



### About the Lesson

In this activity, students will interpret a graph of carbon dioxide output in a forest and graph the data on their TI-84 Plus CE. Using their knowledge of carbon dioxide and photosynthesis, they will then sketch graphs based upon different environmental circumstances.

### Vocabulary

- Photosynthesis

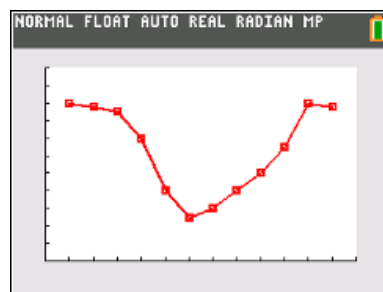
### Teacher Preparation and Notes

- Students should know how to input data into lists and graph a scatter plot.
- Students should understand the process of Photosynthesis, and the reactants and products involved.

### Activity Materials

- Compatible TI Technologies:
  - TI-84 Plus\*
  - TI-84 Plus Silver Edition\*
  - TI-84 Plus C Silver Edition
  - TI-84 Plus CE

\* with the latest operating system (2.55MP) featuring MathPrint™ functionality.



### Tech Tips:

- This activity includes screen captures taken from the TI-84 Plus CE. It is also appropriate for use with the rest of the TI-84 Plus family. Slight variations to these directions may be required if using other calculator models.
- Watch for additional Tech Tips throughout the activity for the specific technology you are using.
- Access free tutorials at <http://education.ti.com/calculators/pd/US/Online-Learning/Tutorials>
- Any required calculator files can be distributed to students via handheld-to-handheld transfer.

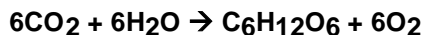
### Lesson Files:

- Please Re-Leaf Me\_Student.pdf
- Please Re-Leaf Me\_Student.doc



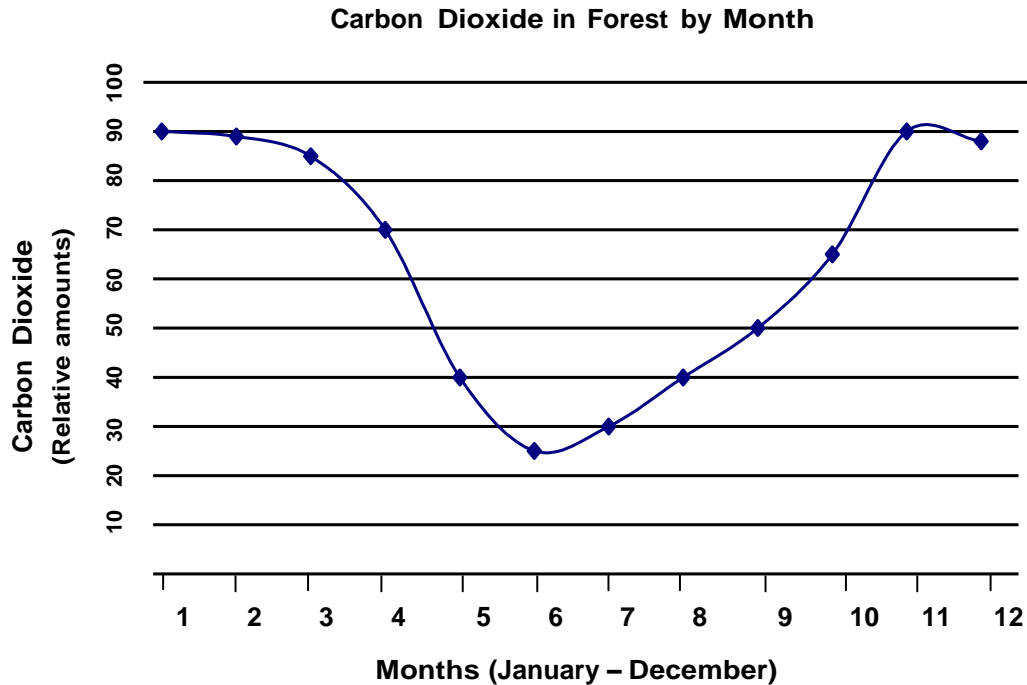
### Introduction

Besides food, what else do you get from plants? Can you think of some other things that may not be spelled out in this chemical equation for photosynthesis that help the plant make food? What makes a plant green and what is the job of that green stuff? What is the fuel, or energy source, for photosynthesis? The more fuel, the more photosynthesis the plant can do, as long as there are enough food-making molecules available. Looking at the equation below, remind yourself what these food-making molecules are. Study the chemical reaction, and answer the questions that follow.



