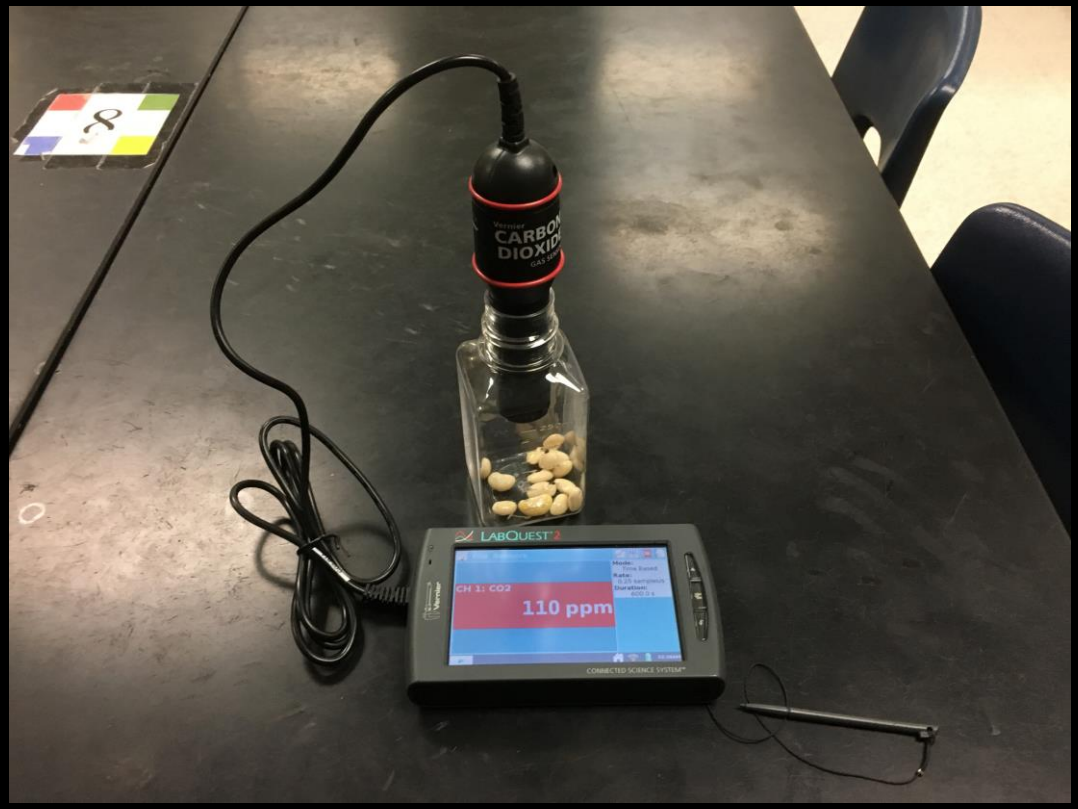
Measuring Cellular Respiration

$C_6H_{12}O_6 + 6O_2 \text{ -------> } \mathbf{6CO_2} + 6H_2O$



Measuring Cellular Respiration

$$C_6H_{12}O_6 + 6O_2 \text{ -------> } \mathbf{6CO_2} + 6H_2O$$

All cells do some form of cellular respiration. In this lab, the beans will be doing aerobic cellular respiration. The formula you see above shows the products of this reaction as carbon dioxide and water. In this lab you will be measuring the rate of CO_2 production using a CO_2 probe attached to a Vernier LabQuest. The unit will measure and graph the results for you. The experiment will look at how temperature affects the rate of CO_2 production. You will measure the rate of cellular respiration in beans that are in three different temperature environments.

CO_2 Production at Different Temperatures

For your table group you will need:

