



Photosynthesis Lesson 1: *The Solve*

Live Video Phenomenon

Student Guide Live Video Phenomenon

The Phenomenon

In the summer of 2017, Adam Harvey, a chef known for his appearance on the television show *Top Chef*, purchased a home in Brooklyn, New York. He decided to install solar panels on the roof of his house so that these panels would turn energy from the sun into usable energy in his home. But after the installation, he realized that his neighbor's seven-story maple tree was blocking the sun from reaching his solar panels.

He asked the neighbor to cut the tree down, but she declined. The tree had been in her yard for over 60 years and had become a staple in the neighborhood!

Several months later, a neighbor looked out the window to find the chef drilling holes in the tree's trunk and filling the holes with a mysterious liquid.

Was the chef trying to kill the tree? If so, how? *Inside Edition* reports: [neighbor's footage](#).

Review Questions

1. What does the chef in the video appear to be doing? Record your observations.
2. What questions do you have about this video?



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Now, it's time for the court date. You've been called to the courtroom as a forensic botanist to answer this question: *Do you think the defendant is guilty of trying to kill the beloved maple tree?*

In order to solve the mystery, you will construct two parts to the argument. You will investigate:

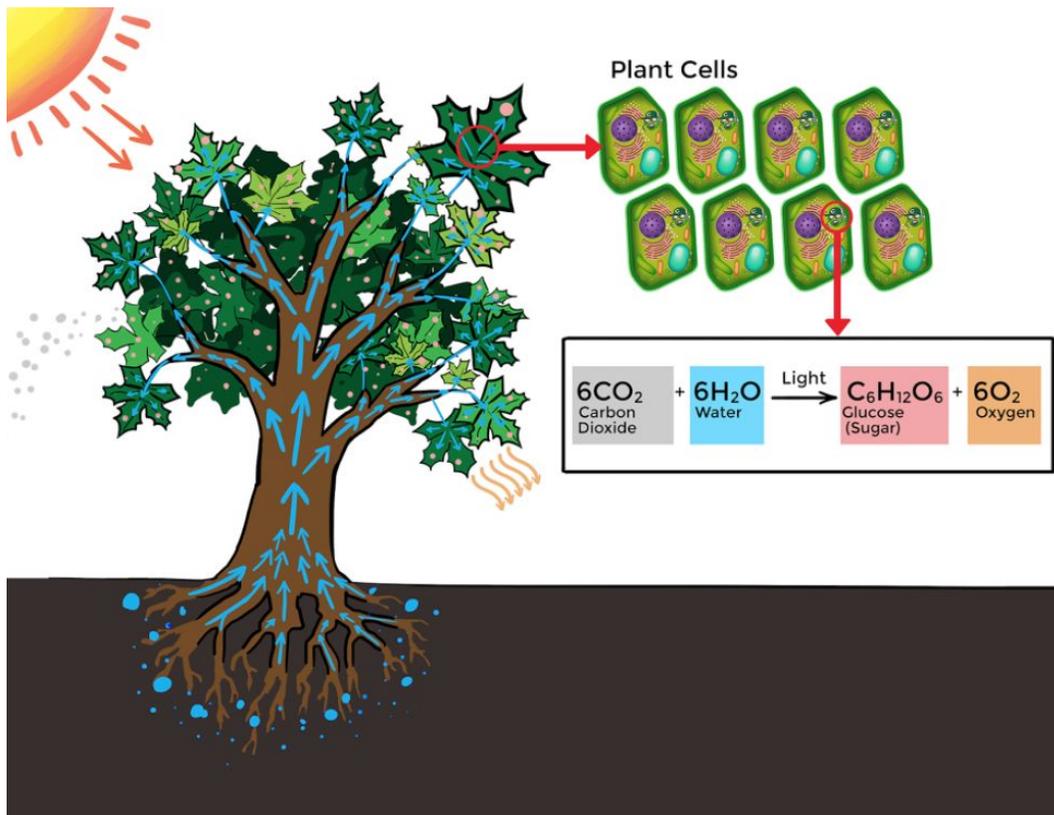
1. How trees make their energy and what would happen if that process was stopped.
2. How food and liquid travel throughout the tree.

Part 1: How trees make their energy

In your research, you find the following information.

About Photosynthesis

Photosynthesis is a process used by plants and other organisms. In photosynthesis, plants convert light energy into simple sugars that they can use as food. It is a chemical reaction that takes place in the chloroplast of the leaf.

