

How A Tree Works!

Essential Question(s):

How does a tree work?

At a Glance: In this activity, learners will learn about different parts of a tree and how they function as an entire system by building a “human” tree. Learners will learn how food is made and stored as an introduction to photosynthesis.

Background Information:

Tree Parts and How They “Work”

Although there are thousands of different kinds of trees in the world, most trees work the same way. Here's a look at how the parts of a tree work together to help a tree get the food, water, and minerals it needs to survive.

1. The Trunk: The trunk of a tree is important for two reasons: First, it acts as a support rod, giving the tree its shape and strength. Second, it acts as the central "plumbing system" in a tree, forming a network of tubes that carries water and minerals up from the roots to the leaves, and food (sugar) from the leaves down to the branches, trunk, and roots. The easiest way to see how a tree works is to look at a cross section of the trunk. Look at the diagram to see the five main layers and what each layer does.

- a) **Bark:** The outer layer of the trunk (and branches) is called the outer bark or just the bark. Its texture, thickness, and flexibility depend on the type of tree. Although bark looks different from tree to tree, it serves the same purpose—to protect the tree from injury and disease. Some trees have very thick bark that helps prevent damage from fires. Others have bad-tasting chemicals in their bark that discourage hungry insects. And some bark is covered with spines or thorns that keep browsing mammals away.
- b) **Phloem:** The layer next to the outer bark is called the inner bark or phloem (FLOW-um). The phloem acts as a food supply line from the leaves to the rest of the tree. Sap (water containing dissolved sugars and nutrients) travels down from the leaves through channels in the phloem to the branches, trunk and roots, supplying all the living parts of the tree with food. If you were to cut a band around the trunk through the bark and phloem, the tree would probably die. That's because the phloem would be severed and food could no longer flow to the lower trunk and roots.
- c) **Cambium:** Next to the phloem is a very thin layer called the cambium. It is often only one or two cells thick, and you need a microscope to see it well. The cambium is a growth layer of the tree making new cells during the growing season that become part of the phloem, part of the xylem (see below) or more cambium. The cambium is what makes the trunk, branches and roots grow thicker.
- d) **Sapwood/Xylem:** The layer next to the cambium is called the sapwood or xylem. Each year the cambium adds new layers of woody tissue; the sapwood is made up of the youngest layers of wood. The sapwood is a network of thick-walled cells that forms a pipeline, carrying water and minerals up the tree from the roots to the leaves and other

Location: Indoors or outdoors

Objectives: Learners will

- 1) describe the parts of a tree.
- 2) explain how each part functions or works.

Skills: communication, listening, analysis

Supplies:

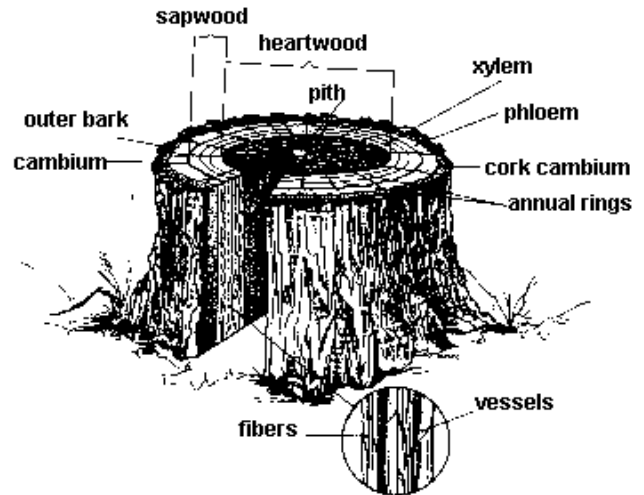
- slips of paper with the names of tree parts written on them
- cross section of a tree diagram
- tree “cookies” (cross sections of a tree)

Subjects: language arts, science

Time: 20 minutes

parts of the tree. The sapwood also stores nutrients and transports them across the tree, from one part to another.