1 LabQuest Unit
1 CO_2 Probe

CO_2 Production at Different Temperatures

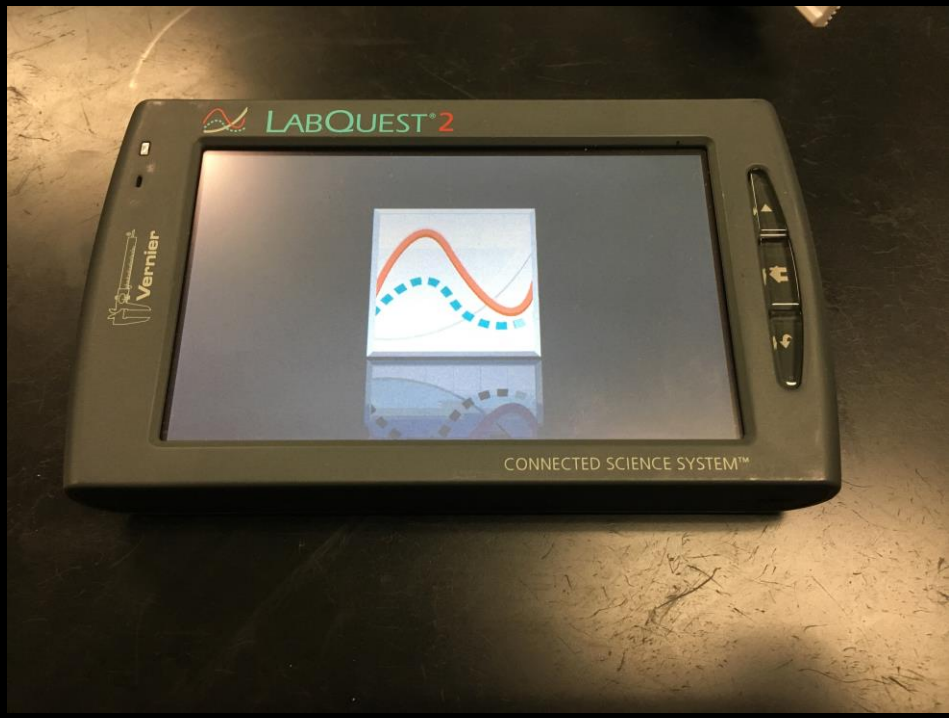
Be sure the CO_2 Probe is set to High

CO_2 Production at Different Temperatures

Turn you LabQuest unit on by pressing the power Button

CO2 Production at Different Temperatures

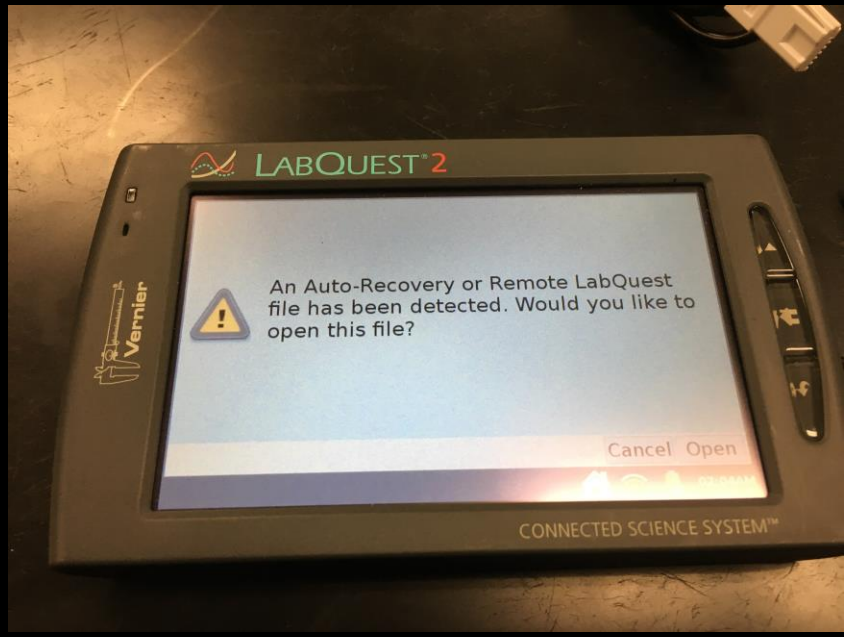
Wait for the unit to start up



CO2 Production at Different Temperatures

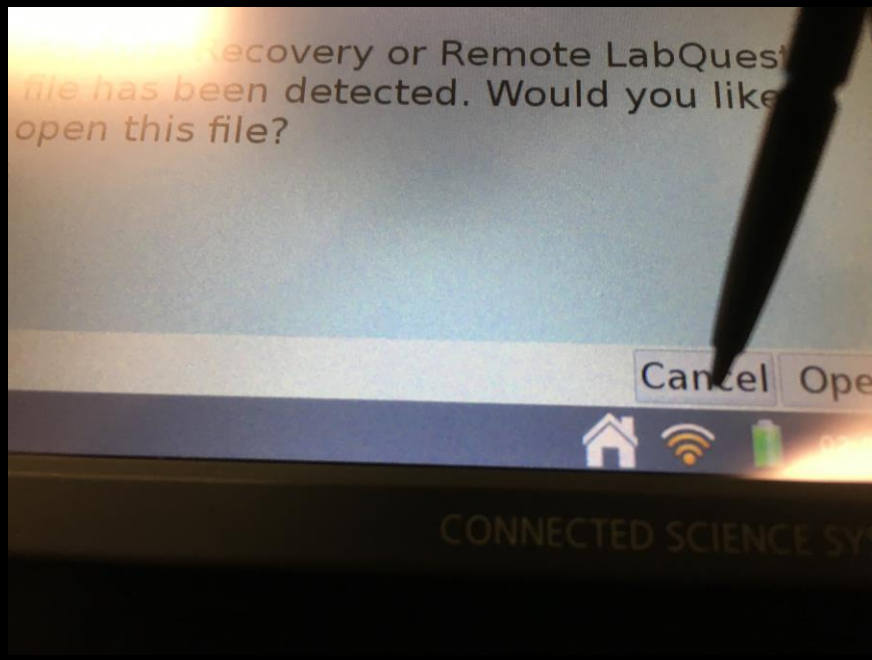
After start up you may get this message:

An Auto-Recovery or Remote LabQuest file has been detected. Would you like to open this file?



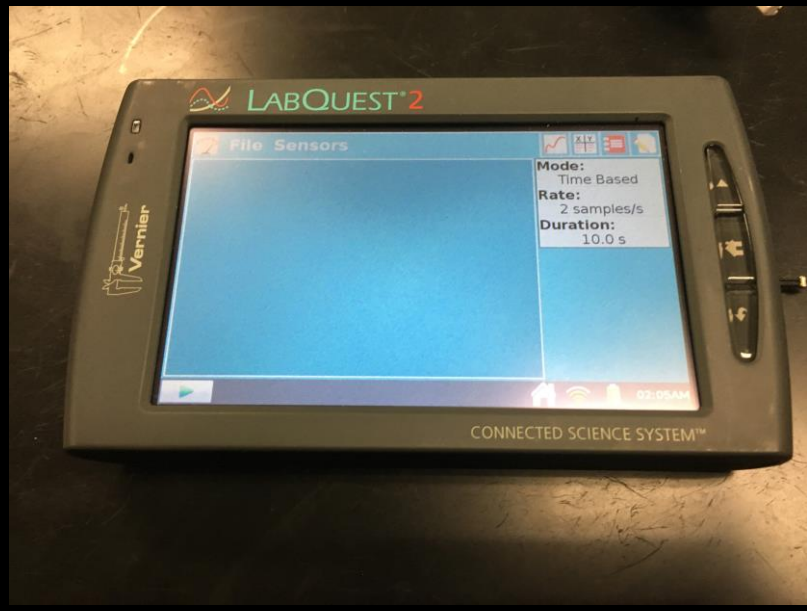
CO_2 Production at Different Temperatures

Go ahead and press Cancel



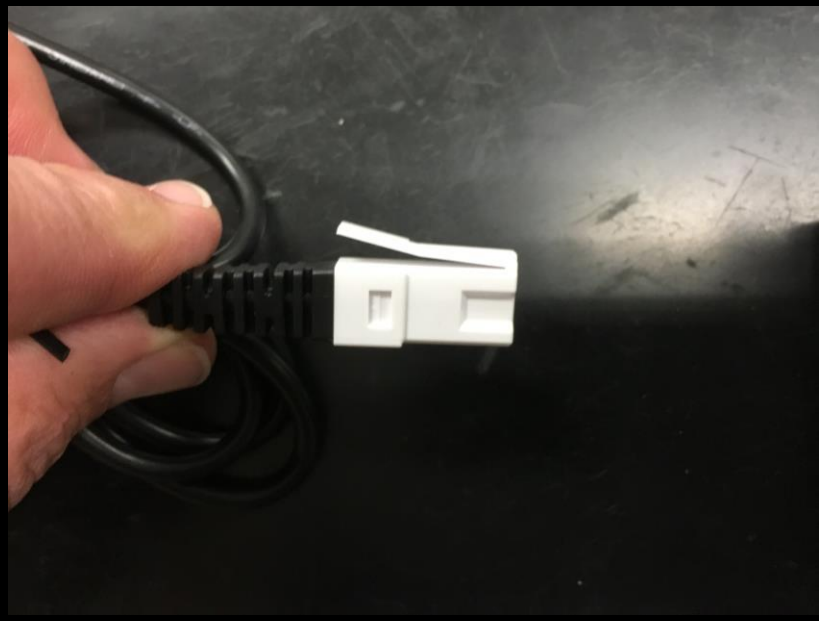
CO_2 Production at Different Temperatures

Your LabQuest is ready to use when you see this screen



CO_2 Production at Different Temperatures

You will be attaching the plug from the CO_2 probe to the LabQuest.



