Inquiry 3.1

Investigating Rates of Heating and Cooling
• 1. Review with your teacher how to use a stopwatch and digital thermometer.
• 2. With your class, review the Safety Tips for this inquiry.
• 3. As a class, go over Procedure Steps 4 through 11. Observe as your teacher demonstrates the steps needed to complete the investigation.
4. Think about this investigation as if it were a race or a test between equal volumes of soil and water. In your SNB, record all the things you think you will need to keep the same for the beakers (controlled variables - make sure to highlight).
• 5. Set up the materials as shown in Figure 3.1. Insert each thermometer approximately 2.5 centimeters (cm) into the soil or water in each beaker. Do not allow the tip of the thermometer to touch the bottom of the beaker. Use the small hole in the cardboard to hold each thermometer upright. Turn on the thermometers
• 6. Allow the thermometers to sit in each beaker until the temperature readings no longer show any sign of changing.
7. While you are waiting for the temperature readings to stop changing, make a hypothesis. What do you think will happen to the temperature of the soil and the water when you turn on the lamp? What will happen when you turn off the lamp? Why do you think this? Record your Hypothesis in your SNB (write in “If-Then-Because” format).
8. Do not turn on the lamp yet. After the readings on the thermometers have stabilized, record the temperatures for both the soil and the water in Table 1 in your SNB across from 0:00 minutes under the column labeled “Heating.”
• 9. Turn on the lamp.
• 10. Start your stopwatch. Read the temperature of both materials to the nearest 0.1°C every minute for 10 minutes. Record your data in the table.
11. At the end of 10 minutes, turn off your lamp but let the watch keep running. Quickly record the 10-minute temperature for soil and water in the Heating columns. Record the same number across from 10:00 minutes at the top of the Cooling columns. Continue reading and recording the Cooling temperature for soil and water every minute for 10 minutes.
• 12. When you finish, clean up.
  – A. Turn off the digital thermometers.
  – B. Dispose of the water from your beaker in a sink or bucket.
  – C. Do not throw away the soil or water.
  – D. Return your materials to your tote tray for the next class.
14. Calculate the overall change in temperature of each beaker during heating and cooling. For the Heating columns, subtract the first temperature (0:00 minutes) from the last temperature (10:00 minutes). For the Cooling columns, subtract the last temperature (20:00 minutes) from the first temperature (10:00 minutes). Give your answers to the nearest 0.1 degree.
7. Work with your group to create a graph in your SNB. While you do, consider these questions:

- A. What title will you give your graph?
- B. How will you label each axis to show the temperature and time changes?
- C. What will be the first number on each axis? How will you space the numbers on each axis? How many degrees will each interval between the numbers represent?
- D. What techniques will you use to make the graph more readable?