**Overview**
By acting out the parts of a tree, your students will see how a tree works like a factory. Afterward, they can create their own "tree factories."

## Background

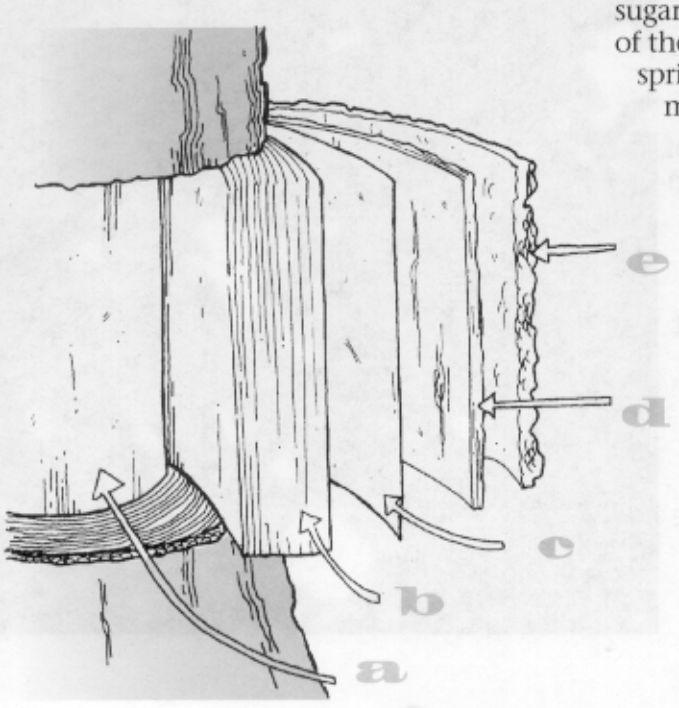
From a tree's tiny ***root*** hairs buried in the ground to the highest leaves in its ***crown,*** each part of a tree plays a role in helping it to function. Here's a rundown of the various parts of a tree and what each one does:

### *Leaves*

Leaves are the food factories of a tree. Using energy from the sun, which they capture with a pigment called *"chlorophyll,"* leaves convert carbon dioxide and water into oxygen and sugar (food!) through the process of ***photosynthesis.*** The gases needed for and generated by photosynthesis enter and exit through tiny holes called *"stomata,"* on the under surface of the leaves. Water vapor also exits through the stomata in the process of transpiration.

### *Trunk and Branches*

The trunk provides support for branches, which in turn support the tree's leaves. The trunk and branches contain the tree's "pipes"—the tubes that transport water and nutrients to the leaves, and sugar from the leaves to the rest of the tree. They also contain the growing layer of the tree that makes the trunk, branches, and roots of the tree thicker each year. Here's a look at a tree trunk from the inside to the outside and a description of what each layer does: (see diagram below)




a. ***Heartwood*** forms the central core of the tree, is made up of dense dead wood, and provides strength for the tree.

b. ***Sapwood,*** also called the xylem (ZEYE-luhm), brings water and nutrients up from the roots to the leaves; older xylem cells become part of the heartwood.

c. ***Cambium*** (KAM-bee-uhm), a very thin layer of growing tissue, makes cells that become new xylem, phloem, or cambium.

d. ***Phloem*** (FLOW-uhm), also called the inner bark, carries sap (sugar and nutrients dissolved in water) from the leaves to the rest of the tree; at certain times of the year, phloem may also transport stored sugars from the roots up to the rest of the tree (for example, in the springtime, the sap of sugar maples rises from the roots and is tapped by people to make maple syrup).

e. ***Bark*** protects the tree from injury caused by insects and other animals, by other plants, by disease, and by fire; bark characteristics vary from species to species (for example, it may be thin, thick, spongy, rough, smooth, covered with spines, and so on, depending on the type of tree).

**LEVELS**
Activity: Grades 3-6
Variation: Grades PreK-2

**SUBJECTS**
Science, Physical Education, Performing Arts

**CONCEPTS**
- Populations of organisms exhibit variations in size and structure as a result of their adaptation to their habitats. (10.1)
- The structure and scale of an ecosystem are influenced by factors such as soil type, climate, availability of water, and human activities. (10.2)

**SKILLS**
Ordering and Arranging, Representing, Identifying Attributes and Components, Comprehending

**OBJECTIVES**
Students will ① describe the general structure of a tree and ② explain how different parts of a tree help the tree function.

