Datalogging
with Handheld Technology.

KS3 Science
Unit 7C
Environment and feeding relationships
Measuring physical environmental factors

This year 7 unit provides many opportunities for datalogging with a variety of sensors, as can be seen from the following extract in the QCA specification:

How do environments vary?			
Learning Objectives	*Possible Teaching Activities*	*Learning Outcomes* Pupils	*Points To Note*
◆ that some animals are adapted to daily changes in their habitat ◆ how to measure and record changes in environmental factors ◆ how to interpret patterns in data	◆ Ask pupils to predict how physical environmental factors around the school, *eg light intensity, temperature, humidity, noise levels,* would change over a 24-hour period and how they could measure the changes. With pupils, set up instruments, *eg datalogging equipment with a light probe, automatic weather station, temperature and sound sensors,* to monitor changes. Provide pupils with data about environmental changes around the school over a 24-hour period and help them to describe what these show and to identify links between the different changes.	◆ describe changes in physical environmental factors, *eg temperature, light intensity,* over a 24-hour period ◆ interpret data about daily changes and explain in simple terms, *eg beginning to get dark* ◆ relate changes in variables, *eg light and temperature,* to each other ◆ relate plant and animal activity to environmental changes	◆ There is an opportunity to use datalogging equipment. Secondary sources, *eg newspapers, Ceefax and geography weather stations*, could be used to confirm readings. ◆ Schools near the coast and by tidal rivers have an opportunity to focus on adaptations to changes in these habitats. ◆ Schools with CCTV may be able to monitor animal activity at night.

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Safety

- teachers will need to check pupils' plans for health and safety before practical work begins.
- all off-site visits must be carried out in accordance with school/LEA guidelines.

Datalogging kit

- TI-73, TI-82, TI-83 or TI-83plus graphing calculator.
- CBL or CBL2, with **fresh alkaline cells**.
- temperature, light, relative humidity sensors: microphone, (pH sensor, dissolved oxygen sensor).
- TI-GRAPH LINK™ software and cable to link to computer.
- chembio application (TI-83 plus) or program group (TI-73, TI-82 and TI-83).
- TI InterActive!™ or spreadsheet application.

Apparatus required

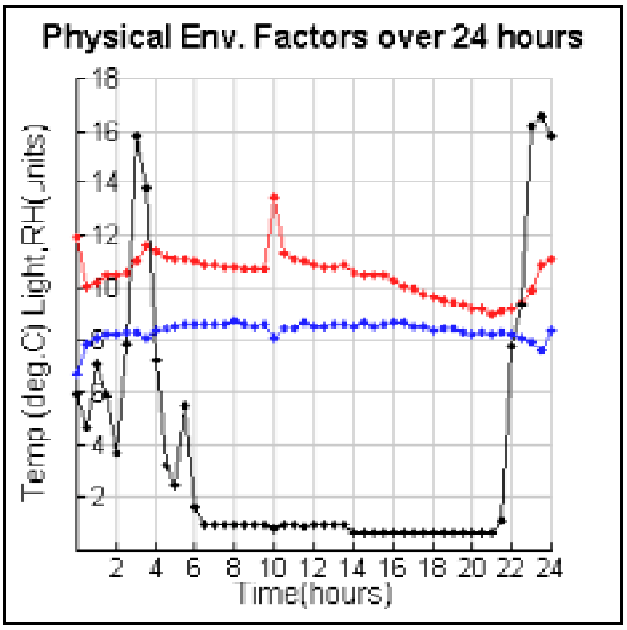
- plastic bag/waterproof housing for CBL/ CBL2.
- a variety of stands, clamps, bluetac etc. to keep sensors in position.
- flags/markers for seashore and riverside work.

Useful web sites

www.ti.com/calc/docs/graph.htm
www.vernier.com
www.oxford-educational.co.uk
www.qca.org.uk

Activity:
Measuring physical environmental factors.

