It looks like a random assortment of stuff.
It pretty much is a random assortment of stuff.

Lab 02: Using LabQuest

INTRODUCTION

Precision and accuracy. While these are definitely separate and distinct concepts, by paying careful attention to the methods we use for data collection, we can maximize both. We discussed the ways in which measurements might be compromised by an imprecise measuring tool or an inaccurate method or technique. One way to improve the quality of our measurements is to automate the process: Use a precisely calibrated instrument, and use in a way which minimizes our chances of doing it wrong. The LabQuest unit will allow us to automate data collection for a wide range of experiments, giving us more precise information, collected more accurately, than we are able to do manually. This will allow us to focus on the meaning and the physics of the experiments we perform, rather than the engineering of how we execute a set of steps to generate a collection of data.

OBJECTIVES

- ◉ Use the LabQuest to automatically collect data
- ◉ Become familiar with different probes and sensors, and how to adjust their settings
- ◉ Learn how to collect, store, and review multiple data sets

- ◉ Determine and input appropriate data collection intervals
- ◉ Analyze data graphically and perform curve-fitting

EXPERIMENTAL EQUIPMENT

- ◉ LabQuest handheld unit
- ◉ Blood Pressure Sensor

- ◉ Temperature Probe
- ◉ Calorimeter with lid

- ◉ Two beakers
- ◉ Crushed ice and hot water

CHECK YOUR PRESSURE

1. Attach the blood pressure cuff to the sensor. Screw it in securely, but do not over-tighten.

2. Turn the **LabQuest** on, and plug the **Blood Pressure Sensor** into **Channel 1.** You should see the LabQuest automatically recognize the sensor, and display a screen which looks like the picture on the right. Your default location is the **Meter** tab.

3. Slide the stylus from the back of the unit, and use it to select items on the screen. Alternately, navigate using the push buttons on the front of the unit.

4. You should not have to change any of the sensor settings, but you should zero the cuff pressure. The **Sensor** menu (under the **Meter** tab) has a **Zero** option.

5. Attach the cuff to the upper arm of your lab partner. Wrap the cuff securely, but not overly tightly. The sensor lead and the pressure bulb should both face up. If you are having your blood pressure taken, you should sit still and not move your arm.

6. Navigate to the **Graph** tab of the LabQuest screen. Start the data run by clicking the **Go** button at the bottom left of the screen. Rapidly squeeze the pressure bulb until the cuff pressure is between **150 and 170 mm Hg**. Please do not exceed 170mm; your lab partner might find it uncomfortable.

7. Set the bulb on the table (don't press the release valve just yet) and watch the LabQuest screen. Pay attention to the cuff pressure, and when it drops to **50 mm**, click the **Stop** button (bottom left again) to stop the trial. Release the cuff pressure by pressing the release valve near the squeeze bulb.

8. You should see your results appear automatically on the screen next to the graph: systolic pressure, diastolic pressure, heart rate, and mean arterial pressure. If the calculated values for systolic and diastolic pressure do not appear automatically, **don't panic**. Occasionally, this pressure sensor is finicky and you may have to simply repeat the measurement.

9. On your lab worksheet, record this data (systolic and diastolic pressures) and make a sketch of the graph next to it. Try to capture the shape of the graph and do not worry about scaling it.

10. On the screen, tap the **File Cabinet** icon to save the data. It will automatically save as **Run 1**, and the screen will change to show you **Run 2** (which is the next trial you will be performing).

Attach the Blood Pressure Sensor, and the Meter tab looks like this. Zero the cuff pressure before collecting any data.

11. Check the blood pressure of everyone in your lab group. Make sure to record the results on your worksheet, and also to save each data run before moving on to the next one. Notice that you can toggle between the runs by tapping the **Run Box** (next to the **File Cabinet** icon) which shows you which data you are viewing.

12. When you have checked everyone's pressure, save your entire data file. Under any of the tabs, the **File** menu is the same. Choose the **Save** option, and give your file a unique name (do not leave it as "untitled"). If you need to retrieve this data, it will still be saved even after the LabQuest is switched off. At any time, you could open this file and resume collecting data. Disconnect the Blood Pressure Sensor before proceeding to the next exercise.


