EXPLORATIONS

Activity 5

Light and Day

Math Concepts

- Measurement
- Data analysis

Science Concepts

- Data collection
- Experimental design
- Environmental science

Materials

- TI-73 calculator
- CBL™
- Light probe
- Temperature probe
- Data link cable
- Program **TEMLITE.73p**
- TI-GRAPH LINK™ (optional)

In this activity, you will:

- Collect data for time, temperature, and light over a long period of time
- Explore the relationships between and within the data
- Discover the relationships of temperature with sunrise and sunset as reported by news sources and as measured by the light probe
- Look at long term relationships in the environment

Introduction

Weather is an important part of life. As it changes, you are forced to change to be comfortable existing in it. In this investigation, you will explore the patterns in temperature as the Earth moves from day to night and back to day again. Based on weather data collected over time, you will discuss how weather is analyzed and predicted.

The Problem

Collect data about the environment in your town over a long period of time using the CBL with two probes (light and temperature). This will help you see what happens to the temperature as the sun goes down, and as the sun comes up. You will also get some idea of the climate at your location as compared to the general city (as reported by the weather station or the

newspaper). You will need to do some research about sunrise, sunset and high and low temperatures for your town, as well as collect information on the phase of the moon, and information about clouds, wind, and rain.

The Set Up

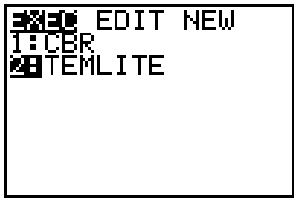
1. You first need to plan the data collection. Locate a place that the CBL™ with the two probes can be set up for a long period of time without being disturbed. The location should not have any bright light sources (streetlights) that would contaminate the light probe, and it should be where you can expose the temperature probe to the outside air.
2. Once this location is found, the next step is to decide on a starting and ending time. This will need to be long enough to collect a sunrise and a sunset, and the experiment should be started far enough away from each event so that you will have data on light and temperature as you approach these events. Look in the newspaper, or watch the TV weather reports to get information on the time for sunrise and sunset on the days you wish to collect data. Contact the local weather bureau or your local airport for additional or more specific information.
3. You will now need to figure out how often to collect data for the time period you selected. In the case of a 25-hour experiment (which is 1500 minutes) you could collect data every 15 minutes for 100 data points. Remember that the largest number of data points that you can collect and store in the CBL is 512, and that 100 to 300 points should be all that are needed for the experiment even if it lasts for more than 24 hours. For the record, it would also be useful to know other information on the conditions of the experiment.

✎ Record the information you have determined in question 1, and the conditions of the experiment in the table in question 2 on the student data sheet.

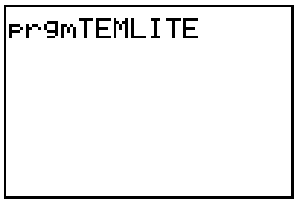
Activity

Collecting Data

1. With the light and temperature probes, the CBL, the link cable, and the TI-73 with the **TEMLITE.73p** in it, you are now ready to set up the experiment.
   a. Press [CLEAR] [CLEAR] to get a clean Home screen.
   b. Press [PRGM] and select the **TEMLITE** program from the **EXEC** menu.

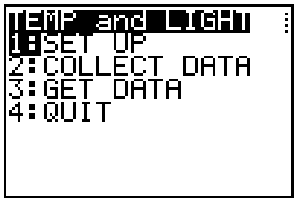


c. Press ENTER to start the program.

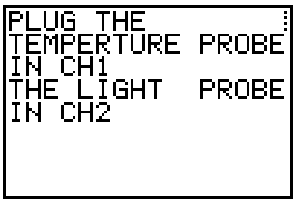


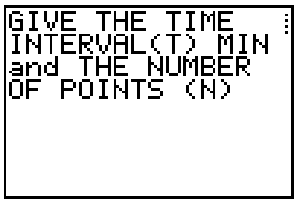
2. You will have to set up the program, telling the TI-73 what you want to do and when you want to do it.

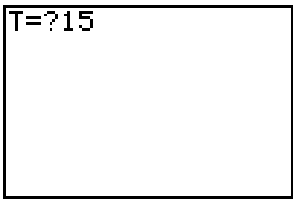
a. Select **1:SET UP** from the **TEMP** and **LIGHT** menu.

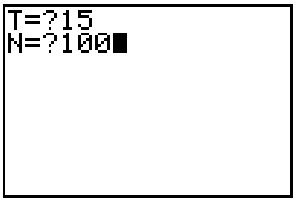


b. Follow the instructions on the screen, pressing ENTER when finished reading or keying in values. In this case, set up the calculator to collect data every 15 minutes (**T**) for 100 data points (**N**). This is then 15*100 minutes, which is 25 hours.







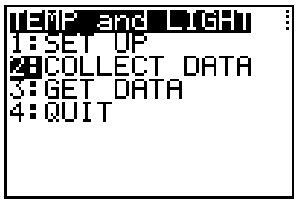


✎ Verify the time for data collection that you wanted, and record the values entered and displayed in the table in question 3 on the student data sheet.

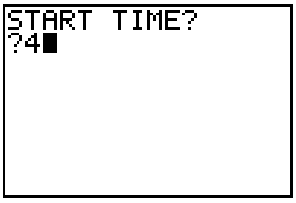
3. The memory of the CBL™ will be cleared when you run this next option, so if you have data from a previous experiment in the CBL, you will need to "**GET**" it before you continue. (To "**GET**" data, see step **6b**.)

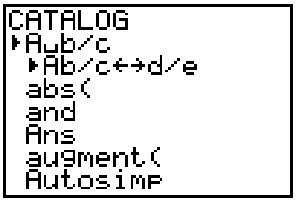
4. Make sure the TI-73 and probes are connected to the CBL, and the CBL is turned on. It is wise to be in the location where you will collect data when you do the set up, but this is not required. When you are ready to collect data, the temperature probe will have a chance to adjust to the surrounding air and give a reading for this location and not be in transition.

