil.
3. Construct and interpret a graph of data collected from a model situation.

Materials:

1 SPLIT earth globe
2 thermometers.
1 transparent plastic cover,
heat source,
clock or timer
2 cups of dry soil in equal amounts of earth globe
Ring stand
Ring clamp
2 Support blocks

PREDICT:

Which one will heat up first? ***Covered*** ***Uncovered***

Which one will cool faster? ***Covered*** ***Uncovered***

What does the dome represent?

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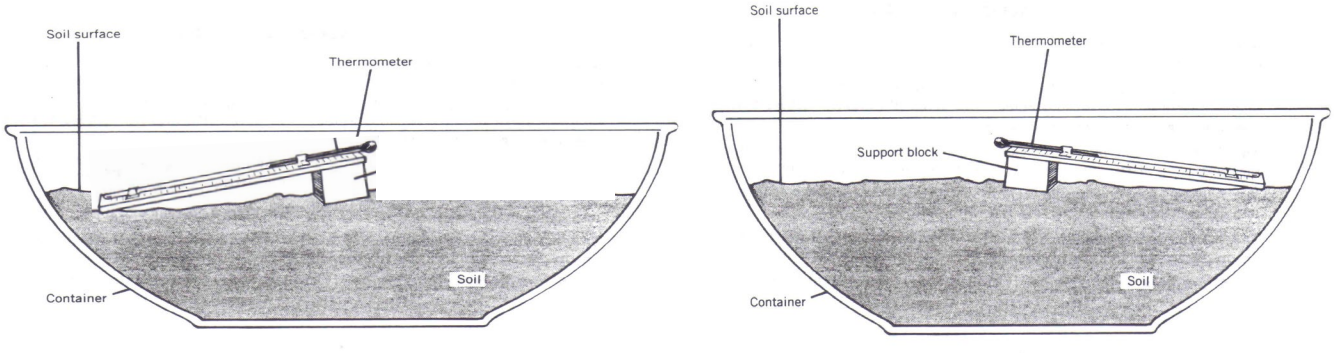
PROCEDURE

STEP 1: Start the lab by preparing two containers of soil

STEP 2: Place the thermometers in them so that the thermometer bulbs are positioned just above the soil surface (See diagram) and FACING each other.



STEP 3: Place the transparent plastic cover **THAT HAS A PIECE OF TAPE ON THE TOP OF IT**, on one container, leaving the other uncovered

STEP 4: Place a heat lamp over the soil containers **CLOSE** to the **DOME but NOT** touching the dome. MAKE sure that the light shines ***EVENLY on to BOTH containers***

STEP 5: In the Data Table on the Report Sheet, record the initial temperature in each container **IN Celsius**

STEP 6: TURN on the HEAT lamp and heat BOTH containers for 15 minutes, **recording** the **temperature** in each container **every minute** in the Data Table on the Report Sheet.

STEP 7: Once 15 minutes are up, turn off the lamp**, remove it immediately** (locate it to the other end of the table)

STEP 8: In the Data Table on the Report Sheet, ***CONTINUE to record the temperatures of each container every minute for another 15 minutes.***

STEP 9: CLEAN up the lab setting when the time limit is up.

STEP 10: 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 11: Answer each of the Summing Up questions at the end of this investigation.

STEP 12: Turn in the lab sheet that has your data and graph on it. Make sure your name is on the lab sheet.