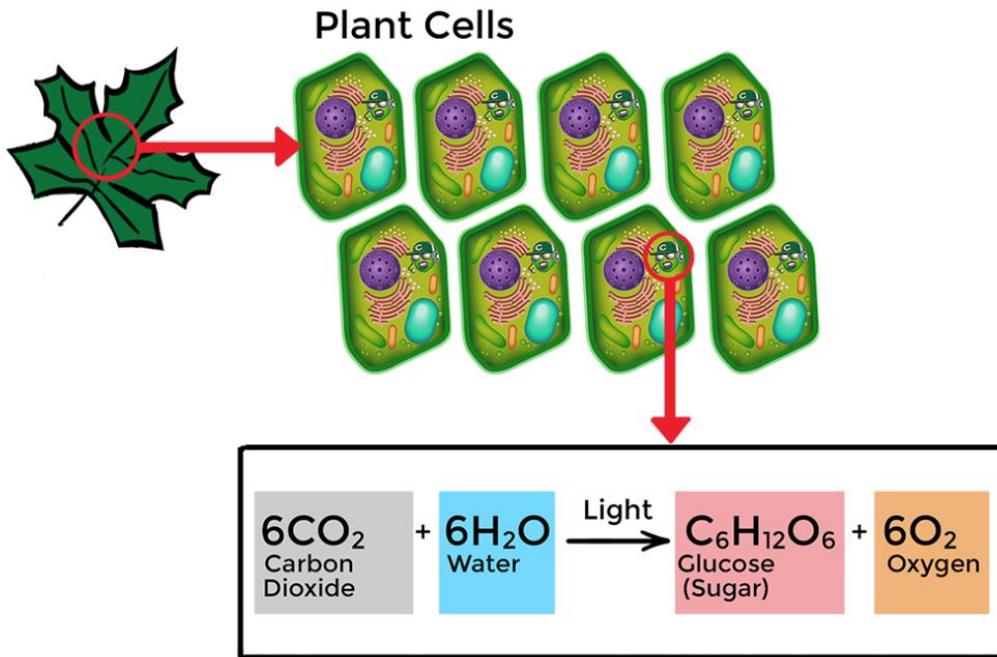




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Let's explore what happens in the chloroplast.



When carbon dioxide and water react in the presence of light, glucose (sugar) and oxygen are produced. This process is called photosynthesis.

The products (outputs) of photosynthesis:

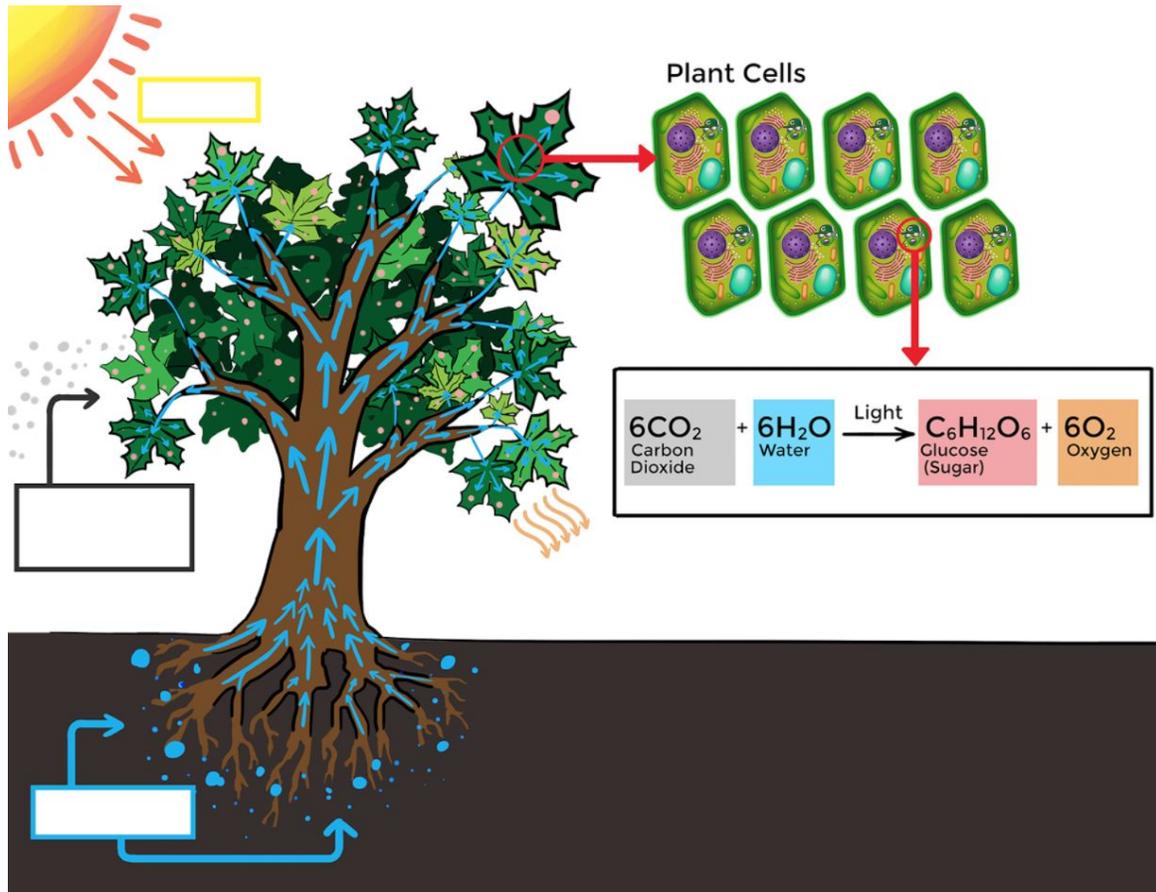
- The oxygen is released.
- The glucose (sugar) is stored in the plant's cells. **The plant needs this glucose (sugar) for energy to survive.**