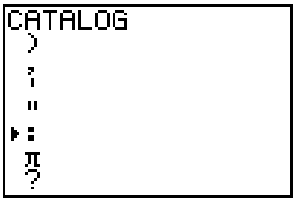
a. From the **TEMP** and **LIGHT** menu, select option **2:COLLECT DATA**.

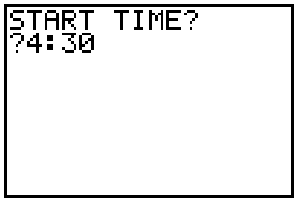


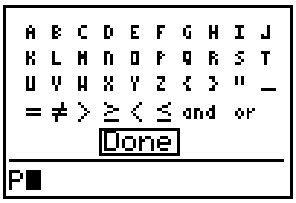
b. Key in the time of day that you plan to start the experiment and the time of day that you plan for it to stop. Use the keyboard and the text editor, with the catalog options to get in the correct times into the categorical list. Press the hour (in this case 4) and then get the colon from the **CATALOG** menu. Press 2nd [CATALOG] and ▲ until you see the desired symbol and then press ENTER. Continue with the rest of the time (3 0) and then key in the letter for a.m. or p.m. from the text editor by pressing 2nd [TEXT], selecting the letter **A** or **P** and then the word **Done**.

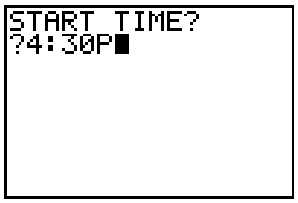


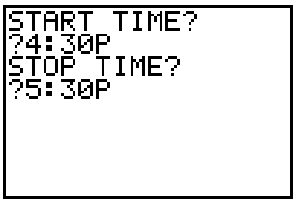






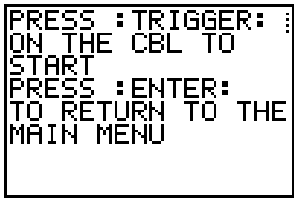




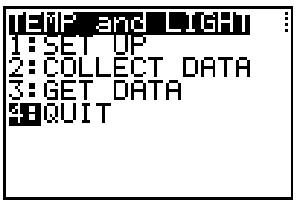


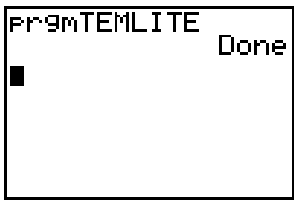
c. Repeat the process for the end time (press ENTER from the Home screen to accept that value).

5. After you enter the last time, you will get the message shown below.



a. Press ENTER, and select option **4:QUIT** from the **TEMP** and **LIGHT** menu.





b. Disconnect the calculator from the CBL™ and position the device with the probes to start the experiment.

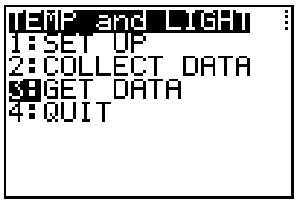
c. Press TRIGGER on the CBL™ when you are finished with the set up and ready to collect data. The CBL should show a value for the temperature in degrees Celsius and read **SAMPLING** with **CH1** and **CH2** selected. If this is not the case, run the program again, and try the option again to collect data.

6. After the time has elapsed for the experiment, the CBL will turn off. If it still reads **SAMPLING**, then wait a bit for **DONE**. If the CBL is off and you turn it on, you should see the last temperature collected and the word **DONE**.

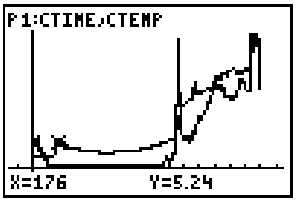
7. The next step will erase the lists in your calculator that are named **CLITE**, **CTEMP**, and **CTIME** (if you have these lists from prior experiments). If you have any data in these lists that you wish to keep, use the TI-GRAPH LINK™ to store them, or write a program to hold the data.

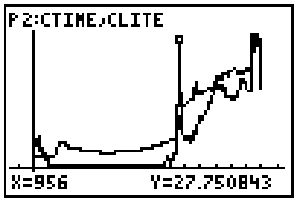
a. When the CBL is ready and your calculator is clear to go, connect the CBL to the TI-73 and run the **TEMLITE** program as before.

b. Select option **3:GET DATA** from the **TEMP and LIGHT** menu.



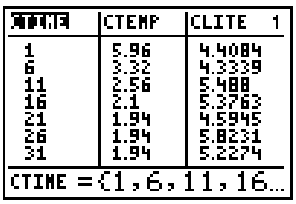
c. When the data is transferred to the calculator, you may trace along the graph that is displayed. The two plots are of time versus temperature and time versus light.





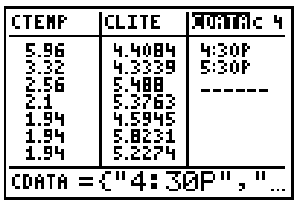
d. When finished exploring the data, press ENTER and leave the program as before.

e. To look at the values in the list, press LIST.



	CTEMP	CLITE
1	5.96	4.4084
6	3.32	4.3339
11	2.56	5.488
16	2.1	5.3763
21	1.94	4.5945
26	1.94	5.8231
31	1.94	5.2274

CTIME ={1,6,11,16...



CTEMP	CLITE	DATA
5.96	4.4084	4:30P
3.32	4.3339	5:30P
2.56	5.488	------
2.1	5.3763	
1.94	4.5945	
1.94	5.8231	
1.94	5.2274	

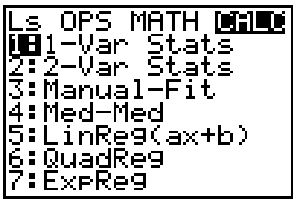
CDATA ={"4:30P","...

✎ Answer questions 4-6 on the student data sheet.

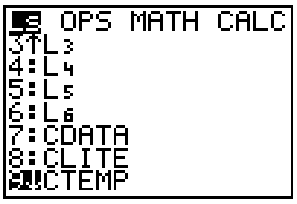
Analyzing the Data

1. Now that you have the data for temperature and light over a cycle of the sun, you can begin to analyze. From a clear Home screen, you can have the TI-73 calculate the statistics on the list with the temperatures (**CTEMP**).