CO2 Production at Different Temperatures

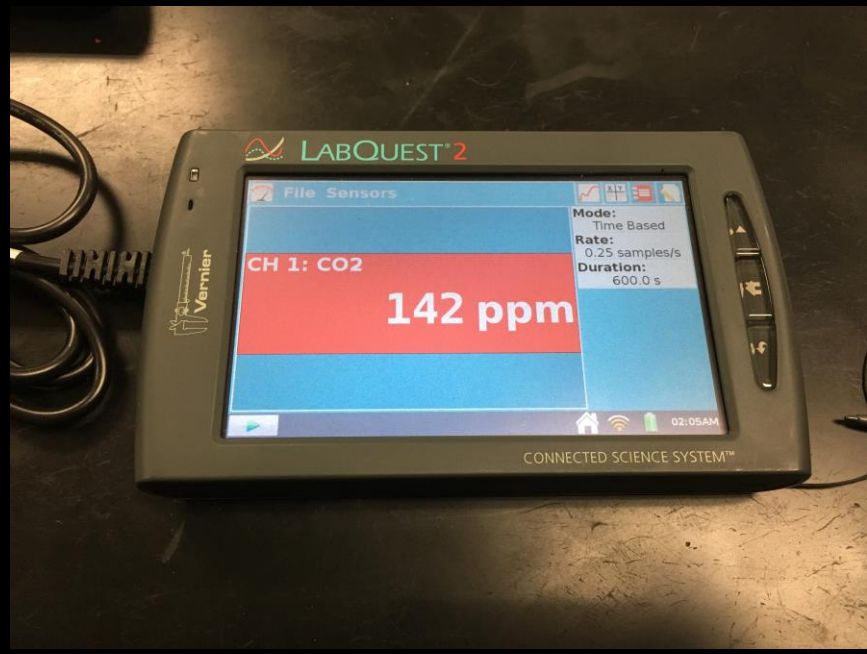
Insert the plug into CH 1

CO_2 Production at Different Temperatures

The LabQuest will automatically detect that you have inserted a CO_2 probe. The screen should change and you will start to see CO_2 readings in Parts Per Million (ppm)

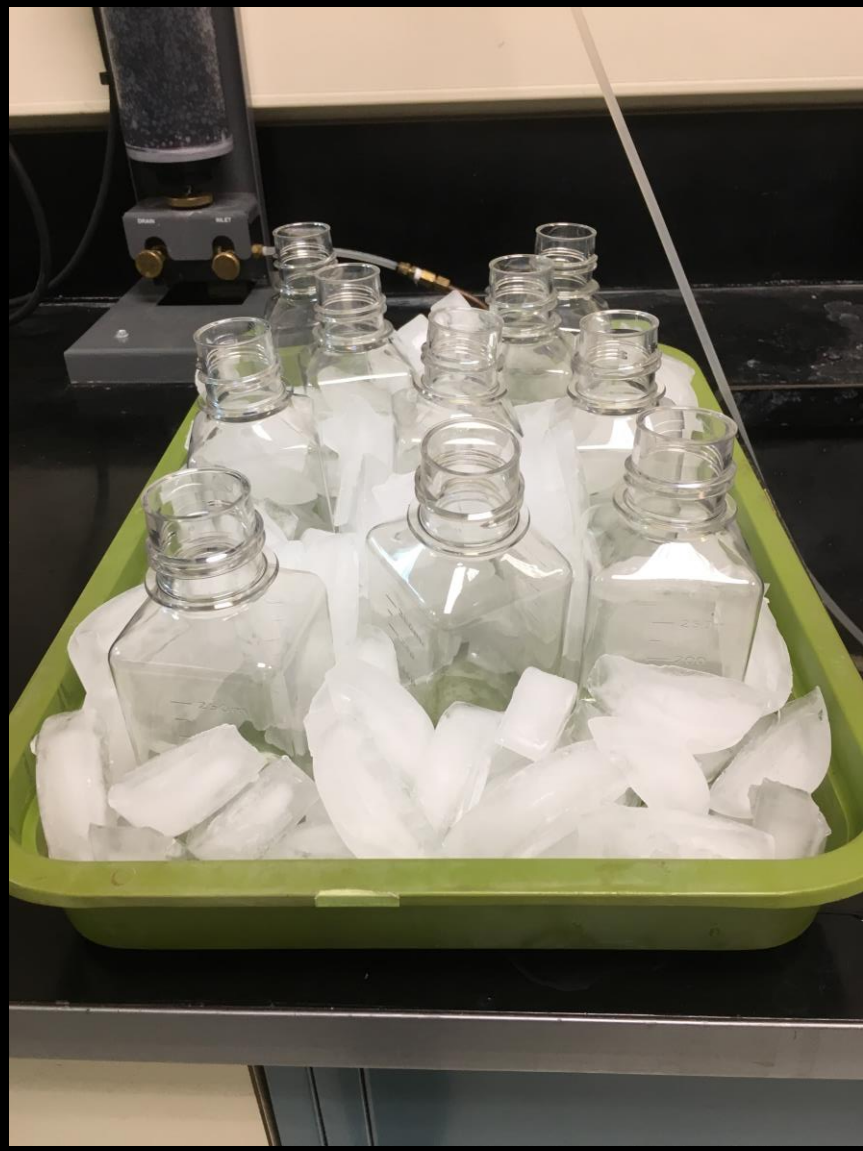
The probe needs a minute or two to stabilize, before you start your experiment.

PPM tells you how many molecules of CO_2 are present in 1 million molecules of air.



CO_2 Production at Different Temperatures

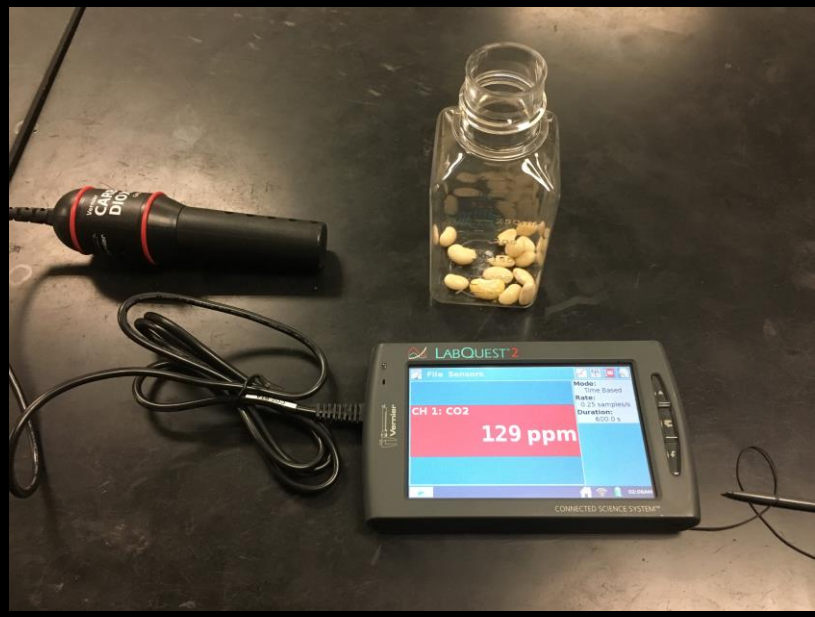
Go to the back of the room and get one of the reaction bottles that is in the ice and return with it to your table.