- e) **Heartwood:** Most of the trunk in an old tree is dead wood called heartwood. The heartwood is old xylem that no longer transports water and minerals up the tree. (After a few years the sapwood in most trees gets filled in with resin-like material and slowly changes into heartwood. The new xylem is the only part of the wood that works as a transport system.) The heartwood is often much darker in color than the sapwood. The heartwood gives the tree support, but sometimes it rots away leaving a hollow, living tree.



2. The Roots: A tree's roots are long, underground branches that spread out to help anchor the tree and to absorb water and nutrients from the soil. Some trees have long taproots that reach straight down for 15 feet (4.5 m) or more. Other trees have more shallow root systems that lie closer to the surface of the ground. Large taproots and lateral roots branch into smaller and smaller roots. An average tree has millions of these small rootlets, each covered with thousands of fine root hairs. The root hairs can easily soak up water and dissolved minerals because the rootlets lie very close to the surface where water and nutrients are found.

3. The Leaves: From skinny pine needles to broad palm leaves, all tree leaves serve the same purpose—to make food for the tree. Leaves use carbon dioxide from the air, water from the roots and the sun's energy (in the form of sunlight) to make sugar (glucose). This food-making chemical reaction is called photosynthesis. Photosynthesis can take place only in the presence of chlorophyll—the green pigment that is found in all green plants. During photosynthesis, chlorophyll absorbs sunlight and the leaves release oxygen which becomes part of the air that we and other animals breathe.

Getting Ready:

Make sure you have the number of learners matched to the number of tree parts.

Procedure:

1. Tell learners that in this activity they will learn about the parts of a tree by acting them out and building a "human tree". Before building the "human tree" discuss the parts of a tree. Use the background information as a guide.
2. Pass out tree "cookies" (cross sections of trunks) for learners to examine the interior of a tree. While learners are looking at the cookies, show them the attached diagram and have them locate the different parts of the tree as you describe them.
3. Collect tree cookies and assign tree parts to different learners. Pass out slips of paper with the tree parts listed in this box written

- heartwood (1)
- sapwood/xylem (2)
- cambium (4)
- phloem (8)
- outer bark (12)
- taproot (1)
- lateral roots (2)

on them. Use the numbers in parentheses for a group of thirty learners. Adjust the number of learners per part according to the size of your group.

4. Building the "human tree".

a. Have the learner playing the part of the **heartwood** hold his/her arms up to show muscles and stand in the center of the play area. Explain that this child represents the heartwood of the tree. This learner should chant "I support, I support."

b. Next, have the child playing the **taproot** sit down at the foot of the heartwood learner. Explain that this person represents the deep taproot that most trees have. The child should make slurping noises.

c. Have the **lateral roots** lie down on their backs spreading out from the taproot with their feet toward the heartwood. The lateral root children should make slurping sounds.

d. Have the **sapwood/xylem** kids join hands to make a ring around the heartwood. Position them so they stand between the lateral roots. They should face in toward the heartwood. The sapwood kids should pretend they are drawing water up from the roots by lowering their joined hands, then raising them above their heads, and saying whoosh, whoosh.

e. Have the **cambium** kids join hands around the sapwood. They will chant, "We make new cells, we make new cells."

f. Next, have the **phloem** kids join hands around the cambium. They will pretend they are transporting food down from the leaves by first holding their hands above their heads, then lowering them, then raising them again. They will chant "Food to the tree, food to the tree."

g. Finally, the **outer bark** kids will form a circle around the entire tree, facing outward and holding hands. They should growl and pose like football players to defend the tree.

Once everyone is in position, ask the kids to go through their motions: The roots taking up water from the soil, the sapwood transporting water up the trunk to the branches and leaves, the phloem carrying food down from the leaves to the trunk and roots, the cambium chanting, "We make new cells.", and the bark growling.

Discussion/Assessment:

What does the phloem do?

What is the function of the bark?

Where does the heartwood come from?

What pipes carry the water through the trunk?

Where does the new tree tissue come from?

What are the different kinds of roots?

Where is the food made?

What is the food making process called?

Where is the food stored?

What do you think would happen if you cut a tree across the middle of the trunk?

Why do trees need water, what happens to the water the tree collects?

Why might different trees have different types of root system?