

PROCEDURE FOR LABPRO OR CBL2

1. Connect the CO₂ Gas Sensor, data collection interface, and calculator. Turn on the calculator.
2. Set up EasyData for data collection.
 - a. Start the EasyData application if it is not already running (located under APPS).
 - b. Select **(File)** from the Main screen, and then select **New** to reset the application.
 - c. Select **(Setup)** from the Main screen, then select **Time Graph...**
 - d. Select **(Edit)** on the Time Graph Settings screen.
 - e. Enter **10** as the time between samples in seconds and select **(Next)**.
 - f. Enter **60** as the number of samples and select **(Next)** (data will be collected for 10 minutes).
 - g. Select **(OK)** to return to the Main screen.
3. Obtain and mass ten adult crickets in a 600 mL beaker and record the mass under Data and Observations.
4. You will collect data at three different temperatures according to your assigned group number (I, II, or III). You will set up a water bath at a different temperature prior to each data collection run until you have collected data at all three assigned temperatures.

GROUP I: COLD TEMPERATURES

- Your group will collect respiration data at 5–10°C, 10–15°C, and 15–20°C. Set up a water bath for the desired temperature. This ensures that the crickets will remain at a constant and controlled temperature. To prepare the water bath, obtain some cool water and some ice from your teacher. Combine the cool water and ice into the 1-liter beaker until it reaches the desired temperature range. The beaker should be filled with about 600–700 mL water. Leave the thermometer in the water bath during the experiment.
- Place the 250 mL respiration chamber in the water bath and remove to avoid water spilling over later when you are collecting data. Be sure to keep the temperature of the water bath constant while you are collecting data. Use a basting bulb or beral pipet to remove or add hot or cold water as needed.
- Record the water bath temperature in Table 1. Perform Steps 5–12 for each of the three temperature ranges.

GROUP II: WARM TEMPERATURES

- Your group will collect respiration data at 20–25°C, 25–30°C, and 30–35°C. Set up a water bath for the desired temperature. This ensures that the crickets will remain at a constant and controlled temperature. To prepare the water bath, obtain some hot and cold water from your teacher. Combine the hot and cold water into the 1 liter beaker until it reaches the desired temperature range. The beaker should be filled with about 600–700 mL water. Leave the thermometer in the water bath during the experiment.
- Place the respiration chamber in the water bath and remove to avoid spills later when you are collecting data. Be sure to keep the temperature of the water bath constant while you are collecting data. Use a basting bulb or beral pipet to remove or add hot or cold water as needed.
- Record the water bath temperature in Table 1. Perform Steps 5–12 for each of the three temperature ranges.

GROUP III: HOT TEMPERATURES

- Your group will collect respiration data at 35–40°C, 40–45°C, and 45–50°C. Set up a water bath for the desired temperature. To prepare the water bath, obtain some hot and cold water from your teacher. Combine the hot and cold water into the 1 liter beaker until it reaches the desired temperature range. The beaker should be filled with about 600–700 mL water. Leave the thermometer in the water bath during the experiment.
 - Place the respiration chamber in the water bath and remove to avoid spills later when you are collecting data. Be sure to keep the temperature of the water bath constant while you are collecting data. Use a basting bulb or beral pipet to remove or add hot or cold water as needed.
 - Record the water bath temperature in Table 1. Perform Steps 5–12 for each of the three temperature ranges.
5. Carefully place the crickets into the respiration chamber.
 6. Place the CO₂ Gas Sensor into the bottle as shown in Figure 1. Gently push the sensor down into the bottle until it fits snugly.

