

Plants need food to grow

You know that plants need air, water, soil minerals and sunlight to grow. Are these things food for plants? To answer this question we must think about the scientific definition of food. Not everything we eat or take into our bodies is “food” according to the scientific definition.

FOOD is material that living things use for chemical energy to live and grow.

There are two important parts to this definition:

1. Food is a material. Humans, animals, plants and all other living things use the materials in food to make new cells, grow and increase weight. If living things do not get material from food, they can't grow.
2. Food stores chemical energy that humans, animal, plants and all other living things use to help their cells and body parts do their jobs like move or grow. If living things do not get energy from food, they can't survive.

Plants make their own food

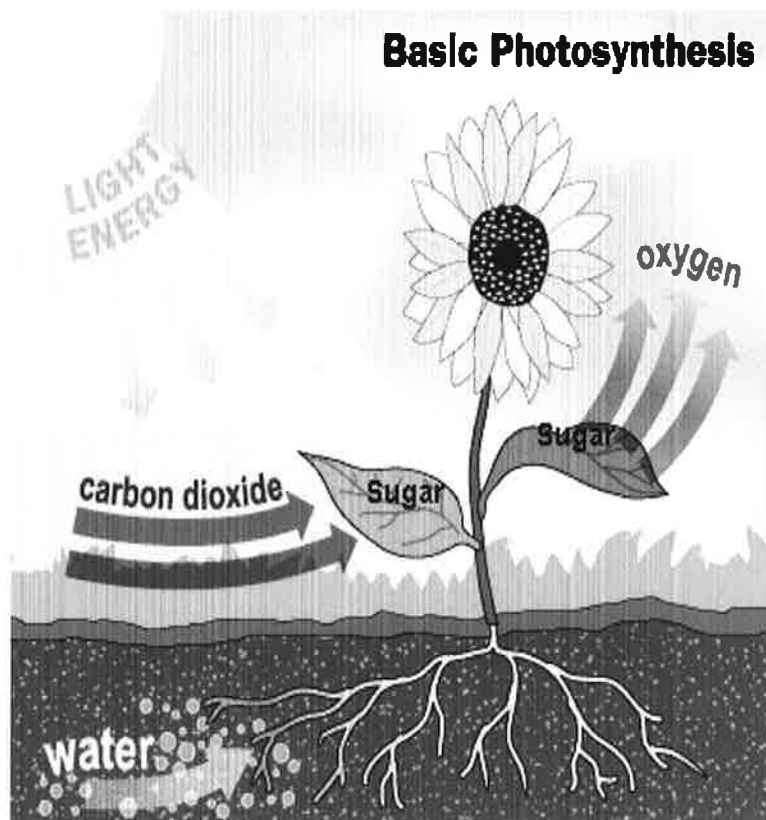
Humans and animals get food by eating it. Plants don't get food the same way. Instead of eating food, plants take materials with no energy from the environment and use the energy from sunlight to make an energy-rich food, sugar.

Plants use two types of materials to make food: water and air. Plants take in **water** from the soil through their roots. The water travels from the roots up the stem in cells that are shaped much like straws. Eventually the water reaches the cells in the leaves. Air is composed of different gases and one of them is **carbon dioxide**. Carbon dioxide gas enters leaves through tiny holes and then goes into leaf cells.

Plants use the light energy in **sunlight** to make food. This light energy is a kind of energy but it is not a material. Leaf cells trap light energy and use this trapped energy to convert water and carbon dioxide into sugar, which stores chemical energy. When leaf cells make food they release **oxygen** gas as a byproduct.