Based on your reading, you decide you'd like to create a diagram of where the reactants (inputs) of photosynthesis come from. In the diagram below, label where the water, carbon dioxide, and sunlight come in.



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After finalizing your diagram, you feel confident you understand how a tree makes energy when working correctly. You discover that the mysterious liquid was a herbicide (also known as a weed killer), a liquid that harms trees. Now it's time to figure out how a herbicide could work. You secure a sample of the liquid in the chef's possession. You discover that the herbicide prevents **carbon dioxide** from being used by the tree.

How would this herbicide kill the tree? Use your knowledge of photosynthesis to explain your answer.



Part 2. How could this herbicide travel throughout the tree?

In addition to proving the herbicide prevented photosynthesis from occurring, you need to prove whether pouring herbicide into just a couple of holes in the tree could actually kill the entire tree, and not just damage the area around the holes. **Your teacher will carry out a demo to help you answer this question. If you are doing this remotely, view the demo.**

Color-Changing Celery



1. What evidence is there that water moves from the beaker to the leaves of the celery?
2. How would water travel through the maple tree?
3. How would a herbicide inserted into the trunk travel to the leaves?



Part 3: Constructing an Explanation

Is the defendant guilty of trying to kill the beloved maple tree?

On your final day in court, you need to present all of your findings. You will be putting together an exhibit for the jury to help them understand the science behind your findings. They will use this information to determine if the defendant is guilty of the charges. You can either (A) fill in the template below and complete a written explanation or (B) create your own poster by following the instructions below.

Be sure to include the following information in your poster:

- a. Do you think the defendant is guilty of trying to kill the tree? *Include a full sentence answer at the top of your poster.*
- b. How did the herbicide kill the maple tree?
 - i. *Use a diagram to explain how trees normally make their energy. You may use the diagram in the template below or you can draw your own.*
 - ii. *Include an annotation on your diagram to indicate how and where photosynthesis is interrupted.*
- c. How did the herbicide kill the whole tree despite being poured into only a small area of the tree? *This can be written or drawn.*

In your written explanation, try to use as many of the following terms as possible:

- **Water:** basis of fluids of living organisms; used in photosynthesis
- **Chloroplast:** the cell part in plants responsible for photosynthesis
- **Oxygen:** a molecule that is released as a by-product of photosynthesis
- **Sunlight:** light from the sun; used as energy in photosynthesis
- **Glucose:** a simple sugar that can be converted into usable energy; made through photosynthesis
- **Carbon dioxide:** a molecule used to make glucose during photosynthesis
- **Photosynthesis:** a process used by plants and other organisms to convert light energy into chemical energy that can later be released to fuel the organism's activities