CO_2 Production at Different Temperatures

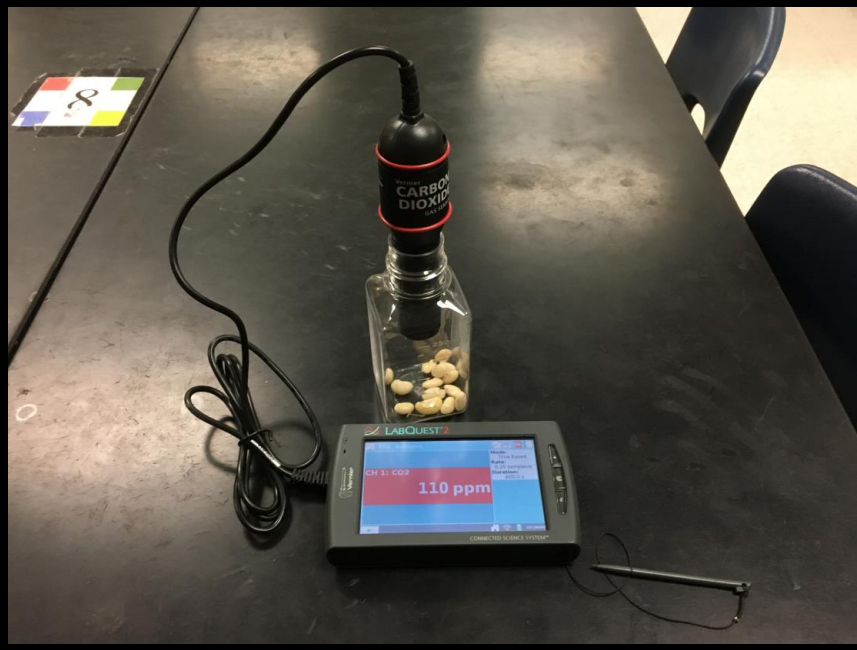
You are ready to begin the experiment if you have all the materials in the picture:

LabQuest
CO_2 Probe Connected
Reaction Bottle with Beans



CO_2 Production at Different Temperatures

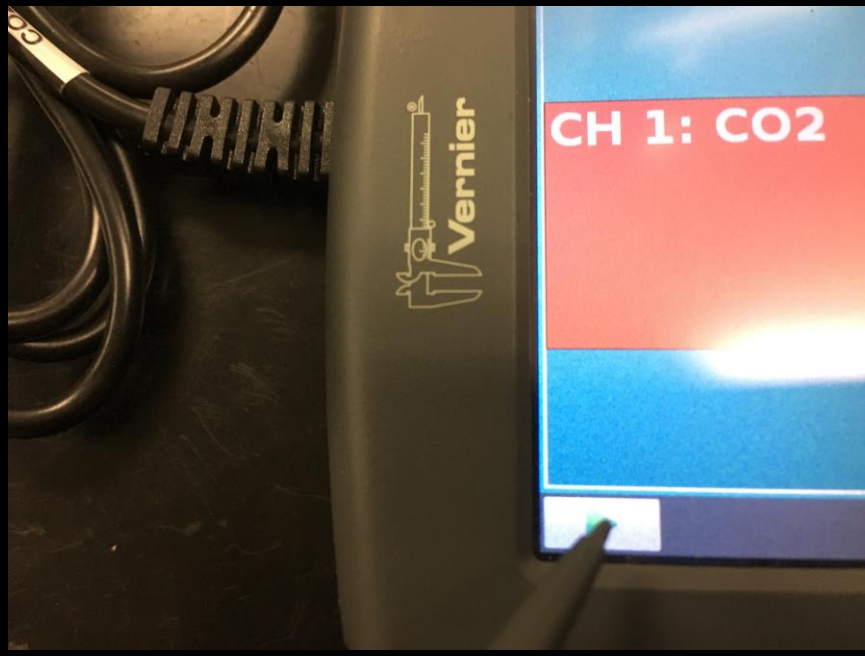
Place the CO_2 Probe into the Reaction Bottle



CO_2 Production at Different Temperatures

Press the green arrow on the bottom left side of the LabQuest. This will start the data collection for your first experiment.

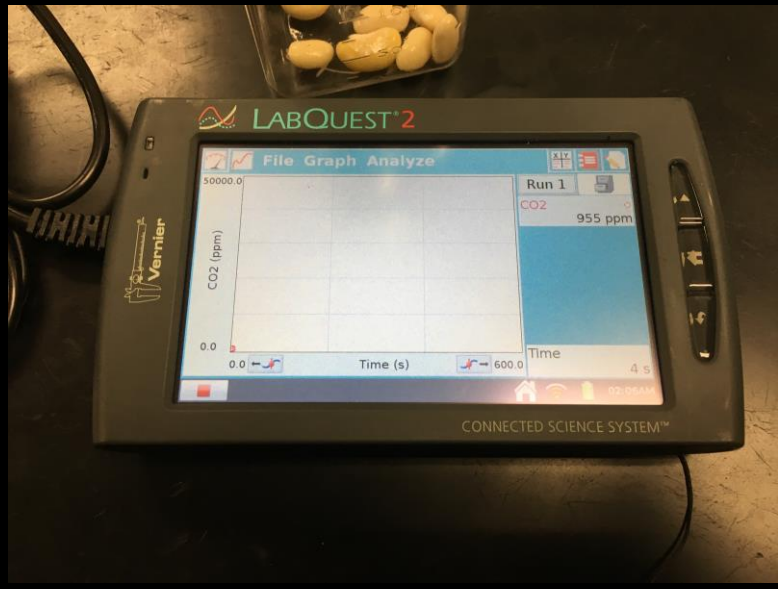
The experiment will run for 10 minutes



CO_2 Production at Different Temperatures

As the experiment runs you will see a graph of the data it is collecting.