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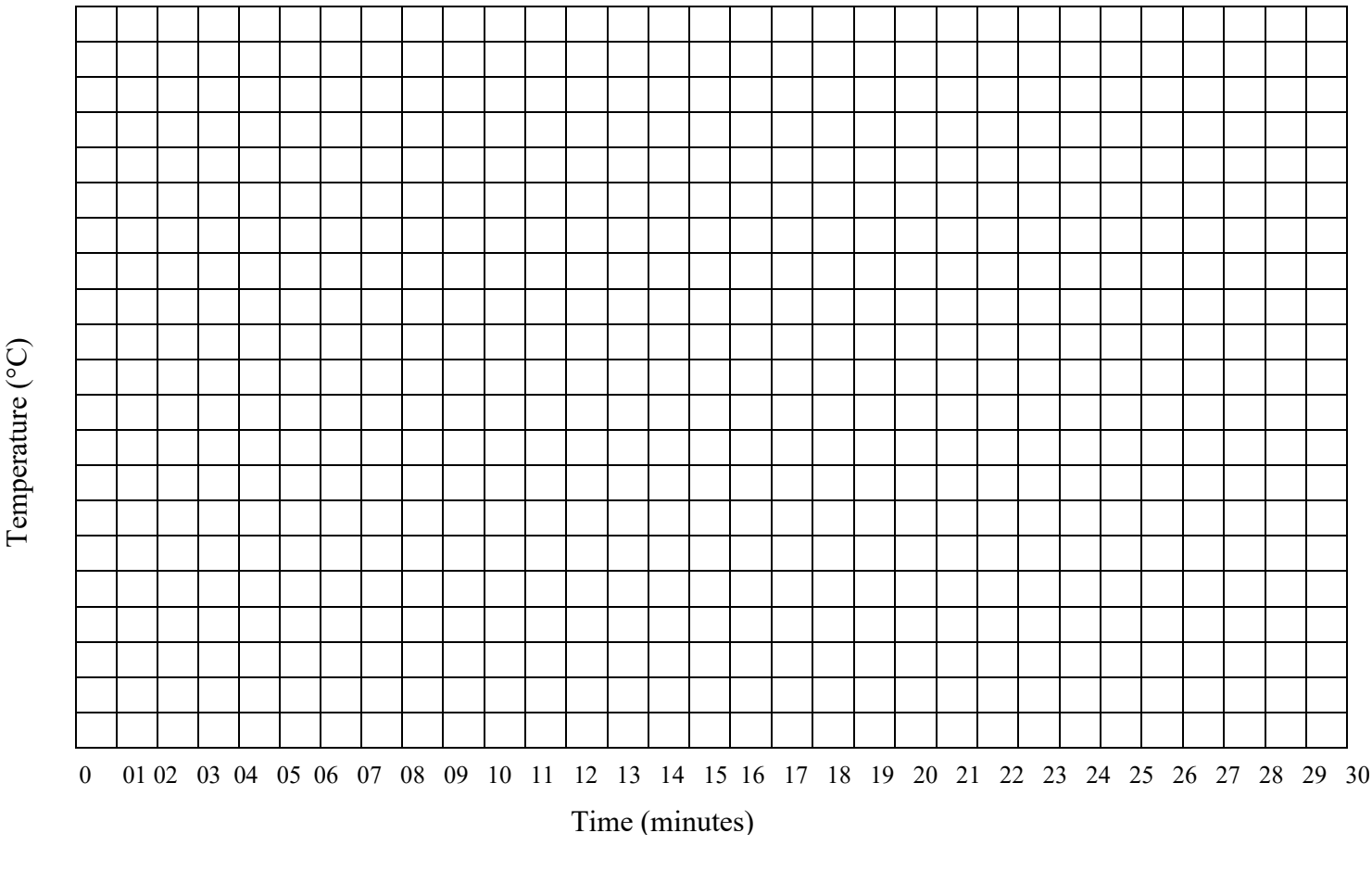
Lab Activity: Clouds vs. No Clouds
REPORT SHEET

DATA TABLES

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

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



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Summing up Cloud vs NO cloud Conclusion

SELECT the best representation for each object

1. **Heat Lamp**
2. **Bowl of soil**
3. **Dome Bowl**

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

4. **Which material received more energy from the lamp?**
   a. Domed SOIL **b. No cover SOIL** **c. NEITHER**

5. **Which material heated more rapidly?**
   a. Domed SOIL **b. No cover SOIL** **c. NEITHER**

6. **Which material cooled more rapidly?**
   a. Domed SOIL **b. No cover SOIL** **c. NEITHER**

7. **Which container showed the greatest temperature change during the 20-minute cooling period?**
   a. Covered **b. Uncovered**

8. **SELECT the best answer for which rate of temperature change that occurred above the soil in each of the two containers.**
   a. Both started about the same temperature but neither cooled quickly
   b. Both started about the same temperature but the covered cooled more quickly
   c. Both started about the same temperature but the uncovered cooled more quickly

9. **What object on the earth produces the same effect as the plastic cover produced on the soil?**
   a. The atmosphere **c. The oceans**
   b. The clouds **d. The Sun**

10. **What might have happened if you had used nontransparent cover?**
    a. Light enters, and inside temperate would rise
    b. No light enters, but the inside temperate would rise
    c. No light enters, and the inside temperate would fall

11. **How does the model help to explain why very cold nights often occur when the sky is completely clear?**
    a. Clouds act "like" a blanket releasing the heat and keeping cooler air out
    b. Clear skies allow heat to escape and cooler air rushes in
    c. Clear skies allow heat to escape but the ozone layer traps warm air in

12. **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 with no cover **b. SOIL covered**

13. **On the non-dome soil, how would the temperature vary when the lamp is turned off?**
    a. Temperature would increase **b. Temperature would decrease** **c. Temperature would remain the same**

14. **On the dome covered soil, how would the temperature vary when the lamp is turned off?**
    a. Temperature would increase slowly **b. Temperature would remain the same** **c. Temperature would decrease slowly**

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