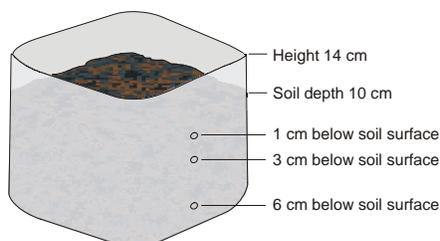


TEACHER INFORMATION

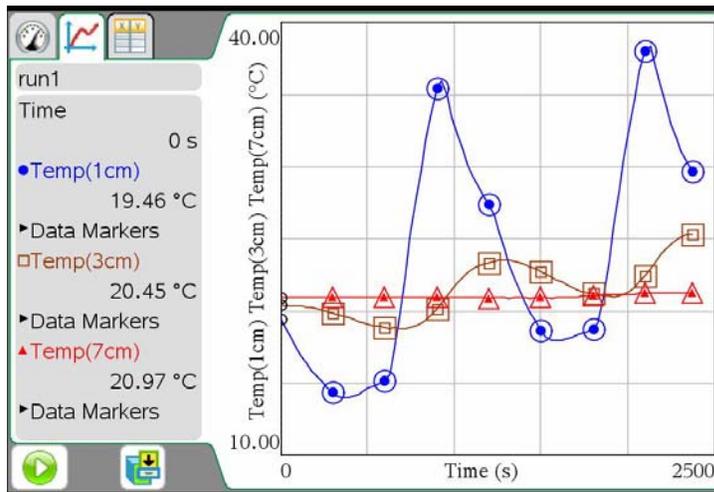
Soil Temperature

1. Editable Microsoft Word versions of the student pages and pre-configured TI-Nspire files can be found on the CD that accompanies this book. See *Appendix A* for more information.
2. This experiment calls for three Temperature Probes. This may mean that you will need to combine the students into larger groups or have some of the groups perform the experiment one day and the rest of the class perform it the next.
3. This experiment is not intended for use with Easy or Go! Products since data from three sensors must be collected at the same time. While you can use three different handhelds, each with their own sensor or multiple Go! Products on the same computer, to collect the data, a single, multi-channel interface is preferred.
4. The soil container should be made up ahead of time. Make one per group.
 - a. Cut the top off of a plastic milk jug so that it is 14 cm high.
 - b. Fill the jug with soil 10 cm deep.
 - c. Using an awl (or a tough ball-point pen), poke three holes in the side of the jug. The holes should be large enough for the Temperature Probe to easily fit and lined up vertically at 1, 3, and 7 cm below the surface of the soil.



5. A 100 W or 150 W bulb works well for this lab. Compact fluorescent and LED bulbs should not be used for this lab.
6. To make it easier for the students to tell which sensor is which, you can have them rename the sensors. To do this, choose Column Options from the  Data menu then select the desired column name. (The sample data was created using this method.)

SAMPLE RESULTS



	1 cm depth	3 cm depth	7 cm depth
Maximum temperature (°C)	38.33	25.39	21.31
Minimum temperature (°C)	13.99	18.82	20.89
Change in temperature (°C)	24.34	6.57	0.42

ANSWERS TO QUESTIONS

- The 1 cm line went up in temperature when the light was turned on and went down when the ice was applied. Of the three, it had the largest temperature swings. The 3 cm line also went up and down in temperature, but there was a time lag and it had smaller temperature swings. The 7 cm line stayed fairly flat.
- The closer to the surface the measurement was taken, the larger the temperature swing. This is because the change in temperature was always applied from the top. Therefore, the soil closest to the top is most affected.
- No, the temperature peaks and valleys occurred at different times.
 - Answers will vary. For the sample data, the first peak in the 1 cm line came 0.5 minutes after the light was turned off.
 - Answers will vary. For the sample data, the lag time between 1 cm and 3 cm was approximately 5.5 minutes.
- As the soil is warmed by the lamp or cooled by the ice, that change in temperature takes time to move through the soil. The heat from the lamp may only take a short time to reach 1 cm into the soil, but it will take several minutes to reach the soil to the 3 cm line.