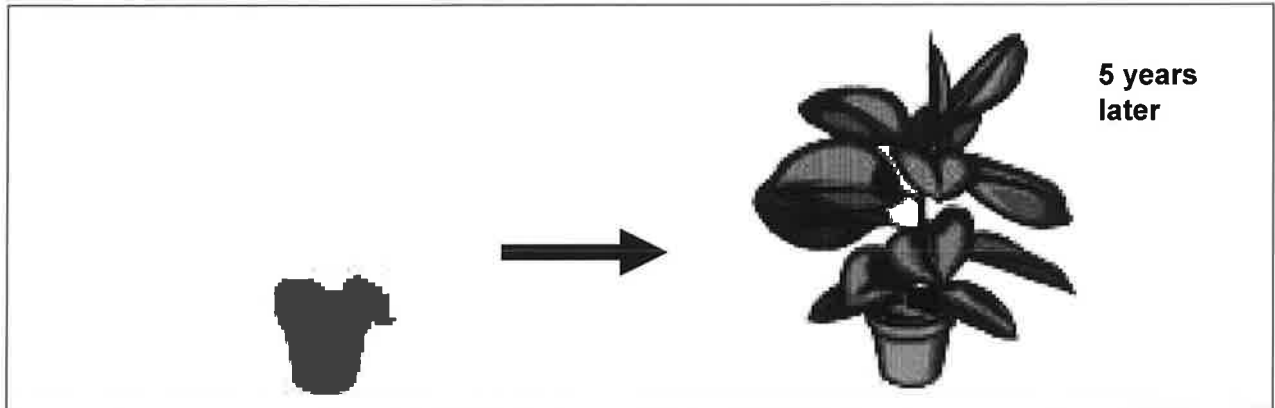
This process of food creation is called **photosynthesis**. “Photo” means light and “synthesis” means putting together. The picture below summarizes photosynthesis.

Can you explain what is happening?



The sugar produced in photosynthesis travels from the leaf cells to the cells in all other parts of the plant. Sugar can then be used by plant cells for energy and growth. This is the only way cells in roots, stems or flowers can get the energy-containing food that they need.

Look at this plant. After 5 years it grew and increased its weight.



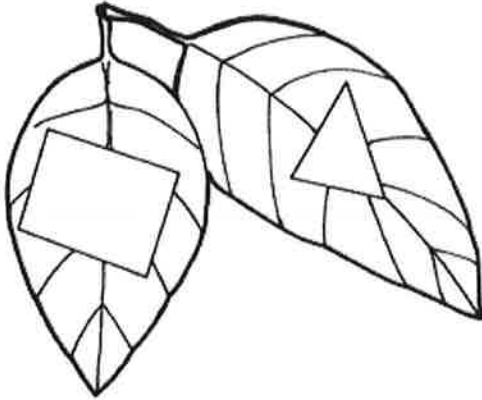
2. How did the plant get the food for growing bigger?

3. Where did the plant get the materials and the energy for making food?

4. A drop of rain falls into the soil near the roots of a large plant. If the water droplet is used to make food where will it travel and what will happen to it?

5. Some plants were put in soil, given water, and placed in a tightly sealed bottle so they could not get any air. The bottle was placed in the sunlight. Will the plant in the jar be able to make food?

6. Some plants were put in soil, given water, and placed in a tightly sealed bottle so they could not get any air. But before the bottle was sealed aluminum foil or cardboard was cut into pieces large enough to cover large areas of the leaves and paper clipped to them. (see illustration below).



The bottle was placed in sunlight. Will the plant in the jar be able to make food?
What is your claim? How can you gather evidence to support your claim?

Name: _____ Date: _____

Are soil, minerals or water food for plants?

Plants are amazing because they can make their own food! You have learned that plants combine water and carbon dioxide to make sugar using the energy in sunlight. This sugar is the origin of all the food for plants, animals, and other living things.

1. Why is sugar considered food according to the scientific definition of food?

Even though we know sugar is food for plants, can we test whether the materials plants take in from the environment (soil minerals and water) are food too? You are going to get together, just like scientists do, and talk about your ideas. When scientists talk, they are not interested in WHO has the right answer, they are interested in working together to come up with the very BEST IDEAS they can. For example, it is not one person who will discover how to keep cancer from killing people. Many scientists are working on this problem at the same time. They enjoy getting together to compare their findings and to debate different ideas, or theories about what is causing the disease and how to stop it. They not only enjoy these debates, they NEED these debates. These discussions give them new ideas that they could not have had by themselves.

Is soil food for plants?

