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Hidden Gems: What to Do with Inherited Vernier Sensors

Experiment

Introduction to Data Collection

- Go Direct Temperature Probe

Workshop Presenter

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Introduction to Data Collection

Data collection is a very important part of science. Meteorologists collect weather data over time to keep an historical record and to help make forecasts. Oceanographers collect data on the salinity (saltiness) of seawater to study changing trends in our Earth's oceans. While data have been collected by hand for thousands of years, the technology to collect data electronically was developed in the 1950s. Only since the 1980s has this technology been available and accessible to schools.

This experiment was designed to introduce you to two of the most common modes of data collection that will be used in this class. Part I will guide you through collecting and analyzing data over time. A temperature probe will be used to record the temperature of water for 60 seconds at a rate of one sample per second. In Part II, you will collect data using a mode called Events with Entry. This style of data collection allows you to collect one point of data, and then enter in a corresponding value. In this part, the data collected will be the temperature of your hand and the value you enter will be your assigned group member number.

OBJECTIVES

- Become familiar with Graphical Analysis data-collection app.
- Use Graphical Analysis and a temperature probe to make measurements.
- Analyze a graph of the data.
- Use this graph to make conclusions about the experiment.
- Determine the response time of a temperature probe.

MATERIALS

Chromebook, computer, **or** mobile device
Graphical Analysis app
Go Direct Temperature
two 250 mL beakers
cold tap water
hot tap water
ice
paper towels



Figure 1

PROCEDURE

Part I Time Graph

1. Place about 100 mL of tap water into a 250 mL beaker. Add two or three ice cubes.
2. Launch Graphical Analysis. Connect the Go Direct Temperature Probe to your Chromebook, computer, or mobile device.
3. Set up the data-collection mode.
 - a. Click or tap Mode to open Data Collection Settings.
 - b. Change Rate to 0.5 samples/s and End Collection to 60 s. Click or tap Done.
4. Place the temperature probe into the cold water and stir briefly. Then position the probe in the cold-water beaker as shown in Figure 1. **Note:** Make sure the beaker will not tip over from the weight of the probe.
5. Place about 150 mL of hot water into a second 250 mL beaker.
6. When everything is ready, click or tap Collect to start data collection. Do not stir or move the water.
7. When exactly 10 seconds have gone by, quickly move the probe to the beaker containing hot water and allow data collection to continue. Do not stir the water or move the probe during the remainder of the data collection period.
8. Data collection will stop automatically after 60 seconds.
9. Remove the probe from the beaker and dry it with a paper towel.
10. Determine the elapsed time when the highest temperature was reached.
 - a. When data collection is complete, a graph of temperature vs. time is displayed. Click or tap the graph to examine the data. **Note:** You can also adjust the Examine line by dragging the line.
 - b. Find the highest temperature.
 - c. Record this temperature (round to the nearest 0.1°C) and the time when it was first reached in the data table.
11. Sketch or export an image of your graph according to your teacher's instructions.
12. You can confirm the time when the highest temperature was reached by viewing the data table.
 - a. Click or tap View, , and turn on the Data Table.
 - b. Find the time when the highest temperature was first reached. Did you get the same time both ways?

Part II Events with Entry

13. Click or tap File, , and choose New Experiment. Click or tap Sensor Data Collection.

14. Set up the data-collection mode.
 - a. Click or tap Mode to open Data Collection Settings. Change Mode to Event Based.
 - b. Enter **Member** as the Event Name and leave the Units field blank. Click or tap Done.
15. Assign numbers to the members of your group by age with the oldest being number one. Record the names in the data table for Part II. Add more lines if needed.
16. Click or tap Collect to start data collection.



Figure 2

17. Measure the hand temperature of the first group member.
 - a. Group member number one should pick up the probe and hold its tip in the palm of his or her hand as shown in Figure 2.
 - b. Watch the live temperature readout. When the temperature stops rising, click or tap Keep.
 - c. You will be prompted to enter a number. Enter **1** as the student's group member number, then click or tap Keep Point. The temperature and group member number have been saved.
18. Cool the probe down by placing it in the cold water from Part I. Monitor the temperature on the screen and remove it from the water when the temperature reaches 25°C.
19. Pass the probe to the next group member.
20. Repeat Steps 17–19 until every group member has his or her hand temperature recorded, entering the correct group member number for each person.
21. Click or tap Stop to stop data collection.
22. Determine each person's hand temperature by using one of the methods described in Steps 10 and 12. Record the values in the data table.
23. Sketch or export an image of your graph according to your teacher's instructions.

DATA

Part I Time Graph

Maximum temperature (°C)	Elapsed time (s)

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Part II Events with Entry

Group member number	Group member name	Maximum temperature (°C)
1		
2		
3		
4		
5		
6		
Group average		

PROCESSING THE DATA

Part I Time Graph

1. Describe the appearance of your graph from Part I.
2. Why is time plotted on the horizontal axis in this experiment?
3. Why is temperature plotted on the vertical axis?
4. Determine the temperature probe's response time. To do this, use your data to find how long it took for the temperature probe to reach the maximum temperature after moving it from the cold water to the hot water.
5. Explain how you determined your answer to Question 4.

Part II Events with Entry

6. Calculate your group's average for the maximum temperatures. Record the result in the data table.
7. Who had the hottest hand?
8. Who had the coldest hand?