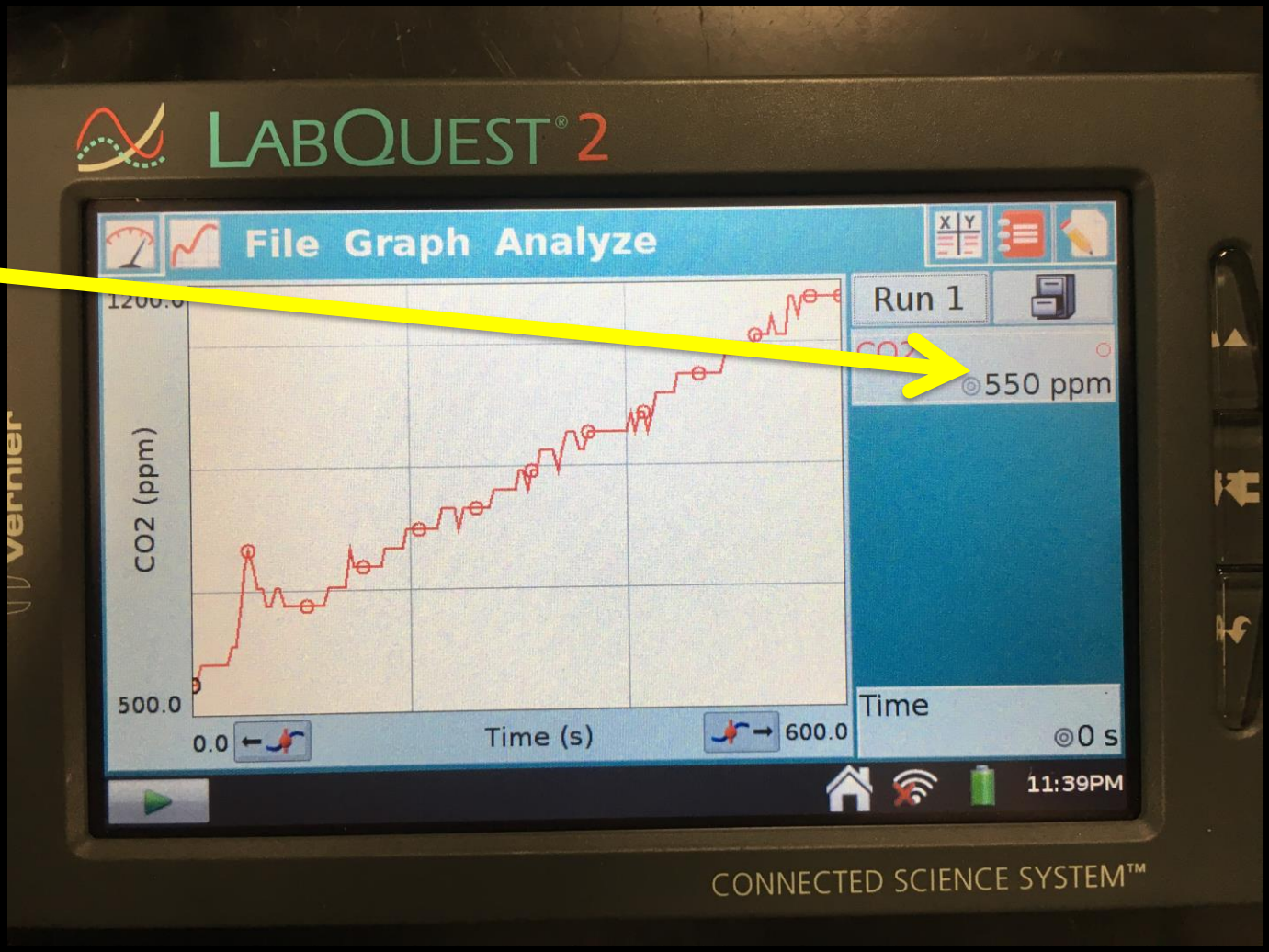
What do you observe happening?



CO_2 Production at Different Temperatures

The experiment will complete after 10 minutes.

Once completed, the readout will show you your starting CO_2 level



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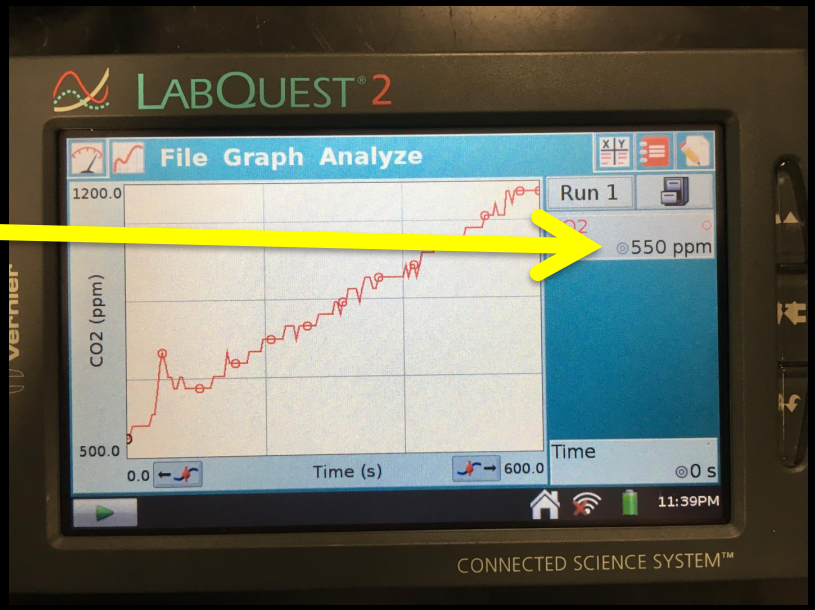
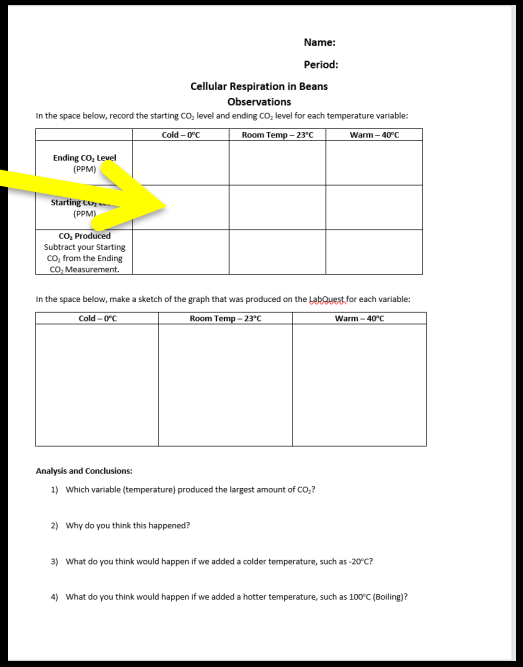


Record this as the starting CO_2 ppm on your observations page



Name:

Period:

Cellular Respiration in Beans

Observations

In the space below, record the starting CO_2 level and ending CO_2 level for each temperature variable:

	Cold – 0°C	Room Temp – 23°C	Warm – 40°C
Ending CO_2 Level (PPM)			
Starting CO_2 Level (PPM)			
CO_2 Produced Subtract your Starting CO_2 from the Ending CO_2 Measurement.			

In the space below, make a sketch of the graph that was produced on the LabQuest for each variable:

Cold – 0°C	Room Temp – 23°C	Warm – 40°C

Analysis and Conclusions:

1) Which variable (temperature) produced the largest amount of CO_2?

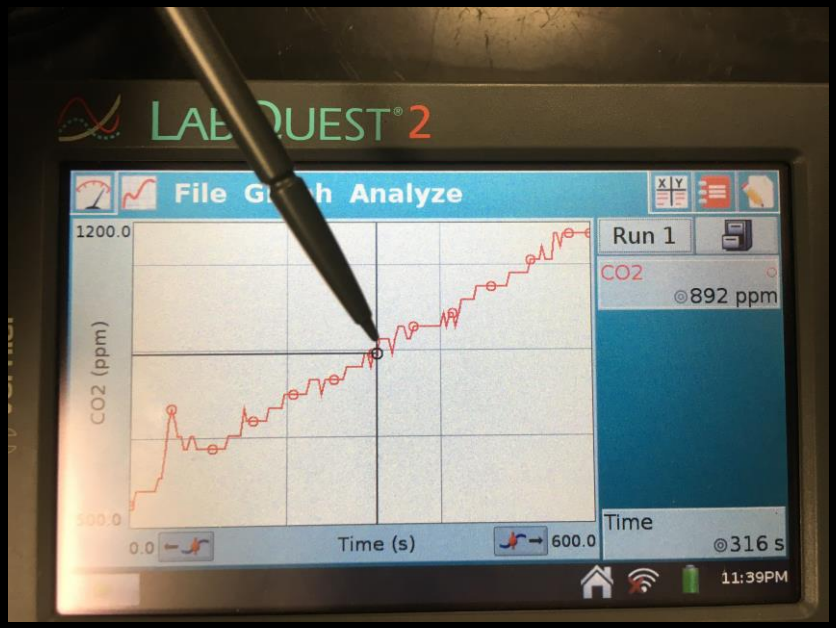
2) Why do you think this happened?