**MATERIALS**
Slips of paper, paper sack, tape (optional), yarn or string, art supplies (see "Assessment Opportunity"), copies of student page 227

**TIME CONSIDERATIONS**
Preparation: 20 minutes
Activity: 50 minutes

### *Roots*

A tree's roots help anchor the tree in the ground. They also absorb water and nutrients from the soil. Trees have ***lateral roots*** that spread out from the tree and cover a broad area. Many trees also have a ***taproot*** that grows straight into the ground. As a tree's taproot and lateral roots grow away from the tree, they branch into finer and finer roots called ***rootlets***. The rootlets themselves are, in turn, covered by even finer ***root hairs***. These root hairs absorb approximately 95 percent of the water and nutrients absorbed by the tree.

### Getting Ready

Activity—Write the following parts of a tree on separate slips of paper and put them in a sack. (We've included enough parts for a group of 30 students. However, you may need to adjust the numbers depending on the size of your group.)

| | | |
|---|---|---|
| Heartwood | | (1) |
| Sapwood | | (3) |
| Taproot | | (1) |
| Lateral roots | | (2) |
| Cambium | | (5) |
| Phloem | | (6) |
| Bark | | (8) |
| Leaves | | (4) |
| Total | = | 30 slips of paper |

Afterward, make four branches for your tree by cutting yarn or string into four 6-foot (1.8-m) lengths. Then find a large, open area where the students can build the tree. Also make copies of student page 227.

Variation—Find an outside area that has a tree and enough space to allow the students in your group to spread out and sit on the ground.

### Doing the Activity

**1.** Ask the class to think about trees and what they need to survive. (food, water, air, and so on) List the ideas on the chalkboard. When students have completed the list, ask them how the tree gets these things, especially since trees can't move around the way most animals can. For example, ask students how a tree gets the water it needs.

- Where does the water come from?
- How does it get into the tree?
- How does it get around to all parts of the tree?
- How do trees get the food they need?
- How do they keep from blowing over in the wind?

Don't worry about answering all these questions completely at this stage. During the rest of the activity, students will learn the answers to these questions.

**2.** Use the Background information to answer the questions raised in Step 1.

**3.** Tell students that they're going to create a tree by acting out the tree parts they just discussed. Have each student pick one slip of paper from the sack (prepared earlier) to find out what role to play in the tree. Take students to an area with lots of space to build the tree.

**4.** Ask students what makes up the center of the tree and gives the tree strength? (heartwood) The students portraying heartwood should stand in the center of an open area, tighten their muscles, and chant, "I support; I support."

**5.** Ask students what tree part transports water to all parts of the tree. (sapwood) Have the sapwood students join hands to form a small circle around the heartwood. Have these students chant,

"Gurgle, slurp. Gurgle, slurp. Transport water," as they raise their joined hands up and down.

**6.** Ask students where the water in the sapwood comes from (it's absorbed by the roots). Then have the taproot sit down with his or her back against the sapwood, and have the lateral roots lie down on the ground with their feet toward the sapwood and their arms and fingers spread out to represent root hairs. Have the roots make sucking noises.

*NOTE—Be sure to warn other students not to step on the roots!*

**7.** Ask students where the water in the sapwood travels (to the leaves). Then have the heartwood hold the ends of the four pieces of yarn or string that you cut earlier. Give the other end of each piece to a different student who represents leaves. Ask the leaves what they do all day (make food through photosynthesis). Have the leaves flutter their hands and chant, "We make food; we make food."

**8.** Ask the leaves what happens to all the food they make using sunlight, air, and water. (It gets transported to the rest of the tree.) Ask everyone what part of the tree transports the food from the leaves to the rest of the tree. (phloem) Have the phloem students join hands and form a large circle around the tree. Then have them simulate the role of the phloem by reaching above their heads and grabbing (for food), and then squatting and opening their hands (releasing the food) while chanting, "Food to the tree!"

**9.** Ask students if they've left out an important part of the tree. What layer produces new sapwood and phloem to keep the tree growing and healthy. (cambium) Have the cambium students form a circle between the phloem and the sapwood. Tell them to sway from side to side and chant, "New phloem, sapwood, and cambium. New phloem, sapwood, and cambium."

**10.** Ask students what final component of their tree is missing—it's something that protects the tree. (bark) Have the bark students lock arms and form a circle that faces out from the center of the tree. Ask them to look tough. Have them march in place chanting, "We are bark. Please keep out."

**11.** When the tree is completely assembled, have all students act out and chant their parts simultaneously. If you want, you can end the session by telling the students their tree is old and falls over. Let everyone carefully fall down.