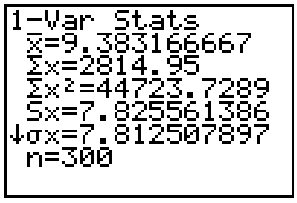
a. Press [2nd] [STAT] [◄] and select option **1:1-Var Stats** from the **CALC** menu.

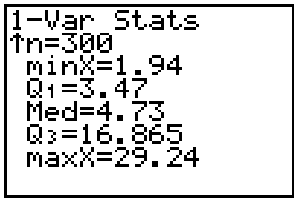


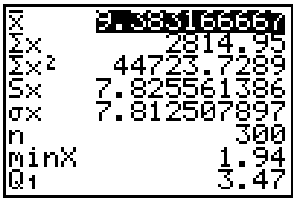
b. Identify the list to do this calculation on by pressing [2nd] [STAT] again and selecting the **CTEMP** list from the **Ls** menu.



c. Press [ENTER] to have the calculation made.





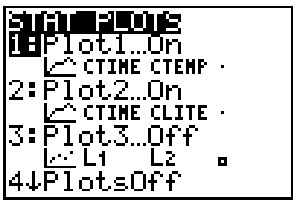


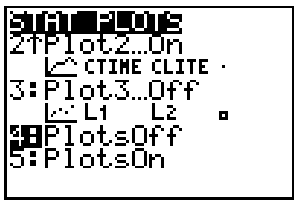
d. Use the cursor to move up and down on this data to examine it, and press [CLEAR] to have a line-by-line display.

✎ Copy the data from your calculator into the table in question 7 of the student data sheet.

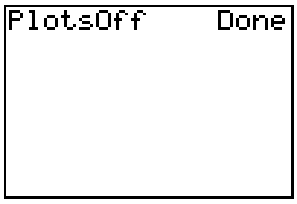
2. Since there are two plots turned on as a result of running the **TEMLITE** program, you will need to turn all of the plots off to do the next step.

a. Press [2nd] [PLOT] and select option **4:PlotsOff** from the **STAT PLOTS** menu.



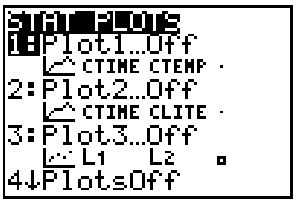


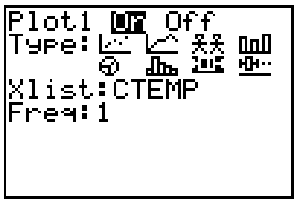
b. Press ENTER to execute the command.



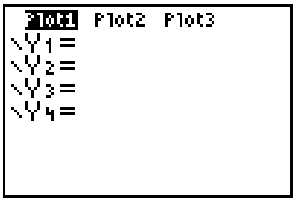
3. With all of the plots turned off, set up **Plot1** as a box-and-whiskers graph of the temperature data to get a visualization of the one-variable statistics just calculated.

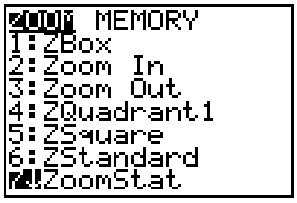
a. From the Home screen, press 2nd [PLOT] ENTER and set up the screen as shown below. Recall that you can get the names of the lists by keying them in or from the **LS** menu (2nd [STAT]).





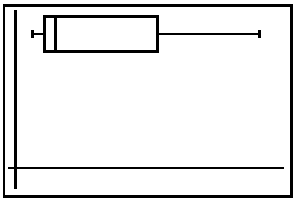
b. Check the **Y=** editor to see that no functions are turned on (Y=), and then set the screen by selecting the **7:ZoomStat** option from the **ZOOM** menu (ZOOM).

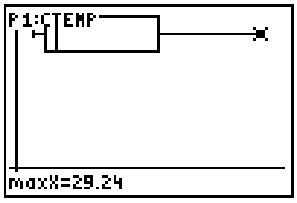




c. Press TRACE and explore the data.

✎ Answer question 8 on the student data sheet.

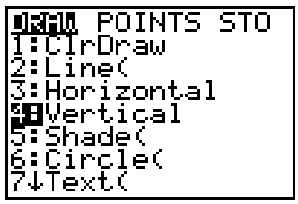


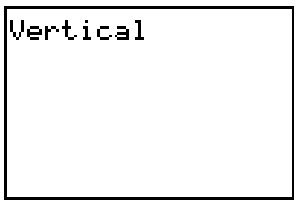


4. Compare the middle temperature (the median) with the average temperature (the mean). One way to do this is to look at the box-and-whiskers graph with the mean shown on the graph as a vertical line.

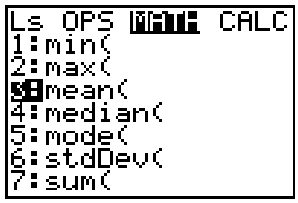
a. Press CLEAR CLEAR CLEAR to clean the Home screen.

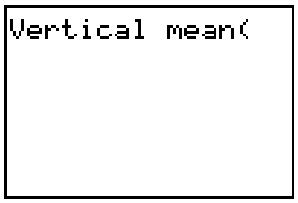
b. Select the vertical line drawing tool by pressing [DRAW] and selecting option **4:Vertical** from the **DRAW** menu.



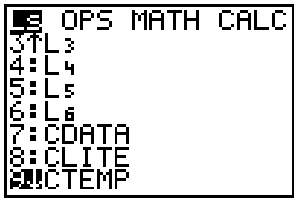


c. Select the value of the mean of the temperature list by pressing [2nd] [STAT] ▶ ▶ and selecting option **3:mean(** from the **MATH** menu.

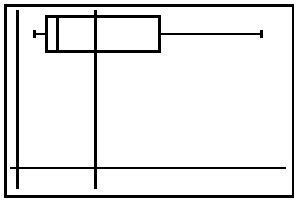




d. On the Home screen, identify the list that needs to provide the mean by pressing [2nd] [STAT] and selecting the list named **CTEMP** from the **Ls** menu.



e. To draw the line, press [ENTER] on the Home screen.

