

CHAPTER 2	Investigation 2.B: Carbon Dioxide Production in Plants and Animals	BLM 2.2.3
HANDOUT		
Question: How does carbon dioxide production compare in plants and animals?		

Hypothesis

In your group, generate a hypothesis about the rate of carbon dioxide production in plants compared with that of animals.

Prediction

Make a prediction about the outcome of this investigation.

Safety Precaution

Your teacher will inform you about safety precautions appropriate to your experimental design.

Materials

As per your experimental design.

Experimental Plan

1. Research (using the Internet or library) and design a procedure to measure the rate of carbon dioxide production by a plant. The following questions can help guide your research and design decisions.
 - What is a respirometer and how can you build one?
 - How could you use carbon dioxide sensors (if they are available) and an appropriate interface such as a computer, calculator, or handheld device?
 - How could you use pH?
2. In your experimental design, be sure to consider the following factors:
 - controlled, manipulated, and responding variables
 - materials (for example, germinating seeds could work well; they generate carbon dioxide through cellular respiration but do not yet absorb carbon dioxide through photosynthesis, a factor that will affect your results if you use mature plants.)
 - data collection (for example, what measurements will you take? How often will you take them? How will you record your data?)
 - safety

Note: The rate of carbon dioxide production in mL/min from respiration is approximately equal to the rate of oxygen consumption in mL/min.

3. Review your procedure with your teacher.

CHAPTER 2	Investigation 2.B: Carbon Dioxide Production in Plants and Animals (cont'd)	BLM 2.2.3
HANDOUT		

Data and Observations

4. Record your data as per your experimental design. Be sure to note all observations you make.

Analysis

1. a) The rate of carbon dioxide production for a Chilean cricket, *Hophlosphyrum griseus*, at 27 °C is, on average, 2.856×10^{-6} mL/min. Calculate the amount of carbon dioxide that an average Chilean cricket would produce in 15 minutes.

b) Would a larger cricket produce more or less carbon dioxide than the average cricket? Explain your reasoning.

c) Would an active cricket or a resting cricket respire at a higher rate? Explain your reasoning.

2. a) At what rate did the plants in your experiment produce carbon dioxide?

b) An average Chilean cricket has a mass of 36.2 mg. Calculate and compare the amount of carbon dioxide produced, per gram, for the plants you studied and the crickets.

CHAPTER 2	Investigation 2.B: Carbon Dioxide Production in Plants and Animals (cont'd)	BLM 2.2.3
HANDOUT		

3. a) Which variables did you control?

b) Discuss how using controlled variables helps you interpret the results of this investigation.

Conclusions

4. Did your results support your hypothesis? Explain.

5. How could you demonstrate that photosynthesis and cellular respiration are complementary processes?

CHAPTER 2	Investigation 2.B: Carbon Dioxide Production in Plants and Animals (cont'd)	BLM 2.2.3
HANDOUT		

6. Up to a point, cellular reactions increase as temperature increases.
- Predict how increasing the temperature in this investigation would affect your results.

 - Predict how increasing environmental temperatures might affect the rapid cycling of carbon.

Extension

7. Many other factors affect the rate at which plants respire. Choose two of the following factors and hypothesize how a change in each factor may influence the rate of carbon dioxide production:
- light levels
 - maturation of tissues (i.e., germinating seed versus mature plant)
 - availability of nutrients
 - species of plant