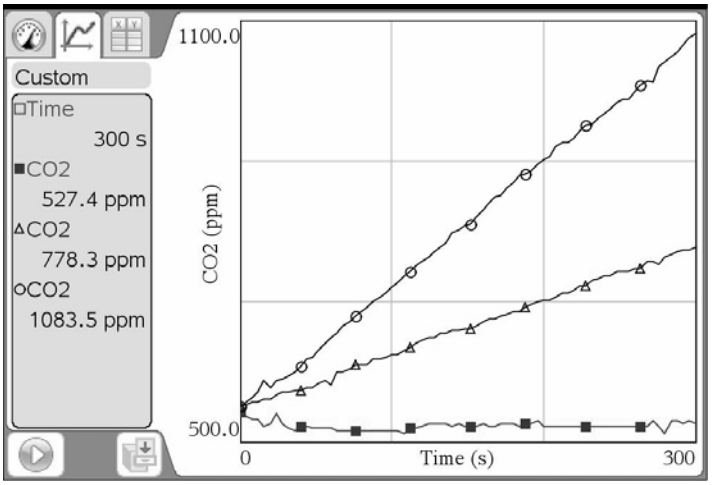
TEACHER INFORMATION

Cell Respiration

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. Allow the seeds to germinate for three days prior to the experiment. Prior to the first day, soak them in water overnight. On subsequent days, roll them in a moist paper towel and place the towel in a paper bag. Place the bag in a warm, dark place. Check each day to be sure the towels remain very moist. If time is short, the peas can be used after they have soaked overnight. For best results, allow them to germinate for the full three days.
3. The CO_2 Gas Sensor has a 90 second warm-up period. Any data collected during this warm up will not be accurate. When using the TI-Nspire Lab Cradle, the text in the CO_2 sensor meter will be displayed in light gray until the sensor has warmed up. At that time, the meter text will be displayed in black.
4. Heavy condensation buildup in the respiration chamber can interfere with readings from the CO_2 Gas Sensor. This can be a source of error if the peas are very wet when placed in the respiration chamber. Before placing the peas in the respiration chamber, blot them dry with a paper towel.
5. The CO_2 Gas Sensor relies on the diffusion of gases into the probe shaft. Students should allow a couple of minutes between trials so that gases from the previous trial will have exited the probe shaft. Alternatively, the students can use a firm object such as a book or notepad to fan air through the probe shaft. This method is used in Step 10 of the student procedure.
6. The morning of the experiment fill a 1 L beaker with ice and water so that students will have cold water. Students will also need access to ice.
7. When doing this experiment with a TI-Nspire handheld, your batteries will drain quickly. This is especially true when using an EasyLink or Go!Link interface. Be sure your handheld has fresh or fully charged batteries.
8. The older-style CO_2 sensor cannot be used with an EasyLink or Go!Link interface. To use this probe, you must use a multi-channel sensor interface.
9. The stopper included with the older-style CO_2 Gas Sensor is slit to allow easy application and removal from the probe. When students are placing the probe in the respiration chamber, they should gently twist the stopper into the chamber opening. Warn the students not to twist the probe shaft or they may damage the sensing unit.

SAMPLE RESULTS



CO_2 respired by germinating – room temperature (○), *non-germinating* (■), *and germinating – cool temperature peas* (△).

Table 1	
Room Temperature (°C)	22.4

Table 2	
Peas	Rate respiration (ppm/s)
Germinating, room temperature	1.78
Non-germinating, room temperature	0.02
Germinating, cool temperature	0.78

ANSWERS TO QUESTIONS

1. Yes, the carbon dioxide concentration *vs*. time graph clearly indicates that carbon dioxide is being produced at a steady rate when germinating peas are in the respiration chamber.

2. Germination greatly accelerates the rate of cellular respiration. This reflects a higher rate of metabolic activity in germinating seeds. In most experiments, non-germinating seeds do not seem to be respiring. Occasionally, however, some respiration is detectable.

3. Warm temperatures increase the rate of respiration. This reflects a higher rate of metabolic activity in warm germinating seeds than in cool seeds.

4. It is necessary for germinating seeds to undergo cellular respiration in order to acquire the energy they need for growth and development. Unlike their mature relatives, seeds do not yet have the necessary photosynthetic abilities needed to produce their own energy sources.