3) What do you think would happen if we added a colder temperature, such as -20°C?

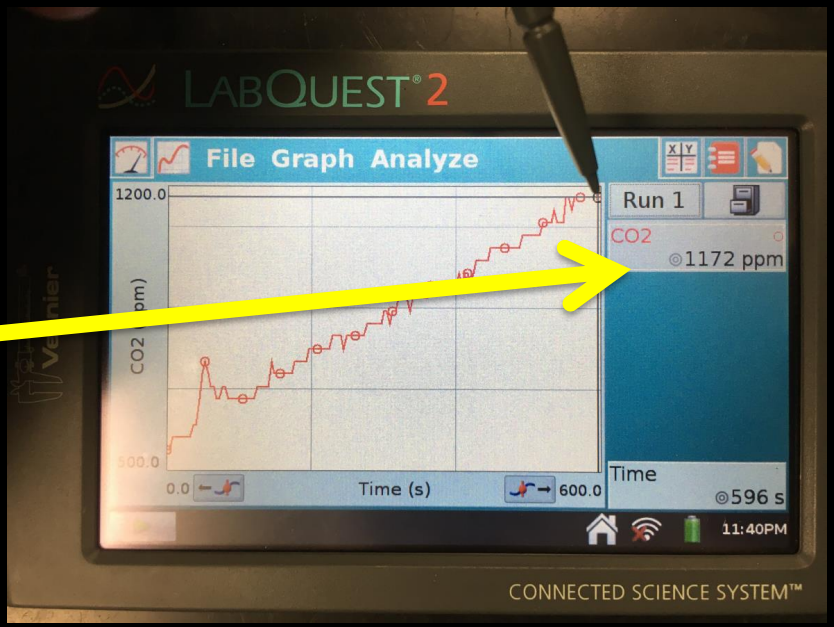
4) What do you think would happen if we added a hotter temperature, such as 100°C (Boiling)?

CO_2 Production at Different Temperatures

You can view any measurement on the graph by tapping it with the stylus.

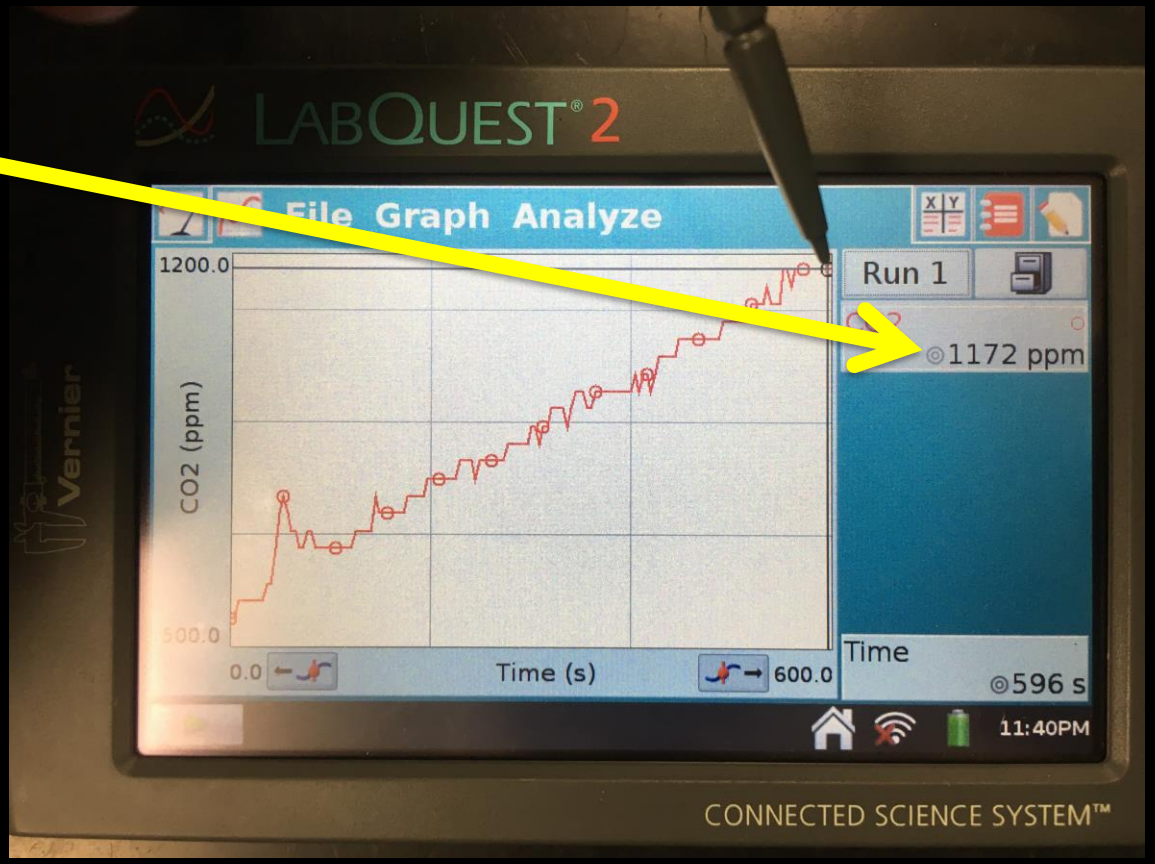


To see what the ending CO_2 ppm was, click on the last point on the graph and record the number displayed.



CO_2 Production at Different Temperatures

Be sure to write down the ending ppm value at the end of 10 minutes.