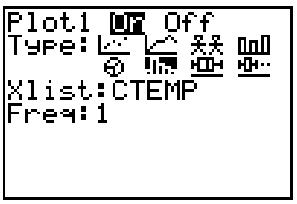


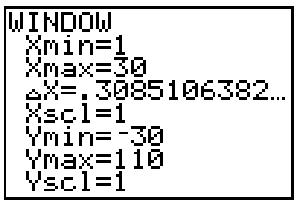
✎ Answer questions 9 and 10 on the student data sheet.

5. You can also look at the data for temperature using another type of graph called a Histogram.

a. Change the set up of **Plot1** as shown on the next page and adjust the window settings manually as shown. In this case, look at the temperatures from 1 to 30 degrees and have them spread out by

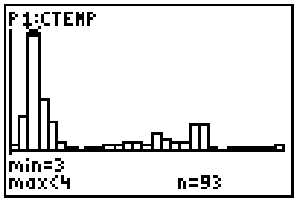
1-degree steps (**Xscl**). Since the sample below had 300 data points, the **Ymax** (the most temperature points in one 1-degree step) is estimated to be 100.





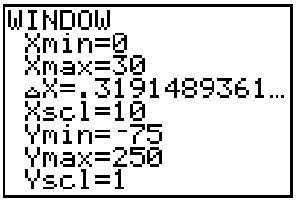
b. Experiment with the window settings to get a nice graph.

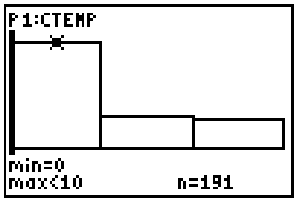
c. Press [2nd] [PLOT] [ENTER] to modify the plot and then [WINDOW] to change the values and then [TRACE] to see the graph and to explore.



✎ Answer question 11 on the student data sheet.

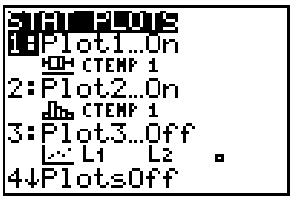
6. If you adjust the **Xscl** on the window settings, you can group the temperatures. (A logical grouping would be by 10-degree steps.) Do this with your data.

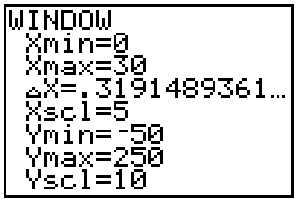




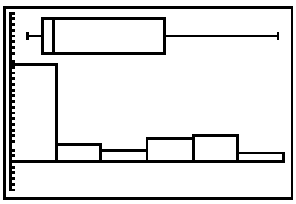
✎ Answer question 12 on the student data sheet.

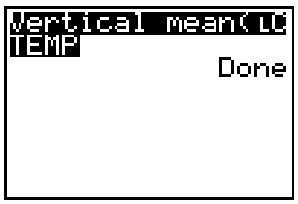
7. Compare both types of plots that you have just explored on the temperature values with the mean temperature displayed as before with a vertical line. To do this, follow the previous steps (**3** and **5**). Set up **Plot1** and **Plot2** as shown below and modify the window.



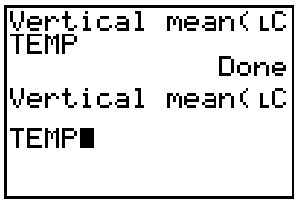


a. From the Home screen, use the ▲ key to locate the vertical line command.

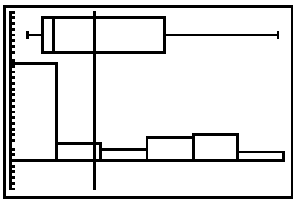


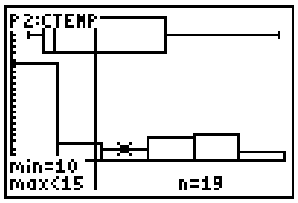


b. Press ENTER to select it and ENTER to execute it.

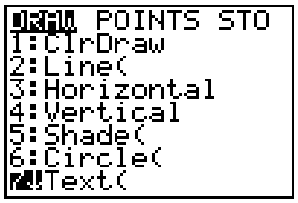


c. Explore the graph using TRACE and switch between the two graphs using the ▼ ▲ keys.

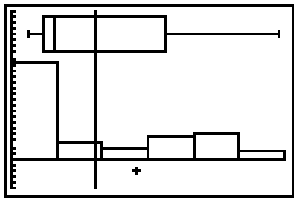


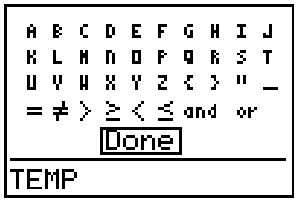


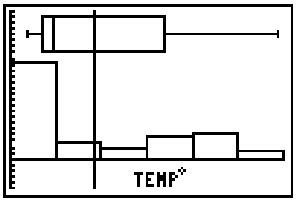
8. You can add some text to the graph by pressing DRAW from the graph screen and selecting option **7:Text(** from the **DRAW** menu.



a. Move the cursor to the desired location and use the text editor (2nd [TEXT]) to identify the letters needed, selecting the word **Done** when finished.

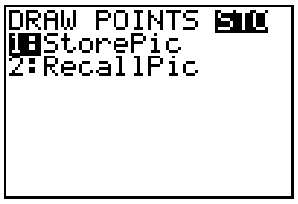






b. Move to other locations to add other words.

c. When finished, store this image as a **Pic**.



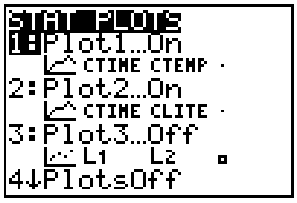
d. Leave the Graph Screen by pressing [2nd] [QUIT].

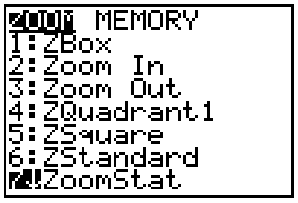
e. Press [DRAW] [◂] and select option **1:StorePic** from the **STO** menu.