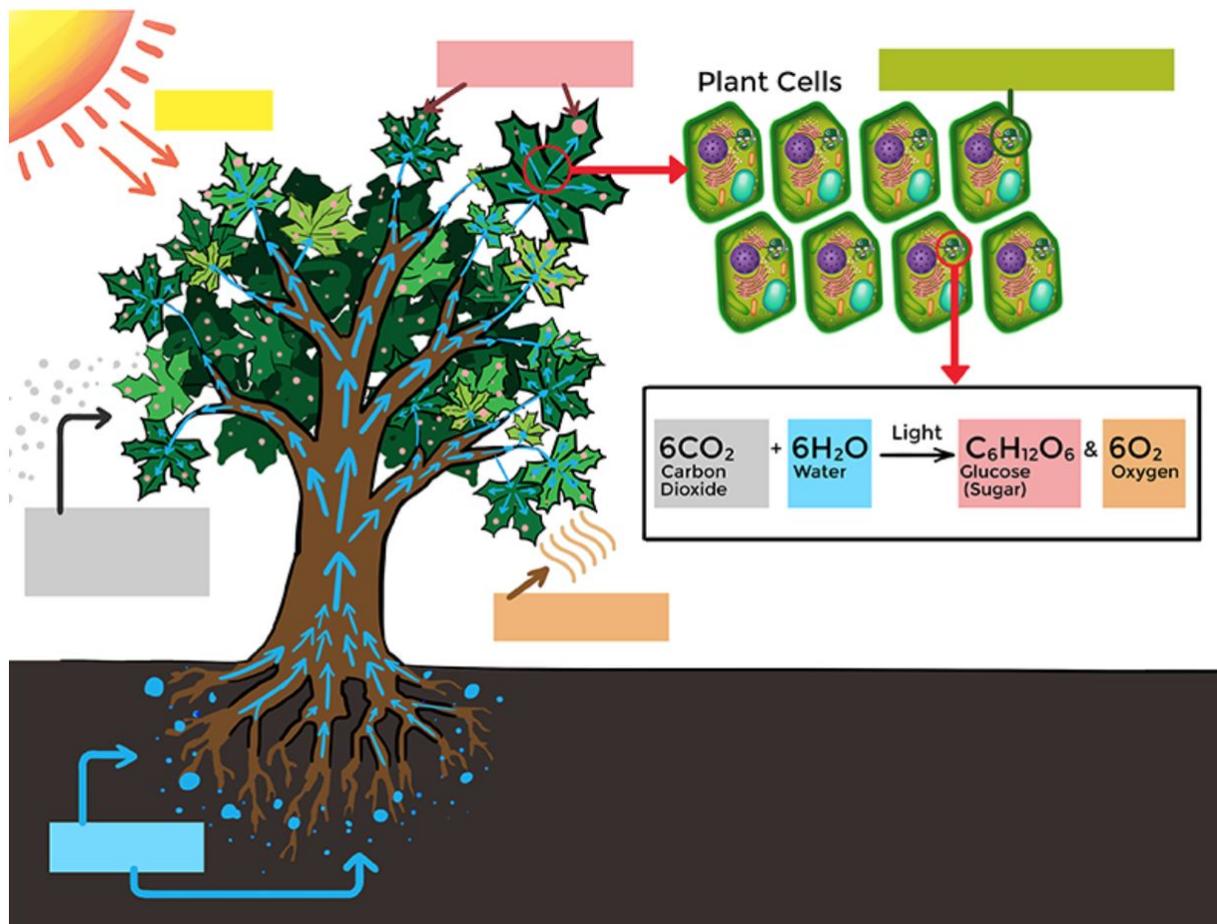
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Exhibit Template (Optional)

1. Identify in a full sentence if the chef is guilty or not guilty.

2. Diagram: Add labels to all parts of the diagram and annotate the image to show how the herbicide impacts photosynthesis.



3. Complete a written explanation of how the herbicide killed the whole tree. Use as many of the vocabulary words listed above as possible.