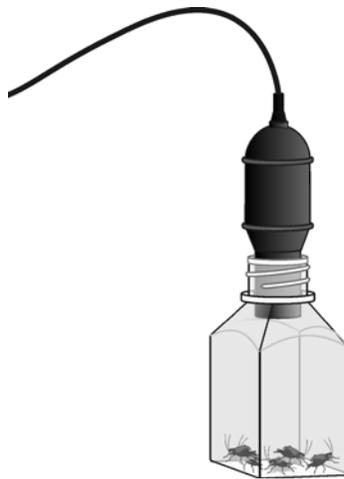


Figure 1

7. With the respiration chamber in the water bath, wait one minute for readings to stabilize, then select **(Start)** to begin data collection. Data will be collected for 10 minutes.
8. When data collection has finished, a graph of CO₂ gas vs. time will be displayed.
9. Remove the CO₂ Gas Sensor from the respiration chamber. Place the crickets in a 600 mL beaker.
10. Fill the respiration chamber with water and then empty it. Thoroughly dry the inside of the respiration chamber with a paper towel. Gently fan air across the openings in the probe shaft of the CO₂ gas sensor for 1 minute.
11. Perform a linear regression to calculate the slope. Record the slope in Data Table 1.

12. Set up the water bath for your next assigned temperature as described in Step 4. Repeat Steps 5–11 for your second temperature range. **Note:** After selecting **(Start)**, select **(OK)** to overwrite the latest run and start collecting data.
13. Set up the water bath for your next assigned temperature as described in Step 4. Repeat Steps 5–11 for your third temperature range.
14. From the Main screen, select **(Quit)**, then **(OK)** to leave EasyData.
15. For each temperature you tested, divide the slope of the regression line by the mass of the crickets. Record this value as the rate of respiration in Table 1.
16. Record the temperatures your group tested along with the respiration rates on the Class Data Table. When all other groups have posted their results, calculate the average for each temperature range. Record the average rate values in Table 2.
17. Using graph paper, plot a graph with temperature along the x -axis and the rates of respiration from Table 2 along the y -axis.
18. Answer Analysis and Conclusion questions on your student answer sheet.

PROCEDURE FOR LABQUEST

1. If your CO₂ Gas Sensor has a switch, set it to the Low (0-10,000 ppm) setting. Connect the CO₂ Gas Sensor to the LabQuest and choose New from the File menu. If you have an older sensor that does not auto-ID, manually set up the sensor.
2. On the Meter screen, tap Rate. Change the data-collection rate to 0.1 samples/second and the data-collection length to 600 seconds.
3. Obtain and weigh ten adult crickets in a 600 mL beaker and record the mass under Data and Observations.
4. You will collect data at three different temperatures according to your assigned group number (I, II, or III). You will set up a water bath at a different temperature prior to each data collection run until you have collected data at all three assigned temperatures.

GROUP I: COLD TEMPERATURES

- Your group will collect respiration data at 5–10°C, 10–15°C, and 15–20°C. Set up a water bath for the desired temperature. This ensures that the crickets will remain at a constant and controlled temperature. To prepare the water bath, obtain some cool water and some ice from your teacher. Combine the cool water and ice into the 1 liter beaker until it reaches the desired temperature range. The beaker should be filled with about 600–700 mL water. Leave the thermometer in the water bath during the experiment.
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- Record the water bath temperature in Table 1. Perform Steps 5–12 for each of the three temperature ranges.

GROUP II: WARM TEMPERATURES

- Your group will collect respiration data at 20–25°C, 25–30°C, and 30–35°C. Set up a water bath for the desired temperature. This ensures that the crickets will remain at a constant and controlled temperature. To prepare the water bath, obtain some hot and cold water from your teacher. Combine the hot and cold water into the 1 liter beaker until it reaches the desired temperature range. The beaker should be filled with about 600–700 mL water. Leave the thermometer in the water bath during the experiment.
- Place the respiration chamber in the water bath and remove to avoid spills later when you are collecting data. Be sure to keep the temperature of the water bath constant while you are collecting data. Use a basting bulb or beral pipet to remove or add hot or cold water as needed.
- Record the water bath temperature in Table 1. Perform Steps 5–12 for each of the three temperature ranges.