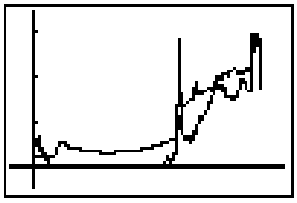
f. Identify the name of the Pic ([1]) and then press [ENTER].

✎ Answer question 13 on the student data sheet.

9. To return to the data for light and temperature as related to the time of day that it was collected, and to see how the sunset and sunrise affected the data, you need to set up your plots as they were when you took the data off the CBL™. Set up the plots as shown below and use **7:ZoomStat** to view them.



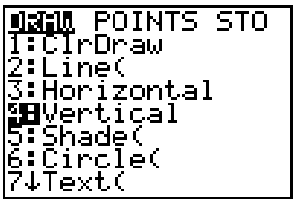


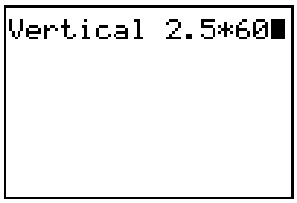


10. Notice the drop and rise in the light levels. These might be related to the sunrise and sunset.

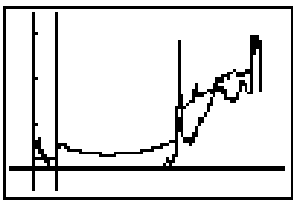
a. Calculate the number of minutes after the start of the data collection that the sunset occurred.

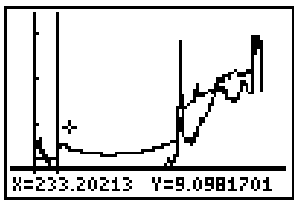
b. Place a vertical line on the graph, from the Home screen as before.



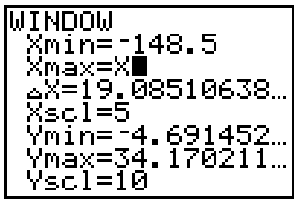


c. Then focus on the data around this time by just moving your cursor as shown in the image below.



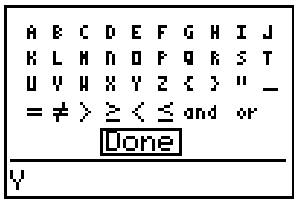


d. Press [WINDOW] and move to the **Xmax** location.

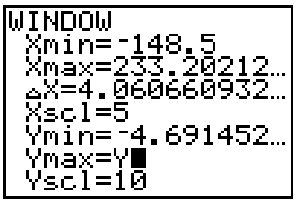


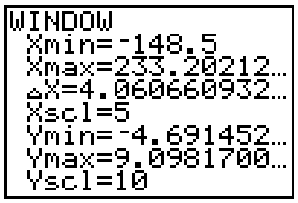
e. Press [x] and [ENTER].

f. Move to the **Ymax** line and bring up the value for **Y** by using the text editor as before.

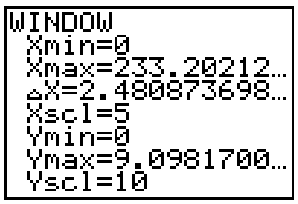


g. Press [ENTER] to paste that value into the window.

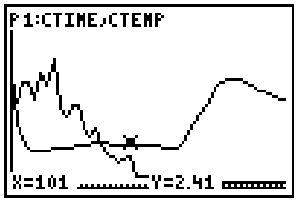




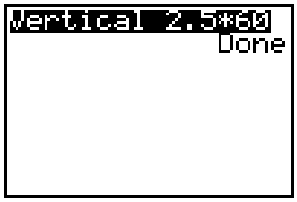
h. Now set the **Xmin** and **Ymin** to more appropriate values (**Xmin** = 0 but **Ymin** might not).

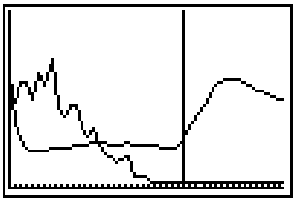
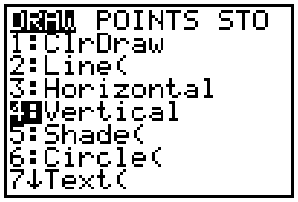


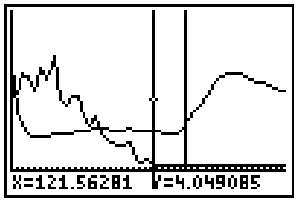
i. Go to the graph and explore by pressing [TRACE].



11. Place the line for the sunset back on this graph by returning to the Home screen, pressing CLEAR CLEAR and using the ▲ key to get to the previous command for the vertical line. Press ENTER ENTER to select it and then execute it again. How does the line match with the decrease of the light levels? From the graph screen, select the vertical line tool and move around to help find a "better" sunset time. Press ENTER to drop the line when you have positioned it.



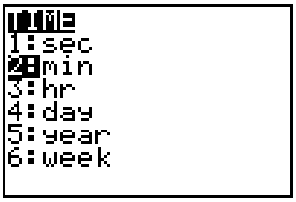


✎ Answer questions 14-20 on the student data sheet.

12. The location of the vertical line you placed on your graph should be stored in the variable **X** (time).

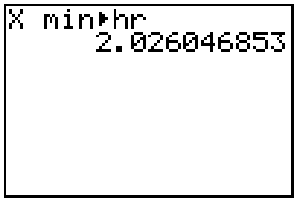
a. To see what time this is, press CLEAR CLEAR *x* 2nd [CONVERT] on the Home screen and select option **4:Time** from the **CONVERSIONS** menu.

b. Select option **2:min** and then **3:hr** from the **TIME** menu.



c. Press ENTER to get the number of hours after the start of data collection that the sun went down.

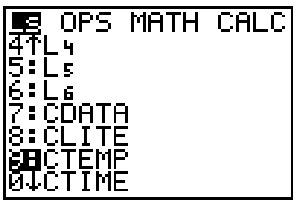
✎ Answer question 21 on the student data sheet.