- Name as many substances in this equation as you can.
- What does the 6 (the coefficient) in front most of the substances mean? Why are coefficients used in a chemical equation?
- Why isn't there a coefficient in front of **C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>**?
- What is the name of the reaction that is represented by this equation?

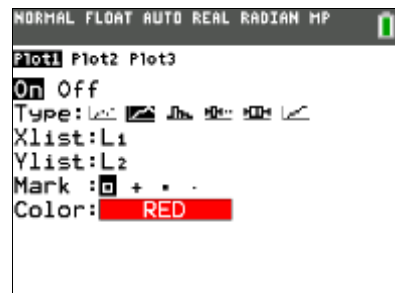
Hopefully, you recognized the equation as the one for photosynthesis, the food-making process in plants. You are completely dependent on plants for food, whether you eat plants, or eat the animals that eat the plants. You are a part of a marvelously woven system called a food web, and plants probably form the foundation of your food web.



**Entering the Data**

Graph the data from the graph above on you TI-84 Plus CE, and then answer questions about the graph. Using your knowledge of carbon dioxide and photosynthesis, you will then sketch graphs based upon different environmental circumstances.

1. Press `[stat]`. Press `[enter]` to choose **1:Edit**.
2. Clear **L1** of all data. Press `[↑]` to move to the heading **L1**. Press `[clear][enter]`.
3. Repeat this procedure to clear **L2** of all data.
4. Navigate back to **L1**, making sure that your cursor is in the first row of the list, and not at the very top. In **L1**, enter a numerical value for the months from the graph. To do this, type in the number and then press `[enter]`, or press `[↓]`. Repeat this until you have entered all of the months in **L1**.
5. In **L2**, enter the carbon dioxide values from the graph, making sure that they correspond with the correct month. Be sure you have the same number of data entries in **L1** as you do in **L2**.
6. Make a graph of the data.
  - a. Press `[2nd]`, `[stat plot]`.
  - b. Press `[enter]` to select **1:Plot1**. Set your handheld as shown at the right.





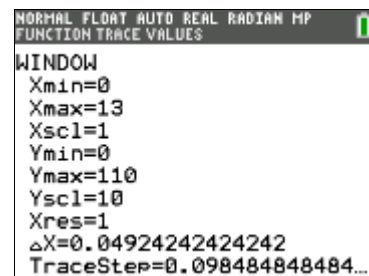
- Press **[2nd]** **[format]** and make sure the defaults are set as shown at the right. If you need to change a setting, press **[v]** to move the cursor, and then press **[enter]** to highlight the item on the left.



- Press **[mode]** and make sure the defaults are set as shown at the right.

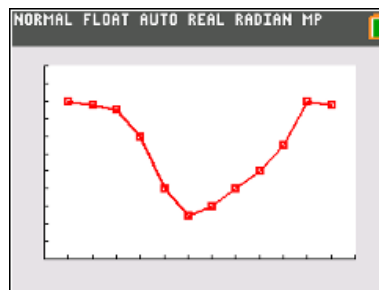


- Press **[window]** and set an appropriate window for the data you have entered and wish to graph. A suggested window setting is shown at the right.



- Press **[y=]**. If there are any equations on this screen, press **[v]** to place the cursor next to **Y1=**, and then press **[clear]**, to clear the equation. Repeat this sequence to clear all equations.

- Press **[graph]**.





### Data Analysis

1. What is the independent variable in this graphical model?

**Answer:** The independent variable is the months of the year.

2. What is the dependent variable?

**Answer:** The dependent variable is the amount of carbon dioxide

3. Describe what happens to the carbon dioxide concentration in the forest throughout the year, and explain why there is such a variation in CO<sub>2</sub> amounts at different times of the year.

**Answer:** Carbon dioxide concentration is lowest in the spring and summer, and highest in the winter. It varies because of the foliage.

4. According to the graph, when were the trees using CO<sub>2</sub> at the fastest rate? Explain how you decided on your answer.