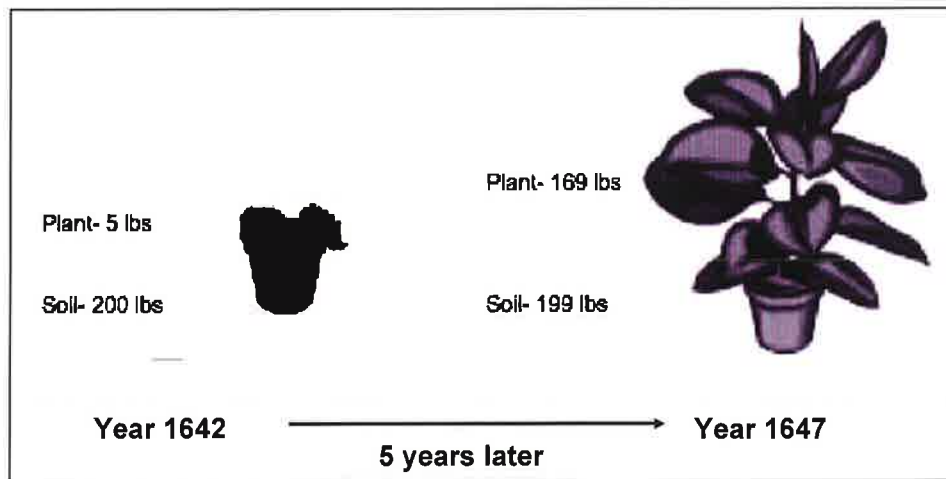
Look at this young tree planted in a bucket of soil. As the tree grows it gains weight. Think about whether the soil is food for the plant. Write down in the box whether you think the weight of the soil in the pot will “increase”, “decrease”, or stay the “same” as the tree grows:



WEIGHT CHANGE OF SOIL

Let's travel back in time 360 years. It is now the year 1642. We are in Europe. It is a time of excitement and exploration. More people are getting interested in finding out about the world around us. We are going to meet one of these early scientists. He is a medical doctor but he also does experiments with plants. His name is Dr. Von Helmont. He is from the country of Belgium. He is going to help us think about our question about whether soil is food for plants. He was very interested in this question.

Almost everyone back in 1642 thought that soil was food for the plants. Von Helmont did an experiment to see if this was true. He planted a 5-pound young tree in a bucket containing 200 pounds of soil. He watered the tree regularly but he did not add any more soil. After 5 years he weighed the tree and bucket again. Here are his results:



Look at the picture above. Can you figure out if the tree or soil lost or gained weight in the 5 years that the plant grew? Write down the changes in weight of the tree and the soil.

WEIGHT CHANGE OF TREE	WEIGHT CHANGE OF SOIL

2. What does Von Helmont's investigation tell you? Is soil food for plants? Why or why not? _____

Measuring Energy in Foods Using Calories: Scientists can measure how much chemical energy is in different foods. They measure how much chemical energy is in a food by using a unit called a calorie. A food with a lot of calories has a lot of chemical energy in it. Foods with very few calories do not have as much chemical energy in them. Materials that contain no calories are not sources of chemical energy.

Von Helmont thought that his experiment was evidence that water must be food for plants. He thought that if soil were not helping the tree gain weight, then the tree must gain weight by getting food from the water. After all, he had been watering the tree everyday for five years.

Is Water Food for Plants?

You might know that plants need water for living and they must be watered or they will not survive. Is water food for plants? For this question is important that you remind yourself of the scientific definition of food.

Look at the “nutrition label” for a cup of water and answer the following questions.

3. An important part of the plant’s weight is water, but does it give the plant chemical energy?

4. Could the plant live and grow if all it took in was water? Why or why not?

Nutrition Facts	
Serving Size 1 cup (8 fl oz) (237g)	
Amount Per Serving	
Calories 0	Calories from Fat 0
% Daily Value*	
Total Fat 0g	0%
Saturated Fat 0g	0%
Polyunsaturated Fat 0g	
Monounsaturated Fat 0g	
Cholesterol 0mg	0%
Sodium 2.4mg	0%
Potassium 0mg	0%
Total Carbohydrate 0g	0%
Dietary Fiber 0g	0%
Protein 0g	0%
Vitamin A 0%	Vitamin C 0%
Calcium 0%	Iron 0%
WATER	

5. Does Von Helmont’s investigation prove that the materials plants need for growth come chiefly from water and air? Explain your answer.