Keep an eye on your graph, but do not stop data collection before the run is over unless you are sure that something is wrong.

CHECK THE TEMPERATURE

1. Get a beaker and fill it with ice from the cooler. While someone is doing this, another person should be getting a second beaker of hot water from the tap. Let the tap water get very hot before filling your beaker.

2. Attach the **Temperature Probe** to the LabQuest. It should recognize the probe, and you should see the room temperature displayed (about 22°C).

3. Adjust the data collection interval. Under the **Meter** tab, the **Sensor** menu has a **Data Collection** option. Select this, or tap one of the boxes on the right (**Mode, Rate,** or **Length**). This will open the **Data Collection** window as well. Change the units on the **Length** from seconds (s) to minutes (min). To change the number of minutes, swipe the stylus across the number on the screen to highlight it. This opens the keyboard, and you can tap the number with your stylus. Make the **Length** equal to **10 minutes.**

4. Now change the **Rate** to **10 samples/min**, then tap **OK**. This means that when you tap the **Go** button, the LabQuest will collect and record data 10 times a minute (every 6 seconds) for ten minutes. During data collection, you can tap the **Stop** button at any time to halt a data run, but you cannot resume your trial if you stop (**Stop** means **stop**, it does **not** mean pause). You should not click Stop before the end of a run unless you are certain (maybe you have all the information you need, or maybe you really do need to start over).

5. Insert the Temperature Probe through the stopper of the calorimeter lid. Fill the inner calorimeter cup with ice, then pour in the hot water. Leave about a half inch of space at the top of the cup (do not overfill). Place the lid on the calorimeter. The Temperature Probe should be in the ice water.

6. Press the **Go** button to start the data collection.

7. While the LabQuest records data, you should be getting your quiz worksheet ready. You will make a graph of temperature vs time, so construct and label your axes. **Time** is on the **x-axis**, **temperature** is on the **y-axis** (this is how it appears on the LabQuest screen as well). You do not need to over-worry about accurately scaling the axes, but you will want to carefully capture the shape of the curve.

8. When the data collection interval is over, analyze your graph. Under the **Graph** tab, the **Analyze** menu has a **Curve Fit** option. Select this, and you will see your graph displayed on the left, and the curve fit choices on the right. Pull down the **Fit Equation** menu, and select a curve fit. Start at the top, and try each of the choices until you get a fit which closely matches the data.

9. Sketch the graph on your lab worksheet, making sure you show its shape (do not worry about matching the scale precisely). Write down the equation of the best fit curve. Is it a line? Are there several curve fits that seem pretty good, or is there only one which matches well with your data?

10. Please be sure to complete the quiz worksheet and submit it before you leave. No worksheets will be accepted for credit after the end of the lab period.
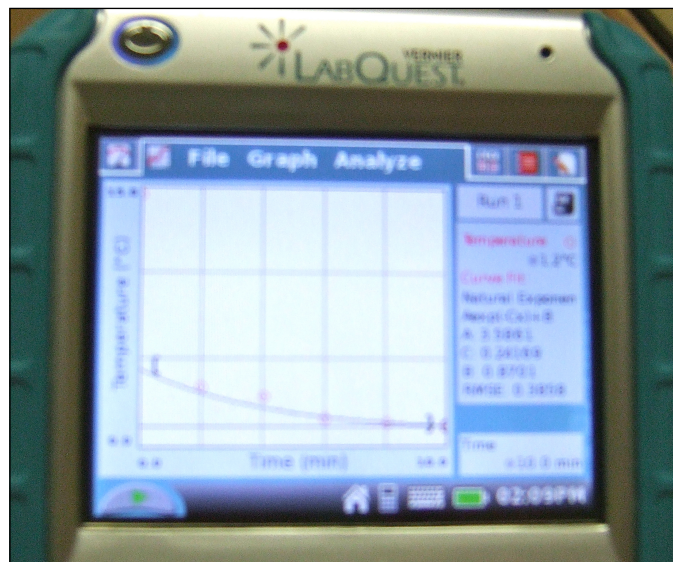
Try the different curve fits to find which one is the best. Make sure to record the equation in your lab notebook.