**VARIATION—FOR YOUNGER STUDENTS**

**1.** Ask students to name things that living things need to survive (sun, air, water, food, space, and so on). List their ideas on a chalkboard. They will now go outside and find out how members of one group of living things (trees) get the things they need to survive.

**2.** Take students outside and have them sit down around a tree. Ask how trees get the water they need.

- Where does the water come from? (rain, snowmelt, groundwater)
- How does it get into the tree? (It's absorbed by the roots.)
- How does it get around to all parts of the tree? (Tiny "pipes" in the sapwood carry water to the trunk, branches, and leaves.)

As the students discuss each question, have them act out the answers. For example, they can simulate rain falling by patting their hands on their legs or the ground, they can simulate roots by lying on their backs with their arms and legs spread out as they make slurping sounds, and they can simulate sapwood chanting, "Gurgle, gurgle, gurgle. Water to the tree."

**3.** Next, ask students where trees get the food they need to survive. Do they chase after animals? Grab things with their branches? (No! They make their own food in their leaves by using energy from the sun.) Then have the students imitate how the leaves make food. Have them hold their arms up

and alternately curl and straighten their fingers ("leaves") while chanting, "Making food, making food." Afterward, explain that the leaves also "breathe" by taking in gases from the air and releasing other gases through tiny holes in their under-sides (stomata). You might pass around some leaves and magnifying glasses so students can look for these holes.

**4.** Have students stand up and wrap their arms around the trunk of the tree. What does the trunk do for the tree? (It provides strength, supports the branches and leaves, and contains all the "pipes" that transport water and food around the tree.) Then have the students act out the trunk of the tree by standing straight and tall and by looking strong.

**5.** Have students feel the bark of a tree and describe what it feels and looks like. Then ask them how bark might be useful to a tree. (protects it from pests and disease) Have students act out the role of bark by holding hands and forming a circle with all students facing out from the center. While they still hold hands, have them chant, "We're the bark. Insects, keep out!"

**6.** Have students look for seeds, fruits, nuts, or cones on the tree. Ask them what these parts of the trees do. (produce new trees) Then have them act out a seed growing into a tree by scrunching down into a ball (the seed) and then slowly straightening up until their arms are raised over their heads.

**7.** Ask students what keeps the tree from blowing over. (roots) Then divide the group into two parts. Have all students lie down with their arms and legs spread out, and have one group make slurping sounds (to simulate the roots absorbing water) while the other group chants: "Stay in place. Stay in place" (to express how roots anchor the tree).

**8.** Finally, call students together to build a model tree. Divide the students into three groups. One group, the roots, should stand close together with their arms entwined and chant, "Gurgle, gurgle, gurgle. Water to the tree." The next group, the bark, should make a circle around the roots, join hands, and chant, "We're the bark! Insects, keep out." Members of the last group, the leaves, should stand at various distances around the bark and chant, "Making food, making food" while flexing their fingers.

## Enrichment

**1.** Have the students take a look at cross sections of a tree (tree cookie) and identify the heartwood, sapwood, phloem, and bark. You may also want to do the activity "Tree Cookies" on page 289.

**2.** Ask students how a tree is similar to a factory. (It takes sunlight, air, and water; and manufactures leaves, fruits, nuts, and flowers.) What different departments are in a "tree factory," and what jobs are done by each? (In the "roots department" the tree gets anchored to the ground and water is absorbed from the soil, and so on.) Have students draw a cut-away diagram of a tree factory in which you can see the jobs that get done by each department.

**3.** After exploring how a tree works, have your students consider how they benefit from trees. Give each student a blank piece of paper; have each draw a small tree in the center. Have students draw eight lines radiating from the tree like the spokes of a wheel. On each line, have them write the name of something the tree gives to them (beauty, shade, protection from wind, furniture, pencils, paper, apples, something to play on).

**END NOTES...**

### ASSESSMENT OPPORTUNITY

1. Pass out art supplies, such as drawing paper, scissors, construction paper, toilet paper rolls, straws, aluminum foil, scissors, and tissue paper. Tell students to create a model of a tree. Explain that they should include and label all tree parts they've learned about and be able to explain what each part does. They may explain orally, or create labels that give these explanations. Encourage them to be as creative as possible while still being accurate.

2. For younger students, pass out copies of "Living Labels" student page 227 to pairs of students. Explain that the sheet is like a talking book, but without electronics. Instead, each student will do the talking when one of the buttons on the bottom is pressed. Depending on the level of your group, you may want to go over each of the words on the buttons below the drawing. Explain that each partner should take turns pressing the buttons on the bottom. Each time a student presses a button, the partner must point to the corresponding part of the tree and explain how it helps the tree survive.