**Answer:** The trees were using CO<sub>2</sub> fastest in the spring and summer. The carbon dioxide levels are lowest at these times of the year.

5. According to the graph, when did the trees lose their leaves? Explain.

**Answer:** The trees probably lost their leaves in either October or November, because this is when the carbon dioxide levels greatly increased.

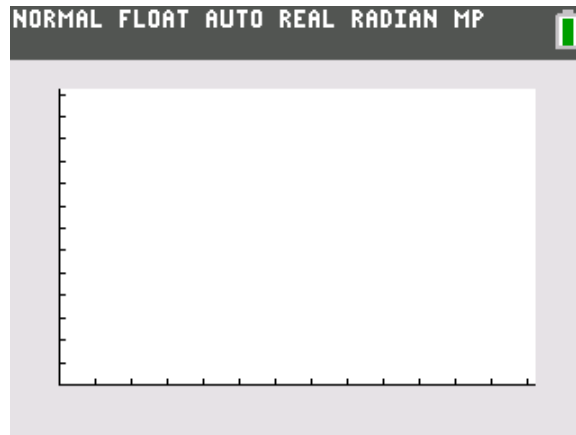
6. Explain the increase in CO<sub>2</sub> levels in the forest from June to August.

**Answer:** Photosynthesis slowed down during the summer. This could be due to a limited water supply.



7. The graph you have been looking at has been a long term graph; one profiling an entire year. With a sketched graph, predict what the  $\text{CO}_2$  concentration would look like over the course of a single day in July, starting at 12:00 midnight and ending at 12:00 midnight the following night. Don't forget to label your axes! Then sketch a predicted graph of what the  $\text{CO}_2$  concentration would look like over the course of a single day in January. Below each graph, explain why you decided to draw your graphs the way you did.

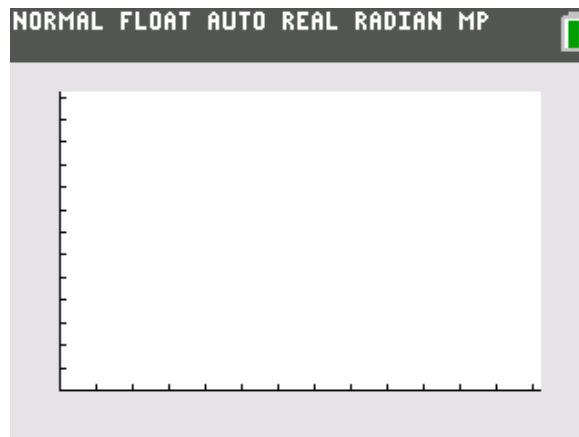
### $\text{CO}_2$ Concentration for a Single July Day



Explanation of your graph:

***Student Answers will vary.***

### $\text{CO}_2$ Concentration for a Single January Day



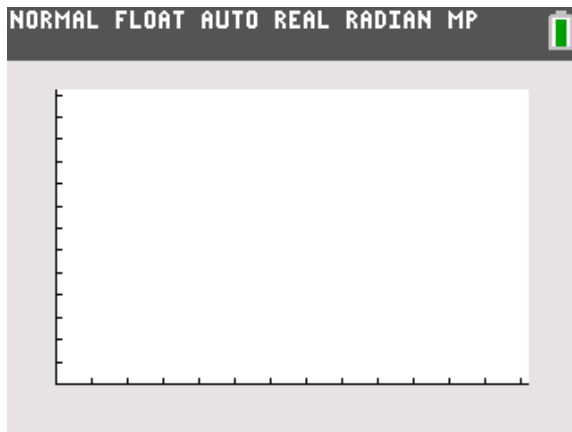
Explanation of your graph:

***Student Answers will vary.***



Predict with a graph what the CO<sub>2</sub> concentration would look like in a tropical rain forest in a day in January. Explain your graph.

Graph Title: \_\_\_\_\_



Explanation:

***Student Answers will vary.***

8. Go back to the original graph on page 1. Remember that you were observing the carbon dioxide levels in the forest. Make some predictions about the oxygen levels in the forest. Using your graphing calculator, produce a graph that will graphically display your predictions. Sketch your graph below.

Graph Title: \_\_\_\_\_

