

Reflect

Imagine you were hungry and all you had to do to eat was step into the sunshine, dig your toes into the soil, and breathe. Wouldn't life be easy if you could make your own food?

That is basically the process green plants use to get the nutrition they need to grow. Green plants make their own food with the air, water, and sunshine they get from their surroundings.



How do green plants make their own food?

Plants are able to produce their own food through a process that changes light energy into chemical energy. Water is absorbed by the roots and carried up through the stems. *Carbon dioxide*, a gas in the air, is taken in through openings in the leaves. Leaves also absorb sunlight. The leaves take the light energy they absorb and, using the carbon dioxide and water, change it into chemical energy, which is then stored as a sugar for the plant to use. Oxygen is produced as a waste from this process and released from the leaves back into the air.



Plants are called *producers* because they can make their own food. Plants use the chemical energy in this food to grow, repair themselves, and reproduce. Some plants, such as fruits and vegetables, store the chemical energy. When you eat an apple or an ear of corn, the stored energy is passed along to you. Any organism that eats plants is called a *consumer*, because it can't make its own food and must consume a producer for energy.

Matter and Energy in Plants

Do plants really need dirt?

The roots of a plant take in various nutrients from the minerals in the soil and in the water. While we generally see plants in soil, plants can grow quite well without soil. Yes, plants can grow with just water and air!

Horticulture is an area of science that deals with plant growth. There is an area of horticulture called **hydroponics**, in which plants are grown without soil. Hydroponics includes growing plants in a substance that has no nutrients (such as rocks or sand) and providing the plants with the nutrients they need through the nutrient-rich water. Sometimes the plants are just grown with the nutrient-rich water and nothing else.



Watermelons are being grown using hydroponics. Mesh slings help support the weight of the fruit.

hydroponics – growing plants without soil, usually by providing a nutrient-rich water

Hydroponic gardening is an excellent method for growing fruits, vegetables, and herbs in areas that have a limited supply of land. Hydroponic gardening can take place in small apartments, on patios, and even on rooftops.

Hydroponic gardening isn't limited to apartments and small patios. Birds Eye, an American company that is known for frozen foods, started investigating hydroponic farming in 2013 as a way to guarantee year-round food supplies.

A hydroponic herb garden on a patio



Lettuce being grown hydroponically in a greenhouse

Matter and Energy in Plants

Aquaponics takes hydroponics to the next level by raising fish and other aquatic organisms, such as snails, crayfish, and shrimp, in the water supply and then pumping the fish water through the hydroponics system and then back to the fish tank. The waste products of the fish become the nutrients and fertilizers in the water for the plants. The plants do not need the soil in order to gain nutrients and grow.



The fish are raised as a food source in tanks such as this.



The nutrient-rich water is pumped from the fish tank through the plant containers and then recycled back to the fish tanks.

Look Out!

Epiphytes, sometimes called *air plants*, grow on other plants, such as trees, and gather their nutrition from the air and rain. Mosses, orchids, and bromeliads are examples of epiphytes.



What Do You Think?

People must be careful not to pollute the air, water, and soil so that plants can have a healthy environment in which to grow.

What if plants could actually clean the soil? What if toxic materials could be removed from water and soil by using plants? It may sound like science fiction, but it is a reality. The process is called *phytoremediation*.



Phytoremediation uses plants such as sunflowers to absorb and store the toxic and unwanted materials in their roots. Sometimes the plants can change the chemicals they absorb into something less harmful. Phytoremediation is very environmentally friendly and less expensive than other methods of cleaning soil.

Try Now

Now it is your turn to create your very own hydroponics system!

Materials

- 1 2-liter bottle
- 2–3 cups of growing medium (beads, small rocks, sand, etc.)
- 3–4 cups water
- 1 washcloth, cut into 1-inch-wide strips
- aluminum foil
- fertilizer
- 1 packet of seeds
- 1 permanent marker
- 1 pair of scissors

Procedure

1. Using your permanent marker, draw a line around the outside of the bottle, a few inches from the top.
2. Using your scissors, carefully cut your bottle around the line you drew. Place the top section you just cut off into the bottle, with the spout facing the bottom.
3. You will prep your water by adding nutrients to it. Be sure to read the package label on the fertilizer to see how much to add to your 3–4 cups of water.
4. Pour your water into the bottle until it reaches the point where the bottle cap would normally go.
5. Carefully remove the top section of the soda bottle. You will take two of your washcloth strips (each about 1 inch wide) and twist them together. It will look like a long rope. This is going to be the wick of your hydroponics system. Carefully push your wick through the spout of the bottle until about two-thirds of it is hanging out. Put the top section of the bottle back into its resting place inside the bottom section of the bottle. Your wick should drag along the bottom of the bottle.
6. Fill the whole top section of your soda bottle with your growing medium.
7. Open the seed packet. Using one finger, pick up four to five seeds at one time. Read the directions on your seed packet to see how far down you need to plant them in your growing medium. Create a small pocket in your growing medium to plant your seeds, then carefully cover your seeds so they are in a dark environment.
8. Wrap your aluminum foil around the outside of your soda bottle to ensure the health of your plant.