

What's Our Temperature?

Math / Biology / General Science
Middle / High
Math Modeling / Data Collection

Introduction: This activity is an extension of TEMPERATURE ACTIVITY #1. The set up of the CDA is the same as it was before. However, this activity can be done in-groups to compare the differences in temperatures between members of the group. Each group should have no more than 5 students in it. We will do this activity with a group of 4 students.

Objectives: Students will be able to...

1. Collect data by following an experimental procedure.
2. Input data in a graphing calculator.
3. Compare results.
4. Draw conclusions.
5. Make predictions.
6. Discuss the biology of body temperature

Realted Key Words:

warm blooded	cold-blooded	hypothermia
Metabolism	metabolic rate	heat stroke
Celsius scale	Fahrenheit scale	Kelvin scale

Materials:

- 1 CASIO CFX-9850G or FX-7400 Graphing Calculator
- 1 CASIO EA-100 CASIO Data Collector (CDA)
- 1 Temperature Probe (Included with the CDA)
- 1 Link Cord (Included with the CDA)

Remember; turn on the CDA after the probe is in place. Press the SHIFT MODE key, this will allow you to pick the time intervals of the data collection by using the data log key, once picked, press the TRIGGER key. Next, using the DATA LOG key select the number of samples you would like to take, and press the TRIGGER key to set them. Finally, make sure that the type of time setting is set to 1.

Grasp the temperature probe in your hand, making sure that the tip of the probe is covered, and press the TRIGGER key. The word "SAMPLING" will appear of the CDA's display screen. This will collect the data into the CDA.

When the word DONE appears, release the probe and prepare to transfer the data into your calculator. Turn on the calculator and enter the program menu. Execute the "RECEIVE" program. This will put the data into LIST 1 and LIST 2 of your calculator. To restart the CDA press the SHIFT RESTART key, this will restart the activity at the same parameters that were already set in the CDA. Now have the second person in the group grasp the temperature probe and press the TRIGGER key. This will store the new temperatures into the CDA.

*****AT THIS POINT, YOU MUST BE VERY CAREFULL!!!!****

We need to transfer the data from the CDA into the calculator, however if we simply ran the receive program as before, it would overwrite the data already in LIST 1 and LIST 2. To change which list is going to receive the data we must edit the RECEIVE program. To do this, enter the PROGRAM MENU of your calculator and scroll down to the RECEIVE program and press F2 [EDIT]. This will allow us to change which list the data will be transferred into. Since the time will be put into LIST 1 we do not need to

change this, but we do need to change the second line from LIST 2 to LIST3. Move the cursor under the "L" in LIST 2 and press the [OPTN] key. Now press F1 twice. This will enable you to enter the word "LIST" into the program. Now all you have to do is enter which list you want the data to go into, in this case enter the number 3, a closed parenthesis and the [EXE] key. Now press the [EXIT] key 3 times and the F1 key to execute the program. This has placed the data from the second person into LIST 1 and LIST 3. To check this, go to the STAT menu and look at the lists.

We now repeat the same procedure with the last two students in the group. Remember to edit the program and change the second line of the program in order to place the data into the appropriate list.

You should now have data in 5 LISTS in your calculator. LIST 1 should contain the TIME. LIST'S 2 through 5 should contain the temperature readings from the 4 people in the group.

Since we can only graph 3 different STATGRAPHS at one time we will need to store one of them as a picture and overwrite the other three on top of it. The one thing that you must be careful of is to change the values in the viewing window before you store anything as a picture.

To change the values in the viewing window, and get them to stay, do the following. Remember, in the STAT mode there is a feature that automatically sizes the view window to match the values of the data. To get around this, we must first turn off the auto window. To do this, get into the STAT Menu and press SHIFT MENU to get to the set-up screen for the STAT MENU. The first line should say AUTO, we want to change this to MAN by pressing F2 [MAN]. Press [EXIT] and F1 [GRPH], then press F6 [SET]. This is where we will tell the calculator which lists to use for each of the STATGRAPHS. For STATGRAPH 1, the X-LIST should be LIST 1, the Y-LIST should be LIST 2, and the color should be BLUE. For STATGRAPH 2, the X-LIST should be LIST 1, the Y-LIST should be LIST 3, and the color should be changed to orange. For STATGRAPH 3, the X-LIST should be LIST 1, the Y-LIST should be LIST 4, and the color should be changed to green. To graph all three graphs at once, press the [EXIT] key and then the F4 [SEL] key. Now select all three STATGRAPHS by highlighting them and pressing F1 for ON.

Now you will need to make sure that the view window is set up correctly. To do this check the data in the lists and find the maximum and minimum values of the temperature, these values will be the Y-min and Y-max for the viewing window. The X-min and X-max will not have to be changed since the time data that was collected didn't change. Once the new window is entered, draw the first 3 STATGRAPHS.

Once you have all three of the STATGRAPHS drawn, we will need to store these so that we can graph the other set of data. Press the [OPTN] key and press F1 [PICT]. Press F1 [STO], then press one of the F keys, depending on which PIC you want to store it as. Now the three graphs are stored as a picture.

The next thing that we must do is graph the final set of data, we only have one set but could have at most two more sets to graph. Press the [EXIT] key, then press F6 [SET]. This will allow you to change the lists in the STAT GRAPH setup. We want the X-LIST to remain LIST 1, but our Y-LIST changes to LIST 5. We also want to change the MARK TYPE from a box to the "X". This will allow us to differentiate it from the other graph of the same color. Press the [EXIT] key, and press F1 to draw the graph. Now, press the [OPTN] key so that we can recall the picture of the other three graphs. Notice that we can only trace on the graph that is graphed, and not on the graphs that are stored as pictures.

For a more in depth look into these techniques, try to come up with different ways to compare the different data sets.

Dave Barron of Casio, Inc developed this activity.

Questions and Problems:

Level 1: Answer the following questions in complete, well-structured sentences.

1. Explain how an individual's data compares to that of the group's.
2. How does the average of the group's temperature compare to the accepted value?

Level 2:

1. Explain 3 ways you could improve the procedures for this lab. (What are 3 sources of error?)
2. Calculate the percent difference of your classes average body temperature to that of the average of 37 degrees Celsius.
3. Doctors can take a person's temperature in a variety of ways. Discuss the various other methods and explain why these might be better or worse.

Extension: Have students take their temperatures in different ways. For example, place the probe in a person's armpit, hold the probe between the upper and lower arm by placing it in the elbow joint and have the student touch their shoulder with their fingers.

Test to see how physical exertion effects body temperature. Have students run in place for several minutes then take their temperature.