GROUP III: HOT TEMPERATURES

- Your group will collect respiration data at 35–40°C, 40–45°C, and 45–50°C. Set up a water bath for the desired temperature. To prepare the water bath, obtain some hot and cold water from your teacher. Combine the hot and cold water into the 1 liter beaker until it reaches the desired temperature range. The beaker should be filled with about 600–700 mL water. Leave the thermometer in the water bath during the experiment.

- Place the respiration chamber in the water bath and remove to avoid spills later when you are collecting data. Be sure to keep the temperature of the water bath constant while you are collecting data. Use a basting bulb or beral pipet to remove or add hot or cold water as needed.
 - Record the water bath temperature in Table 1. Perform Steps 5–12 for each of the three temperature ranges.
5. Carefully place the crickets into the respiration chamber.
 6. Place the CO₂ Gas Sensor into the bottle as shown in Figure 1. Gently push the sensor down into the bottle until it fits snugly.

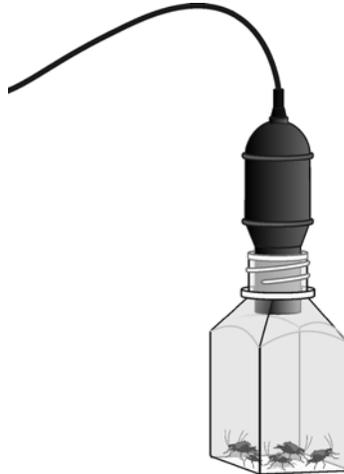


Figure 1

7. Wait one minute for readings to stabilize, then start data collection by tapping the green start arrow in the lower left corner of the screen. Data will be collected for 10 minutes.
8. When data collection has finished, a graph of oxygen gas vs. time will be displayed.
9. Remove the CO₂ Gas Sensor from the respiration chamber. Place the crickets in a 600 mL beaker.
10. Fill the respiration chamber with water and then empty it. Thoroughly dry the inside of the respiration chamber with a paper towel. Gently fan air across the openings in the probe shaft of the CO₂ Gas Sensor for 1 minute.
11. Perform a linear regression to calculate the slope. Record the slope in Data Table 1
12. Set up the water bath for your next assigned temperature as described in Step 4. Repeat Steps 5–11 for your second temperature range.
13. Set up the water bath for your next assigned temperature as described in Step 4. Repeat Steps 5–11 for your third temperature range.
14. For each temperature you tested, divide the slope of the regression line by the mass of the crickets. Record this value as the rate of respiration in Table 1.

15. Record the temperatures your group tested along with the respiration rates on the Class Data Table. When all other groups have posted their results, calculate the average for each temperature range. Record the average rate values in Table 2.
16. Using graph paper plot a graph with temperature along the x -axis and the rates of respiration from Table 2 along the y -axis.
17. Answer Analysis and Conclusion questions on your student answer sheet.

Cricket Respiration

Measuring the Effect of Temperature on Ectotherms

DATA AND OBSERVATIONS

Mass of crickets	g
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Table 1			
Assigned Temperature Range (°C)	Actual Temperature (°C)	Slope (ppm/s)	Respiration Rate (ppm/s/g)

Table 2: Class Averages	
Temperature (°C)	Respiration Rate (ppm/s/g)
5–10°C	
10–15°C	
15–20°C	
20–25°C	
25–30°C	
30–35°C	
35–40°C	
40–45°C	
45–50°C	

ANALYSIS

1. Use proper graphing techniques to make a graph of the class data for *each* temperature on the graph paper provided.
2. What does the slope represent?
3. Explain the relationship between temperature and each of the slopes of the lines on your graph.

CONCLUSION QUESTIONS

1. What is purpose of waiting one minute from the time the cricket chamber is immersed into the water bath and beginning data collection?
2. Two groups performed the experiment at 17°C. The two groups had different combined cricket masses. What effect does the difference in mass have on the slopes reported to the class? Mathematically justify your answer.
3. One of the groups failed to flood the chamber with water between trials two and three. What effect did this error have on the slope reported for trial three?
4. A different group failed to completely dry their chamber between trials two and three. What effect did this error have on the slope reported for trial three?