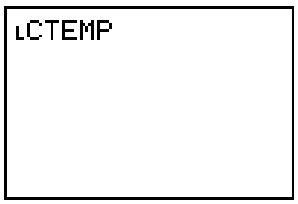


Converting Data

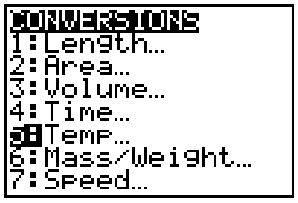
1. Since we use temperatures in Fahrenheit rather than Celsius in the U.S., you might want to examine the data that you collected in those units. To use the **Convert** options to do this, follow these steps.

a. From the clean Home screen, select the list that has the temperature values in it (**CTEMP**). Press [2nd] [STAT] and select the list from the **Ls** menu.

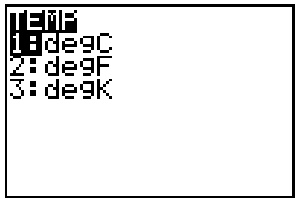


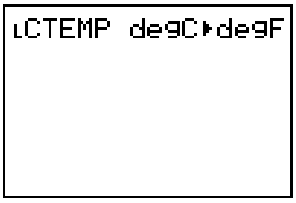


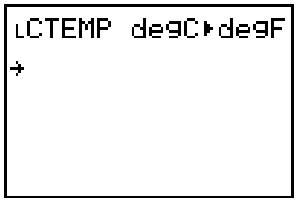
b. Press [2nd] [CONVERT] and select option **5:Temp** from the **CONVERSIONS** menu.

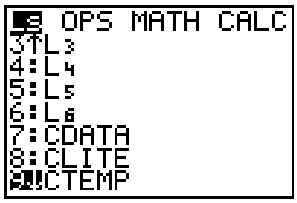


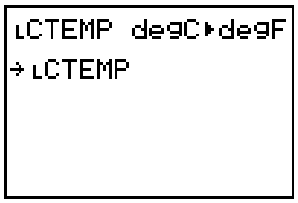
c. Select option **1:degC** and then option **2:degF** from the **TEMP** menu.

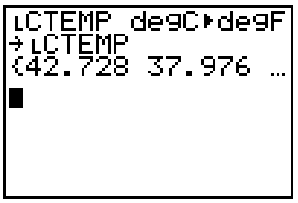








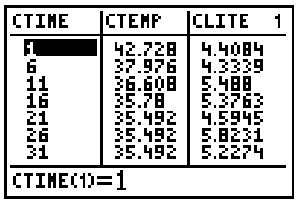




d. From the Home screen press [STO▸] and then pick the list **CTEMP** by pressing [2nd] [STAT] and selecting it from the **Ls** menu.

e. Press [ENTER] at the Home screen to get this new set of Fahrenheit values stored in the list for temperatures.

f. Check these values by pressing [LIST] and looking up and down the list.



✎ Answer question 22 on the student data sheet.

Going Further

1. If you collect data from noon on one day to 3 p.m. on the next and needed 277 data points, how many seconds would you need between data points? How many minutes? How many minutes and seconds long would the experiment last?
2. Relate the Mode of the temperatures collected to the Mean and the Median calculated in the investigation.
3. Do one-variable statistics for the data in the list for light (**CLITE**).
4. Make a graph showing the data in the list of light data (**CLITE**) as both a histogram and a box-and-whiskers plot. Report the window used.
5. Repeat the analysis of the light and temperature as the sun came up, in a similar fashion to the examination of the light and temperature as the sun set.
6. Convert the list for time (**CTIME**) from minutes to hours using the Convert options on the TI-73. Report the new times.

Student Data Collection and Analysis Sheet

Name(s)_____

Date _____

Activity 5

Light and Day

1. Complete the table below.

Date of Start of Experiment	
Sunset Time	
Sunrise Time	
Start Time	
End Time	
Total time for experiment	
Time Interval for data collection	
Number of data points	
Date of End of Experiment	

2. Experimental conditions for the experiment:

Are the probes inside a building or outside? _____

If the probes are inside, will the room be heated or cooled during the time of data collection? _____ Will there be people in the room during the data collection times? _____.

If the probes are outside, what phase will the moon be in?

_____

What are the predicted weather conditions for the time of data collection?

_____

_____

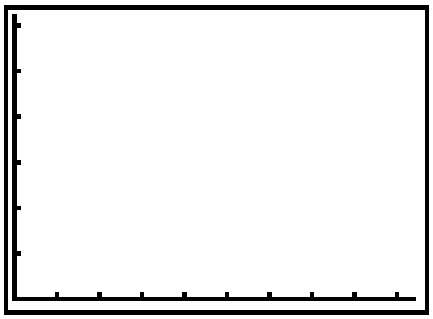
In either case, make a sketch below that will show the location of the CBL™ with the probes, and the location of any light or temperature source that might affect the collection of data. Make sure you show the orientation of the probes relative to these potential sources and that you label all parts of the sketch.

3. Complete the table below:

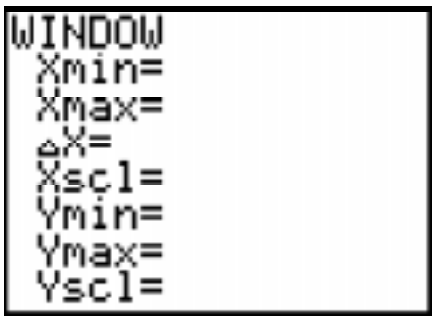
Item	Value Entered or Reported
T	
N	
Hours for data collection	

4. Store the data from the experiment using the TI-GRAPH LINK™. Save all four lists **CDATA**, **CLITE**, **CTIME**, and **CTEMP**, or write a program to store the list (see *Appendix A: Saving Lists*)

5. Make a sketch of the data graph that appears after the data is transferred from the CBL to the TI-73, or capture the image with the TI-GRAPH LINK and print it.



