Sometimes, when you are sick, your parents have you keep an oral thermometer under your tongue for three minutes because it takes about that long for the thermometer to register your body's temperature. The time needed by the thermometer to reach your body temperature is the response time of the thermometer. In this experiment, you will study the response time of a temperature probe in still water.

You will also improve your graphing skills as you graph the data that you will have collected using the a LabPro device and a temperature probe.

OBJECTIVES

In this experiment, you will

- use the LabPro data collection system, and two types of temperature probes to measure probe response time
- study recorded data
- use the graphed data to make conclusions about the experiment
- determine the response time of each temperature probe

MATERIALS

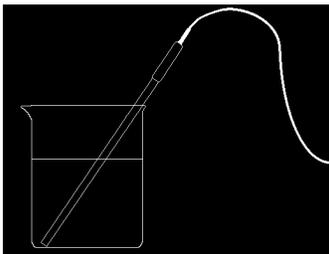|	
LabPro	
USB Cable	two 250-mL beakers
Vernier Auto-detectTemperature Probe	cold water (cooled with ice)
Vernier Stainless Steel Temp Probe	hot water

*Figure 1*

PROCEDURE

Set-up LabPro for Data collection

1.   Turn the power on to your Lab Station PC.

2.   Acquire a LabPro unit. Plug the power adapter into the unit. When the unit is plugged in, wait 5 seconds for the diagnostic beeps to insure the unit is working properly.

3.   On the PC, log in as Student. When the desktop comes up, run the Logger Pro Software.

4.   Connect the LabPro unit to the PC using the USB cable. When you do, the LabPro connect icon should appear on the upper left part of the screen.

5.   Connect the white Auto-detect Temperature probe into Channel 1 of the LabPro. Confirm the connection by viewing the real-time data displayed by the LabPro connection icon.

Experiment Set-up

1.   Place about 100 mL of ice water into a 250-mL beaker.

2.   Place the white temperature probe into the cold water and stir briefly. Then position the probe in the cold-water beaker as is shown in Figure 1.

3.   Ready program for data collection. Pull down the Experiment Menu and choose the Data Collection option. The following window will appear:
        Set the Length to 60 seconds. Under sampling rate, choose 1 sample per 1 second.

4.   Get about 150 mL of hot water in a second 250-mL beaker (CAUTION! Hot water will be HOT!).

Note: In Step 6, you will switch the temperature probe from the cold water to the hot water at exactly 10 seconds after you have begun data collection.
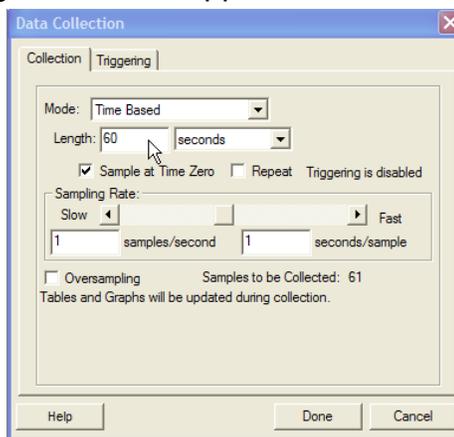
5.   Make sure the temperature reading is steady, and then hit the F11 key (or click on the Green Collect icon). This will begin the data collection.
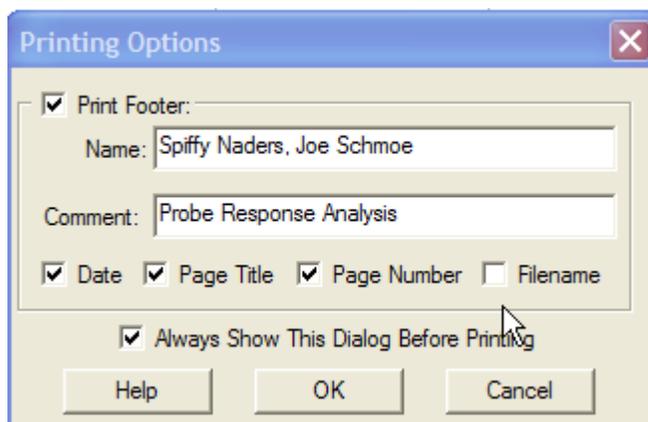
6.　　When exactly 10 seconds have gone by, quickly move the temperature probe to the beaker containing hot water and continue data collection. Do not stir the water or move the temperature probe during the remainder of the data collection period.

7.　　The data will be graphed as it is collected. Keep the probe in the hot water until data collection is complete (60 seconds).

8.　　Once data has been collected, check to make sure your data table is labeled correctly. Time (in seconds) should be displayed in column X, White Probe Temp in Column Y. If it is not, double click each header and type in the appropriate headings. (left-hand side of the screen).

9.　　Label your graph by double-clicking anywhere inside your graph. The first graph should be labeled "Probe Response Time – White Probe". The second graph (you do later) will be labeled "Probe Response Time – Stainless Steel Probe".

10.　　Pull down the File Menu and choose Printing Options. Check the box "Print Footer". Enter the name of everyone present on your lab team in the Name field. Under Comment, enter "Probe Response Analysis".

Printing Options

Print Footer:

Name: Spiffy Naders, Joe Schmoe

Comment: Probe Response Analysis

☑ Date ☑ Page Title ☑ Page Number ☐ Filename

☑ Always Show This Dialog Before Printing

Help　　OK　　Cancel

11.　　Now it's time to print. Pull down the File Menu and choose the "Print Data Table" option. You will want to print your data table in Portrait mode (see the instructor if you have a question of how to do this).

Next, choose the 'Print Graph' option. You will want to print this in Landscape Mode (again, check with your instructor if you don't know how to do this). Once you have checked your printouts, click on the New button (you can save your data if you want to).

12. Now repeat the experiment above using the Stainless Steel Temperature probe (replacing the white probe)
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13. After you have printed out the Stainless Steel probe Data Table and Graph, it's time for head-to-head competition. Hit New and get ready to begin…

14. Keep the Stainless Steel Temperature probe in channel 1, and place the white temperature probe in channel 2. The screen should change to reflect both probes. Repeat the experiment above, keeping the two probes side-by-side.

15. Print out your data table and graph (two separate sheets), answer the questions below, staple your printouts to this handout, hand it in and you're done!

16. Make sure to put everything away, and clean up any mess you may have made.

Questions

1. Calculate the response time for each probe (using the data from the head-to-head experiment).

On the data table printout, circle the temperature for each probe just before you placed it into the hot water (should be 10 or 11 seconds). Draw a square around the temperature where the maximum temperature was first reached.

The response time is the difference between these two times.

Response time for the White Temperature Probe _____

Response time for the Brass/ SS Temperature Probe _____

Which probe has the faster response time? _____

Staple you printouts to the back of this assignment and turn it in.