Name:

Period:

Ce lar Respiration in Beans

Observations

In the space below, record the starti el and ending CO_2 level for each temperature variable:

	Col	Room Temp – 23°C	Warm – 40°C
Ending CO_2 Level (PPM)			
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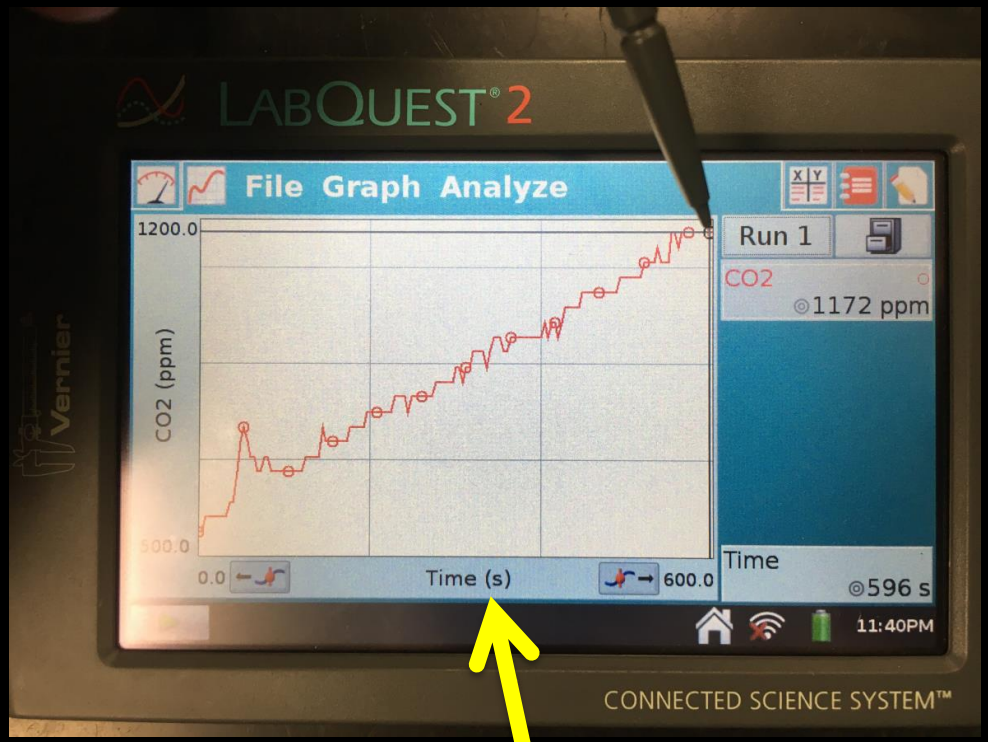
3) What do you think would happen if we added a colder temperature, such as -20°C?

4) What do you think would happen if we added a hotter temperature, such as 100°C (Boiling)?

Subtract the starting level from the ending level to get the CO_2 Produced

CO2 Production at Different Temperatures

Record your graph



Name:

Period:

Cellular Respiration in Beans
Observations

In the space below, record the starting CO_2 level and ending CO_2 level for each temperature variable:

	Cold – 0°C	Room Temp – 23°C	Warm – 40°C
Ending CO_2 Level (PPM)			
Starting CO_2 Level (PPM)			
CO_2 Produced Subtract your Starting CO_2 from the Ending CO_2 Measurement.			

In the space below, make a sketch of the graph that was produced on the LabQuest for each variable:

Cold – 0°C	Room Temp – 23°C	Warm – 40°C

Analysis and Conclusions:

1) Which variable (temperature) produced the largest amount of CO_2?

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3) What do you think would happen if we added a colder temperature, such as -20°C?

4) What do you think would happen if we added a hotter temperature, such as 100°C (Boiling)?

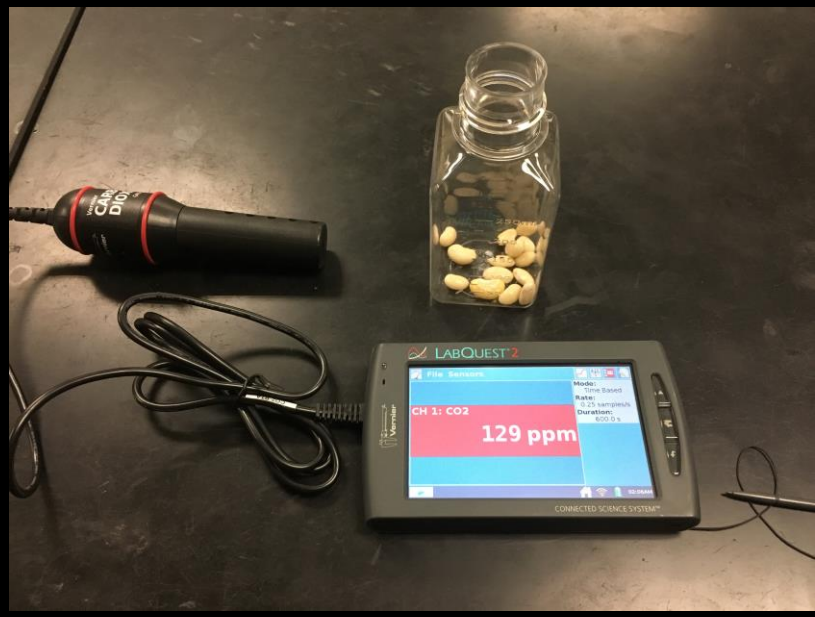
Make a sketch of the graph that is produced by the LabQuest for each temperature

CO2 Production at Different Temperatures

Return your reaction bottle to the Ice Bath and pick up a reaction bottle that has been sitting a room temperature.

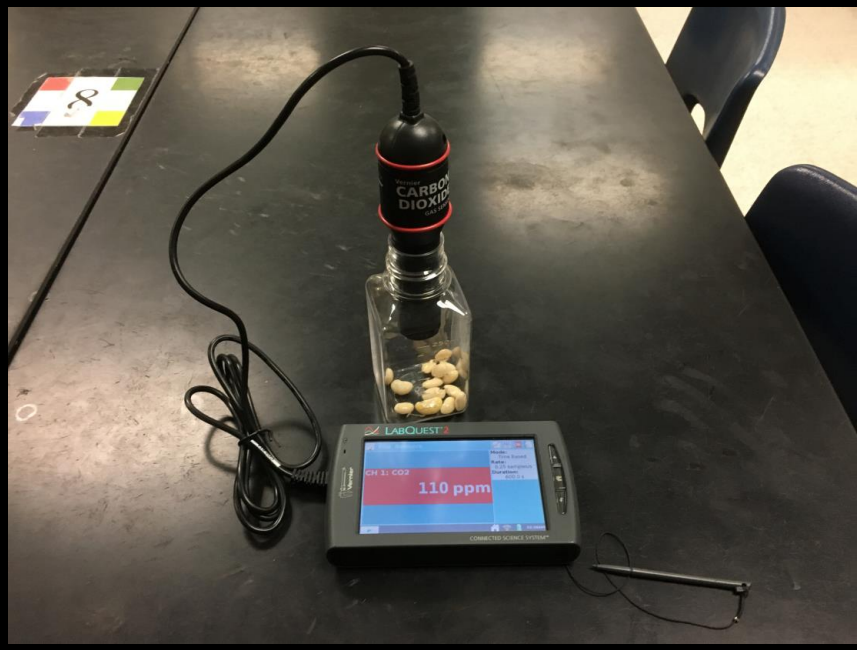
CO_2 Production at Different Temperatures

You will be repeating the experiment with the room temperature beans in the reaction bottle



CO_2 Production at Different Temperatures

Place the CO_2 probe into the reaction bottle.