6. Give the window for this graph in the table below, or use the TI-GRAPH LINK™ to grab the **WINDOW** screen and print.



7. Complete the table for the one-variable statistics on the temperature:

Measure	Symbol	Value
Mean Temp	$\bar{x}$	
Sum of Temp	Σx	
Sum of the Squares of Temp	Σx^2	
Standard Deviation (Sample)	Sx	
Standard Deviation (Population)	σx	
Number of Temps	n	
Minimum Temp	minX	
First Quartile	Q_1	
Median Temp	Med	
Third Quartile	Q_3	
Maximum Temp	maxX	

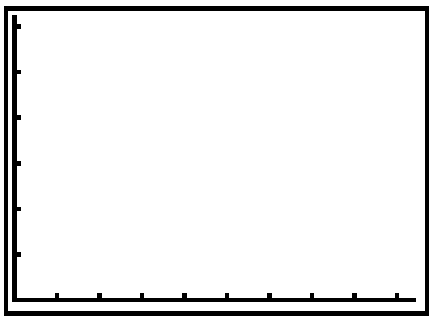
8. How much did the temperature vary over the time period?

_____

_____

What is the range of values for the temperature? _____

9. Make a sketch of the box and whiskers graph below with the mean displayed. Either sketch it in the space below, or print it using the TI-GRAPH LINK™.



10. Describe, in words, the relationship between the mean of the temperatures collected and the median of the temperatures.

_____

_____

_____

11. Fill in the table below showing the number of values for temperature that fall in each temperature range. If your data did not allow for 1-degree steps, set the graph and fill the table with the values you could use (2-degree steps, 3-degrees steps, and so forth). Use the lowest value possible.

Temp.												
Freq												

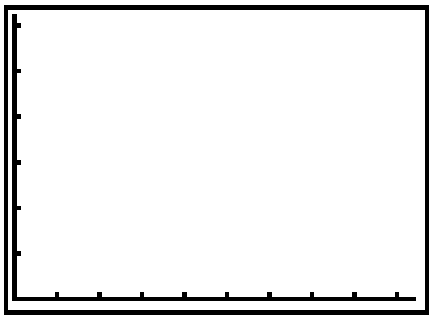
Temp.												
Freq												

Temp.												
Freq												

12. Fill in the table below for the temperatures when grouped by 10-degree steps.

Temperature	-20 to -10	-10 to 0	0 to 10	10 to 20	20 to 30	30 to 40	40 to 50
Frequency							

13. Save the **Pic** you stored to the computer using the TI-GRAPH LINK™ if available and make a sketch of it with the information on the window settings below (or print the screen with the graph and the screen with the window).



14. Give the time of day the sun set on your experiment: _____

Give the time of day that you started your experiment: _____

Give the number of minutes between the two events stated above: _____

15. Save and print the graph of the data around sunset using the TI-GRAPH LINK™ or sketch it.

16. How many minutes after the start of the experiment did your graph indicate a drop in light? _____

What time of day was that? _____

How close was the sunset time reported by the media and the sunset time indicated by your data?

_____

_____

17. How much time did it take for the sun to "go down"? _____

How do you get that value? _____

_____

18. What happened to the temperature as the light level dropped around sunset?

_____

_____

19. Did anything unusual happen to the light or temperature levels during the night? When?

_____

_____

_____

20. Write a description for 3 hours of the experiment. Explain the changes of light and temperature during this time period and use actual data points to make your point.

_____

_____

_____

_____

_____

_____

_____

21. How long after the start of data collection did your new vertical line indicate the sunset? _____

What time of day was this? _____

22. Complete the table below based on a recalculation of the one-variable statistics on the list of temperatures now in Fahrenheit.

Measure	Symbol	Value
Mean Temp	$\bar{x}$	
Sum of Temp	Σx	
Sum of the Squares of Temp	Σx^2	
Standard Deviation (Sample)	Sx	
Standard Deviation (Population)	σx	
Number of Temps	n	
Minimum Temp	minX	
First Quartile	Q_1	
Median Temp	Med	
Third Quartile	Q_3	
Maximum Temp	maxX	

Teacher Notes

Math Strands: Measurement, and Data Analysis

Students will collect data for time, temperature, and light over a long period of time and then explore the relationships between the different kinds of data and within the data.

Science Strands: Data Collection, Experimental Design, and Environmental Science

The relationships of temperature with sunrise and sunset as reported by news sources and as measured by the light probe will be examined. The ability to collect information over time and how that can reflect changes in the environment will also be investigated.

Classroom Management and Safety

The data should be collected over at least a 24 hour time period. This will require the TI-73 to have enough free memory to hold all the data and that the CBL™ be placed in a secure location for that amount of time. The TI-73 will be detached from the CBL during the data collection period. Since a great amount of time has been invested, care should be taken to ensure that the information is taken from the CBL and stored in several locations. The CBL should not be re-Triggered or otherwise restarted until this information is removed. Avoid very bright light sources and water as the CBL and probes are left to collect data over night. The CBL will only collect 512 data points for storage, so don't exceed this amount.

The Set Up

- The location of the CBL data collection may need to be at the student's home or in a place away from the school to help avoid the bright lights and traffic around school.
- It may be best to collect data over the weekend, or to have several setups to collect data over the same period.
- The Internet and the local airport will be good sources of information to supplement the newspaper. The information on sunrise and sunset will be very specific to your location and the season that the data is collected in may have some significant effect on the specifics.
- Use of the AC adapter that comes with the overhead calculator unit, or that you can buy as an add-on with the CBL might be good to avoid lost data if your batteries go down.

Activity

- If the students decide to collect a lot of data, they will have memory problems with the TI-73. Make sure they don't exceed the 512K limit and that the calculator is as empty as possible. Use the TI-GRAPH LINK™ to save and store data that will be needed later.
- The program displays the data for time in minutes, the temperature in degrees Celsius and the light in arbitrary units compatible with the magnitudes of the temperatures.
- The Mode on the TI-73 may need to be adjusted from **Float** (the program setting) for younger students. This should be done after the data collection.
- The use of calculated statistical values is based on the most recent calculations made using the **Stat** options. The effect of this is that students may need to recalculate the statistics on a list or set of lists if the investigation last more than one class. If the calculator has been doing other things between the steps described above, then they may have to recalculate.
- In setting up a Histogram, it is important to pick a **Xscl** that will work with your data. If the value is small relative to the range of values, an error will occur. Since there are only 94 pixels on the screen, an effort to make the calculator draw more columns for the Histogram than this allows will create an error. Since the bars are drawn from left to right, if 30 is one value you want shown and you are using a **Xscl** of 1, **Xmax** must be at least 31.