### RELATED ACTIVITIES

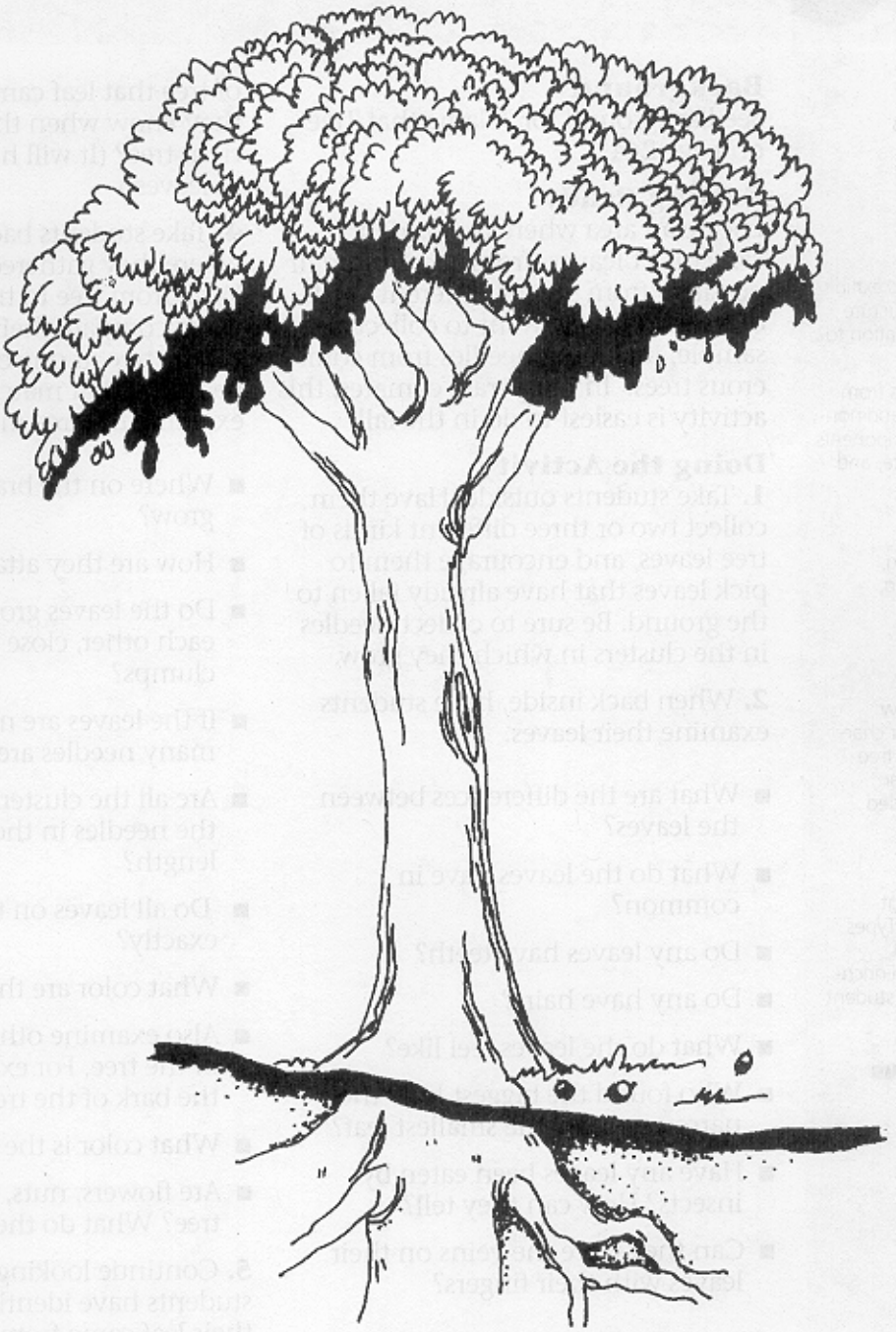
The Closer You Look, Bursting Buds, Looking at Leaves, How Plants Grow, Soil Stories, Trees in Trouble, To Be a Tree

### REFERENCES

Adapted in part from: Cornell, Joseph. *Sharing The Joy of Nature*. Nevada City, CA: Dawn Publications.

STUDENT PAGE©

## LIVING LABELS



TRUNK

BARK

SEEDS

LEAVES

ROOTS