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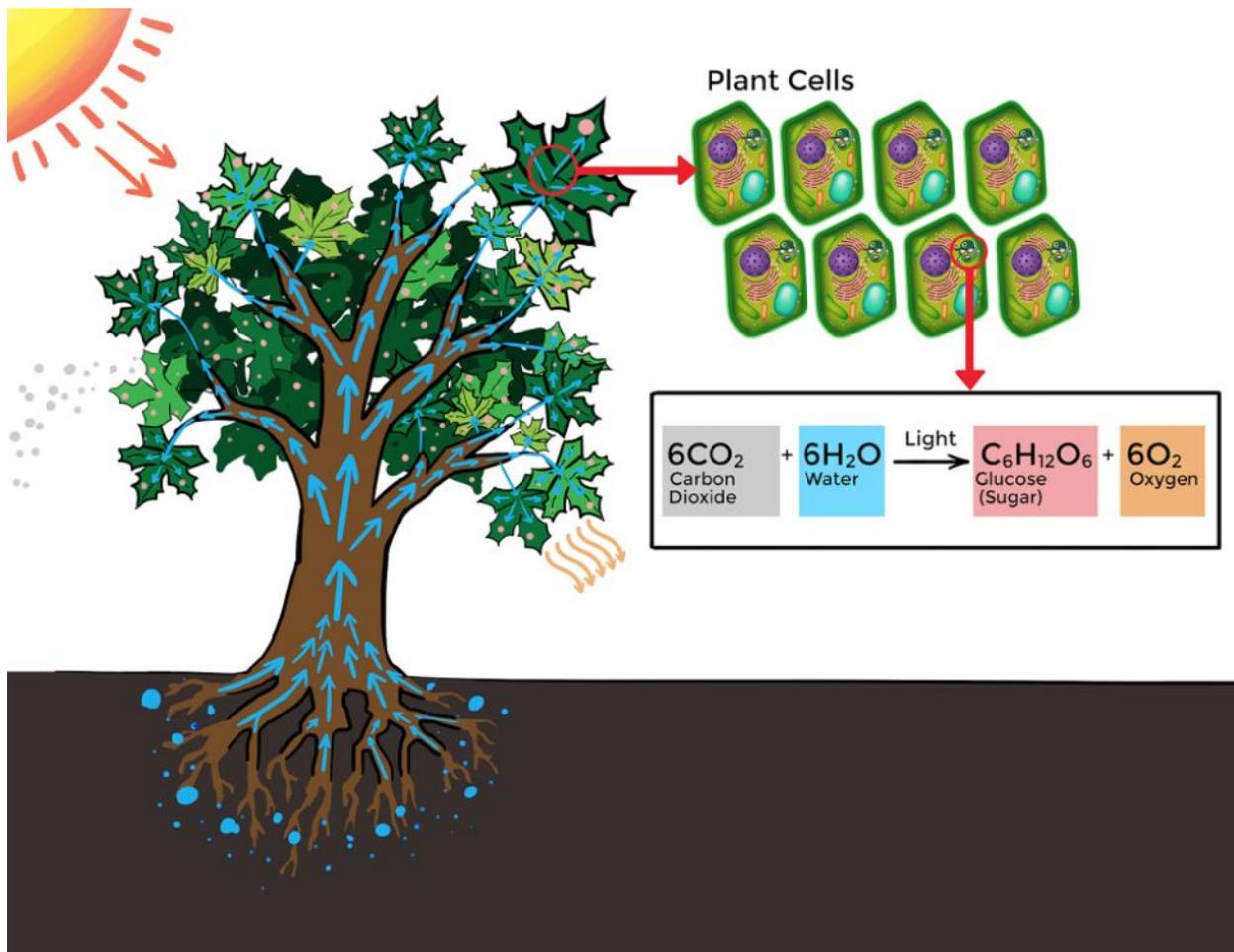
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Part 4. Quiz: Check for Understanding

Complete the exit ticket below or you can take the quiz online!

Name: _____

Date: _____



Use the image to answer the following questions:

1. What process is demonstrated in the image?
 - a. Carbon Dioxide
 - b. Photosynthesis
 - c. Oxygen
 - d. Glucose



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2. What products (inputs) are needed for the tree to carry out the process of photosynthesis?
 - a. Glucose + Oxygen
 - b. Oxygen + Water
 - c. Carbon Dioxide + Water
 - d. Carbon Dioxide + Glucose

3. What outputs are created through the process of photosynthesis?
 - a. Glucose + Oxygen
 - b. Glucose + Water
 - c. Carbon Dioxide + Oxygen
 - d. Water + Carbon Dioxide

4. Where does photosynthesis occur in plants?
 - a. Roots
 - b. Soil
 - c. Bark
 - d. Chloroplast

5. When the herbicide was put into the tree, the result was that the tree could not use carbon dioxide. How does this impact photosynthesis?
 - a. Photosynthesis cannot occur because light cannot hit the tree.
 - b. Photosynthesis cannot occur because carbon dioxide cannot react with oxygen to produce energy.
 - c. Photosynthesis cannot occur because carbon dioxide cannot react with water to produce energy.
 - d. Photosynthesis is not impacted.