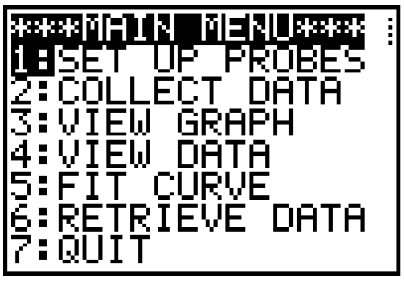
Because of the great variety of possible situations and habitats, this section will address the use of the CBL/CBL2 with multiple sensors over an extended period of time and will not concentrate on any specific activity. A combination of temperature, light and relative humidity sensors is appropriate for a school based or other terrestrial habitat. For small bodies of freshwater or rock pools, a pH sensor can be used in combination with temperature and light sensors. It is probably not appropriate to include a microphone in a multiple sensor set up because of the relatively long period of time between samples. Noise/sound levels can be investigated separately using a regime with more frequent sampling points.



In this example, lists containing captured data (time, temperature, light and relative humidity) have been transferred from the calculator to TI InterActive!™ and used to generate a graph. Lists can also be converted into .txt files using TI-GRAPH LINK™ and imported into spreadsheet applications.

Technique

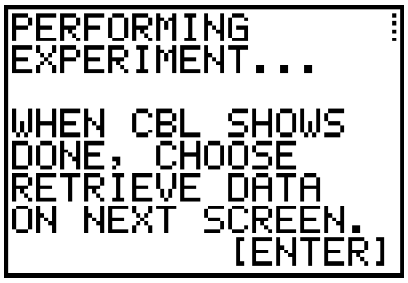
1. Attach the calculator to the CBL/CBL2.
2. Open the chembio application/program and press enter to get to the following screen:-



3. Select `SET UP PROBES` and follow the on screen prompts to place temperature sensor in channel 1, light sensor in channel 2 and relative humidity sensor in channel 3.
4. On the `CALIBRATION` screen, select `1:USE STORED`.
5. Select `2:COLLECT DATA` from the `MAIN MENU`.
6. Select `2:TIME GRAPH`.

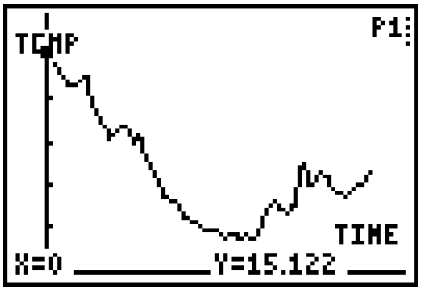
7. For a 24 hour sampling period, sampling every 15 minutes or 30 minutes works well. For 15 minutes enter 900 or (15*60) seconds. To record a data point at hour 24 (i.e.86400 seconds), enter 97 or (24*4)+1 samples; this will actually show an `EXPERIMENT LENGTH` of 87300.0S on the screen.
8. Select `1:USE TIME SETUP.`
9. `PRESS [ENTER] TO BEGIN COLLECTING DATA.`

The calculator will now display the following screen:-



The CBL screen can be used to trace the progress of the experiment. With the CBL2, however, it is necessary to keep a separate record of time as there is no screen.

10. Detach the calculator, leaving only the CBL/CBL2 and sensors on site.
11. Press `ENTER` and then `7:QUIT`. At this stage the TI-83 plus will show an `ERR:INVALID DIM` message: however, just press enter again to quit.
12. After sampling has finished (**and it is important for the CBL/CBL2 to have finished collecting data**), re-attach the calculator, enter the chembio application/program and select `6:RETRIEVE DATA` from the `MAIN MENU`. After the `MAKE SURE CBL SHOWS DONE` message, the screen will show `TIME IN L1, DATA IN L2, L3, L4.`



Pressing enter repeatedly will show time v. temperature, time v. light intensity and time v. relative humidity graphs in turn. Using TI-GRAPH LINK™, the screens can be 'grabbed' and either printed or copied to the clipboard. The lists of data can also be transferred to TI InterActive!™ or saved as .txt files and then opened in spreadsheet applications.

Possible Extension Work.

- Use of other sensors (pH and dissolved oxygen) in freshwater studies.
- Investigation of noise levels with frequent sampling points.

Links

- There are further opportunities to measure physical environmental factors in *Unit 8D Ecological relationships*.
- An investigation into noise levels forms an important part of *ICT Unit 7 Measuring physical data*.