Student Data Collection and Analysis Sheet – Key

1. Table Values

Date of Start of Experiment		Month-Day-Year
Sunset Time		6:15 PM
Sunrise Time		6:22 AM
Start Time		4:00 PM
End Time		5:00 PM
Total time for experiment		25 hrs = 1 500 min
Time Interval for data collection		15 min
Number of data points		100
Date of End of Experiment		Month-Day-Year

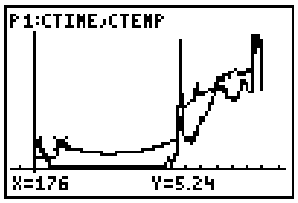
2. Answers will vary.

3.

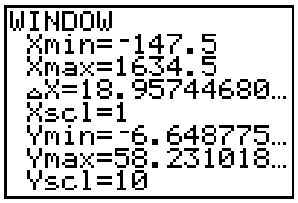
Item	Value Entered or Reported
T	
N	
Hours for data collection	

4. Location of the files (the four lists).

5. A sketch of the Time vs. Temperature and Light graph with labels and values. (Time is in minutes, temperature is in Celsius, and light is arbitrary units.)



6. The Window from the graph.

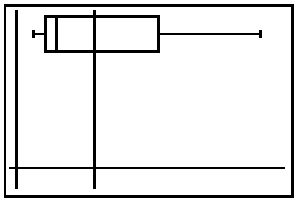


7.

Measure	Symbol	Value
Mean Temp	$\bar{x}$	9.4
Sum of Temp	Σx	2815
Sum of the Squares of Temp	Σx^2	44 724
Standard Deviation (Sample)	Sx	7.83
Standard Deviation (Population)	σx	7.81
Number of Temps	n	300
Minimum Temp	minX	1.94
First Quartile	Q_1	3.47
Median Temp	Med	4.73
Third Quartile	Q_3	16.87
Maximum Temp	maxX	29.24

8. Answers will vary.

9. A graph that looks like this:



10. Look for information describing the arrangement from the graph to have meaning. The mean in the example above is to the right of the median since there where a lot of cool temperatures, in a small range, and then the variation in the larger temperatures were greater. Look for the use of the actual values (mean of 9.3 degrees and a median of 4.7 degrees).

11. See **DAYLITE.73p**

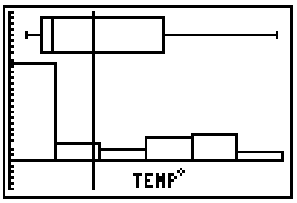
Temp.												
Freq												

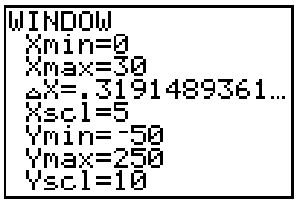
Temp.												
Freq												

12. See **DAYLITE.73p**

Temperature	-20 to -10	-10 to 0	0 to 10	10 to 20	20 to 30	30 to 40	40 to 50
Frequency							

13. Look for **Pic** name and location and then a sketch with a window like this:





14. Answers will vary.

15. Name and location of files or program.

16. Answers will vary.

17. Answers will vary.

18. It dropped also.

19. Answers will vary.

20. Answers will vary.

21. Answers will vary.

22. Answers will vary.

Going Further – Key

1. About 351 seconds

About 5.85 minutes or 6 minutes

About 5 minutes and 51 seconds

27 hours; 1620 minutes; or 97 200 seconds and if you select 277 data points 6 minutes apart you have 27 hours 42 minutes.

2. mode = 3.62, mean = 9.3832, and median = 4.73

3. Similar data as shown on the 1-Variable Statistics on light (see table).

4. Similar graph as shown with the temperature data.

5. Answers will vary.

6. Answers will vary.

TEMLITE.73p

```
3-22-98
DAY
CoordOn:GridOff:AxesOn:LabelOff:ExprOn:Normal:Float:Degree:A␣b/c:Autosimp
SetUpEditor ʟCTIME,ʟCTEMP,ʟCLITE,ʟCDATA
ClrScreen
Lbl Ø
Menu("TEMP and LIGHT","SET UP",1,"COLLECT DATA",2,"GET DATA",3,"QUIT",4)
Lbl 1
Output(1,1,"PLUG THE        TEMPERTURE PROBEIN CH1")
Output(4,1,"THE LIGHT  PROBEIN CH2")
Pause
ClrScreen
Output(1,1,"GIVE THE TIME   INTERVAL(T) MIN and THE NUMBER  OF POINTS (N)")
Pause
ClrScreen
Prompt T,N
T*6Ø→T
ClrScreen
Output(3,1,"YOUR TIME FOR   DATA COLLECTION IN HOURS")
TN/36ØØ▸F↔D→H
Disp H
Pause
Goto Ø
Lbl 2
Clear Home
{"START","STOP"}→ʟCDATA
Disp "START TIME?"
Input ʟCDATA(1)
Disp "STOP TIME?"
Input ʟCDATA(2)
Send({6,Ø})
Send({1,Ø})
Send({1,1,1})
Send({1,2,1})
Send({3,T,N,1,Ø,Ø,Ø,Ø,1,Ø})
ClrScreen
Output(1,1,"PRESS :TRIGGER: ON THE CBL TO   START")
Output(4,1,"PRESS :ENTER:   TO RETURN TO THEMAIN MENU"
Pause
ClrScreen
Goto Ø
Lbl 3
ClrScreen
Get(ʟCTEMP)
Get(ʟCLITE)
Get(ʟCTIME)
PlotsOff :FnOff
round(ʟCTIME/6Ø,Ø)→ʟCTIME
ʟCLITE*(max(ʟCTEMP)/max(ʟCLITE))→ʟCLITE
Plot1(xyLine,ʟCTIME,ʟCTEMP,·)
Plot2(xyLine,ʟCTIME,ʟCLITE,·)
ZoomStat
Pause
Goto Ø
Lbl 4
Clear Home
Stop
```

***Note**: Sample data is in a program named **DAYLITE.73p**.*
*This and all other programs are available for download on TI's website at: **http://www.ti.com/calc***