Inquiry 3.1:
    Heating and Cooling Rates

Name _____

Date _____

Period _____

Background: Each statement below is FALSE. Rewrite each sentence to make it TRUE.
(1) 1. FALSE: Light-colored things absorb more heat than dark-colored things.

TRUE: _____

_____

(1) 2. FALSE: Heat from the Sun is <u>only</u> absorbed or reflected by the atmosphere, <u>not</u> by land or water.

TRUE: _____

_____

(1) 3. FALSE: Molecules in a liquid are closer together than molecules in a solid.

TRUE: _____

_____

Materials: Clamp lamp with 100 watt bulb, 2 thermometers, 2 beakers, 100 mL room temperature soil, 100 mL room temperature water, stopwatch, ruler, 2 cardboard strips, 2 bookends.

Set-Up: We will be observing both set-ups at the same time. Look at pg. 28 in the book to see how to set up the materials.

*** Testable Questions ***
What heats up faster during the day, soil or water?
What cools down faster during the night, soil or water?

Every testable question in science needs to include two things:

1. <u>Manipulated (independent) variable</u>: what is being changed by a person during the experiment.

2. <u>Response (dependent variable</u>: what is supposed to be observed, recorded, or measured in the experiment.

→ **Talk with your group about what you might do with this set up to answer the testable question. Then answer questions # 4 -10.**

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Procedure:

(4) 4. Put the steps in order.

_____ Turn off the lamp and record the temperature with the lamp off. Continue doing this every minute until the timer reaches sixteen minutes.

_____ Place the thermometer in the cardboard sleeves and then put one in each of the different beakers; do not let them touch the sides of the beakers.

_____ Place the two beakers exactly 30 cm from the 100 watt lamp at an angle so that lamp shines at the end of the thermometer in the beaker.

_____ Turn on the 100 watt lamp, start the timer and record the first temperature of the water and soil immediately.

_____ Put 100 mL of room temperature soil in a beaker and 100 mL of room temperature water in another beaker.

_____ Put away any materials you need to put away. Make sure to turn off the thermometers.

_____ Record the temperature of the two different substances in Celsius every minute for eight minutes.

Variables: *Hint: the answer to #5 and 6 are in part of the testable question!*

(1) 5. What is the manipulated variable? (What will we be changing between the two set-ups)?

_____

(1) 6. What is the response variable? (What will we be measuring and recording during the experiment)?

_____

(3) 7. List at least three things that need to stay the same during the inquiry in order to be a fair test.

- _____

- _____

- _____

Prediction/Hypothesis: *(Hint: answer the testable question as best you can.)*

(1) 8. _____

_____

Safety:

(2) 9. List at least two safety concerns for you and/or the equipment.

- _____

- _____

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(5) **10. Data Collection**
Title: _____

HEATING			COOLING		
Time (min)	Soil Temp. (Celsius)	Water Temp. (Celsius)	Time (min)	Soil Temp. (Celsius)	Water Temp. (Celsius)
START – 0:00			8:00		
1:00			9:00		
2:00			10:00		
3:00			11:00		
4:00			12:00		
5:00			13:00		
6:00			14:00		
7:00			15:00		
8:00			END - 16:00		
Total Temp. Change			Total Temp. Change		

(5) **11. Data Presentation**
Title: _____

_____

KEY:

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Analyzing and Interpreting Results

(2) 12. **Answer the testable questions:** Now that you've done the lab, what does your data tell you about the answer to the testable questions? Do **not** include any actual data here).

_____

_____

_____

(4) 13. **Evidence-based conclusion**: Include some of your specific results to support your conclusions. (Use *actual data* from the table or graph to show your answer to number 12 is correct.)

_____

_____

_____

_____

_____

_____

_____

(2) 14. **Scientific Explanation**: Use science concepts you've learned about in class to explain your results. (Include info. from the background section at the beginning of the inquiry! *WHY* did you get the results you did?)

_____

_____

_____

_____

(3) 15. **Problems & Improvements:** Think about your investigation. Describe any problems you had, how they might have affected your results, and suggest possible improvements.

Problem: _____

How affected results: _____

_____

Improvement: _____