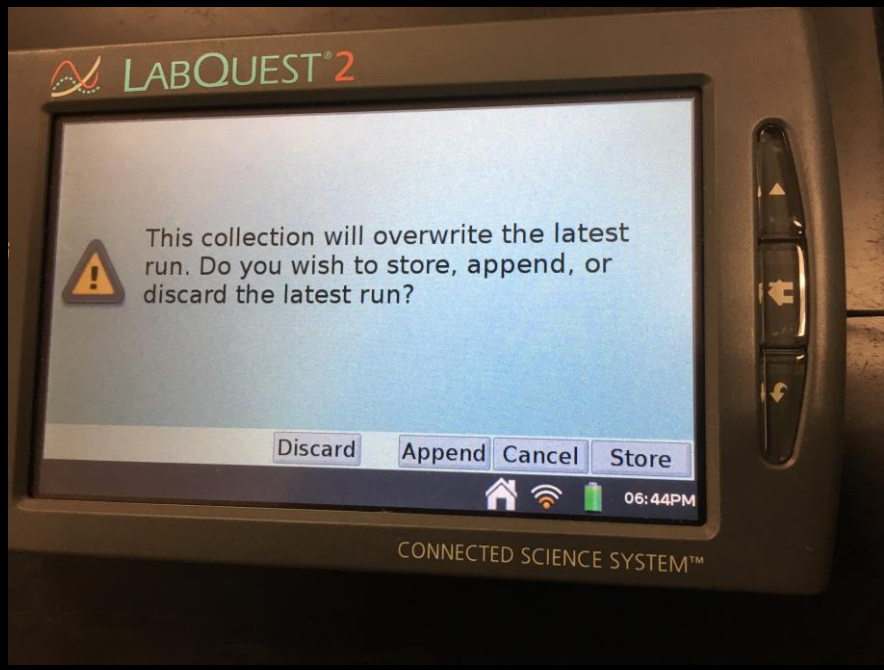


CO2 Production at Different Temperatures

Press the green arrow on the bottom left side of the LabQuest, this will start an new experimental data collection.

CO2 Production at Different Temperatures

This message will pop up.

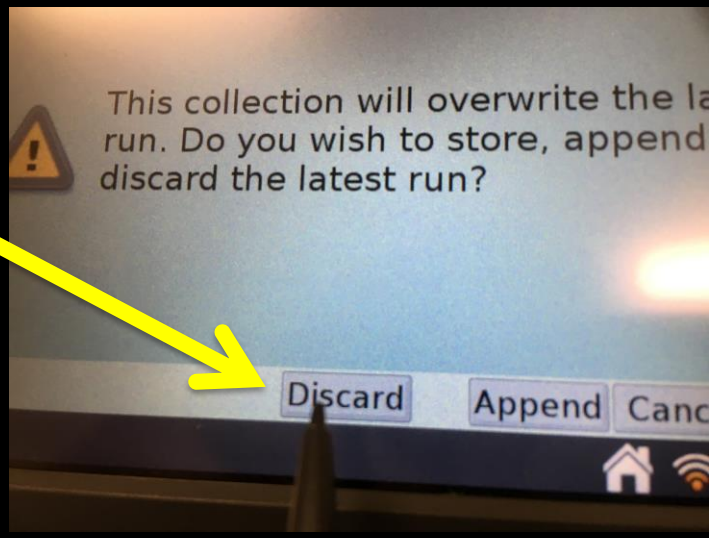


CO_2 Production at Different Temperatures

Press Discard

Your experiment will run like it did in the first trial.

Be sure to record the starting and ending ppm and sketch your graph



CO2 Production at Different Temperatures

Return your room temperature reaction bottle to the back of the room and take a reaction bottle from the heater.

Repeat the steps you did for the other two experiments.

Be sure to record the ppm before and after the 10 minute run and sketch your graph.

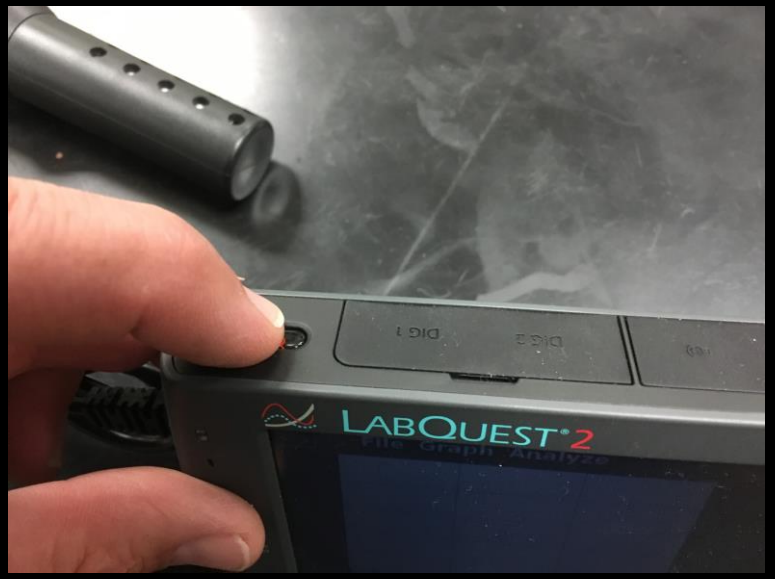
CO_2 Production at Different Temperatures

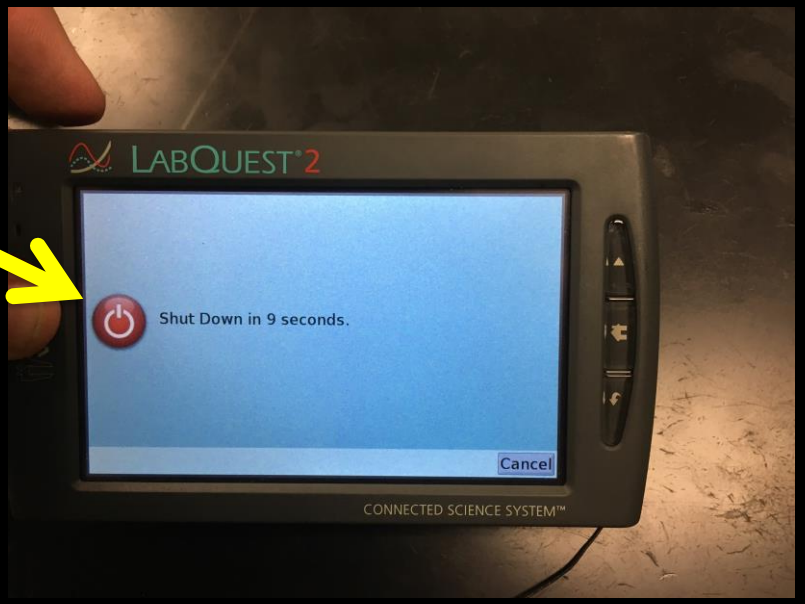
When finished:

Return you reaction bottle to the heater

Disconnect the CO_2 Probe

Turn off your LabQuest by holding down the power button until you see the shut down notice.





Complete your observation paper and turn it in. Each person in your group needs to turn in their own paper.